WASHINGTON STATE BOARD OF PHARMACY

Review Form

PHARMACY TECHNICIAN TRAINING PROGRAMS

Type of approval: New Program ☐ Re-approval/Renewal: ☒ Date program expired: _____

Program Type: On-the-Job (OJT): ☒ Formal/Academic: ☐ Online: ☐

Facility/ Institution name: Friday Harbor Drug Credential # (if applicable): _____

Location Address : PO Box 516 Friday Harbor, WA 98250

Mailing Address (if different: _____

Name of Program Director : Josh Matlock Phone Number: 360-378-4421

Email Address for Director: contact@fridayharbordrug.com

Corporate /institution Contact Information: _____

Staff Recommendation: **Approved**

	YES	NO	
Requirements for all program types:			
Multicultural health awareness and education effective July 1, 2008 -New requirement RCW 43.70.615			***See page 5 of this form for complete info.***
1. The training program must adequately prepare the trainee to pass an approved national pharmacy technician certification examination, such that the trainee successfully passes prior to license application.	X		WAC 246-901-060 states proof of passing an NCCA-accredited national certification exam is required for licensure (effective 1/1/09).
2. Prior to starting an OJT training program in Washington, the trainee is required to show proof of high school graduation or a high school equivalency certificate, such as a GED.	x		
3. Minimum of 8 hours of instruction is designated for review of relevant Washington state pharmacy law. This must include access to and use of the WA Pharmacy Commission's website to obtain the most current information. This is in addition to a review of all other applicable state and federal laws.	x		Out-of-state applicants must submit a completed 'Verification of Law' form that is signed off by a pharmacist who is licensed in WA (but does not have to reside here & can have licenses in more than one state).
4. Trainee is registered with the Pharmacy Commission as a pharmacy assistant *prior* to starting an OJT program or an externship through an academic program in Washington state.	x		This does not apply to trainees who are in or have completed out-of-state technician training programs that are not physically located in WA.
5. Director of the program is a registered pharmacist. For WA	x		Program directors of WA state

state – the director must also be a licensed preceptor. WAC 246-901-050 states that the "director shall be a pharmacist." Pharmacists directing or supervising the training of pharmacy technicians must meet the same requirements as those of pharmacy intern preceptors. The program direction or delegates must sign off on an applicant's application verifying successful completion of the program.			programs must also be licensed as preceptors. [WAC 246-858] The Board must be notified immediately of any changes in program director or delegates and must have an updated list at all times.
6. Specify the names, license numbers, and training experience of the Director and all program instructors. Describe training responsibilities and functions	X		
7. Length of the program is 12 months or less for whatever is sufficient to meet the requirements in hours and/or credits for either OJT or academic programs. Note that there are 3 types of programs that are recognized: (1) OJT programs at licensed pharmacies; (2) academic programs; & (3) online programs. NOTE: Anyone who works in a pharmacy in WA must be licensed in WA. Trainees are licensed as pharmacy assistants and can only work as technicians	X		Eg, 520 hours for OJT programs to include didactic training & supervised work experience training at the pharmacy. 30 credits for academic, vocational, technical, online, and similar types of programs.
8. The training and resource materials are current, relevant and are listed by title and publication date, with a description of how they will be used.	X		
9. The minimum passing score for a final exam *other* than the PTCE or ExCPT is 75%. However, an option is to use proof of passing an NCCA-accredited national technician exam as your program's final examination.	X		The passing scores for the PTCE and ExCPT are each calculated in different ways and not by percentage.
10. The Pharmacy Commission must be notified in writing or email prior to any significant changes to the program, including change in the Director, course content, and time frames.	X		Changes in director and/or other training personnel do not require resubmission of the entire program for approval.
11. All student-specific records must either be retained on-site and kept for a minimum of 2 years, as well as be made available within 72 hours upon request.	x		These records must be readily retrievable.
Additional requirements for OTJ programs:	**Yes**	**No**	
1. The program consists of 520 total hours of supervised work experience which includes: didactic instruction and 12 hours of individualized instruction provided when the trainer is not working 'on-line'. All work experience within this time frame must be supervised by pharmacists and be part of the training program requirements.	X		The requirement for 12 hours of individualized instruction is specific for pharmacies licensed in WA.
2. The program must also include training on job functions that are unique to a particular practice setting (eg, preparing parenteral products; extemporaneous compounding; providing long term care services; etc.). These job functions must be documented on the ancillary utilization plans submitted for review.	x		Ancillary personnel utilization plans are required of all pharmacies licensed in WA. [RCWs - 18.54.011, 18.64A; & WACs – 246-863, -869, -901]. http://www.doh.wa.gov/hsqa/Professions/Pharmacy/defaul

			t.htm
3. The utilization plans for ancillary personnel are included, namely, pharmacy assistants and technicians. [See the web document on 'Developing a Pharmacy Technician Training Program' for resources.]	x		These plans must describe the manner in which ancillary personnel will be utilized. This requirement only applies to pharmacies licensed in WA.
Additional requirements for academic programs:	**Yes**	**No**	
1. The academic program consists of a minimum of 2 quarters equal to 30 quarter credits (or equivalent in semester hours) and includes a mandatory externship of a minimum of 160 hours.			
2. The vocational program consists of a minimum of 800 hours of instruction and includes a mandatory externship of a minimum of 160 hours.			
3. A comprehensive training manual is provided and includes the following: list of faculty (names, licenses, training experience, & program responsibilities); institutional policies & procedures; description of the Advisory Committee functions & list of members; complete curriculum description & goals; training and testing methods; description of facilities (eg, drug preparation labs, computer labs, etc.) & equipment used; description of the quality assurance program; and anything else relevant to the program and its administration and operations.			
4. The externship is described by practice site and number of hours spent at each site, as well as description of tasks, expectations and required outcomes. Students in externships are evaluated by their externship site supervisor and their academic program instructor (based on a midterm and final clinical evaluation form, as well as the student's work reports, attendance and performance). Students evaluate their externship experience and include a self-evaluation of each experience. The program's policy and procedure for dealing with negative evaluations of students and by students is included.			
5. Program requirements and expectations are included with a description of what constitutes misconduct and how it is handled. One example would be the criteria for expulsion from the program.			
6. If the vocational or academic institution is accredited by an accreditation organization and/or licensed in a state, provide this information.			
Additional requirements for online programs:	**Yes**	**No**	
1. Online programs must meet the same requirements as academic programs.			
2. Program staff must be available to students on a 24-hour basis daily, with a policy & procedure in places for this.			***INCLUDE THE POLICY & PROCEDURE FOR THIS.***

ADDITIONAL REQUIREMENTS

1. All programs are approved for a 5-year period and must be submitted for renewal before their expiration date. Typically programs that are submitted for renewal do not have to be presented at a board meeting for re-approval. However, if such a program is completely revamped, a determination will be made if formal board approval will be necessary, at which time your program would be notified.

2. For OJT programs offered through pharmacies that are licensed in Washington and for academic/vocational programs based in Washington, the documented director (or delegates) of a training program must sign the 'Director's Certification'. The director may designate delegates who can sign this section of the application on his or her behalf, but a letter must be submitted to the board by the director of the program stating who these delegates are and the effective dates. Any changes to this document must be submitted in writing. If either a director's or delegate's names are not on record with the board, this will cause delays in the processing of applications.

3. For pharmacies licensed in Washington, you must maintain an on-site file containing all documentation related to your approved technician training program, including your most current approved ancillary utilization plans. This documentation will be requested as part of the inspection process.

4. Anyone who works in a pharmacy in WA must be licensed in WA. Trainees must first be licensed as pharmacy assistants and can only work as technicians-in-training when they are being trained! Trainees cannot 'fill in' as technicians 'as needed'. Their work experience must be part of the approved training program. And, since proof of passing one of the NCCA-accredited national certification exams is a requirement for licensure, trainees should be preparing for an exam while they're in training. The training program should be preparing them to take an exam. The national exam should be taken sooner rather than later, meaning that your trainee can't be a tech-in-training indefinitely, especially after they have completed the training program. At the latest, trainees should be ready to take a national exam when they have just completed a training program.

5. Always remember to access the Board of Pharmacy website for the most current pharmacy technician or assistant applications, as the applications are periodically updated. The same applies for the most current information on Board of Pharmacy laws, rules, policies, guidelines, and the like.

6. Training programs that are reviewed as part of a specific applicant's application process will only be approved for that applicant. Out-of-state training programs that are interested in obtaining board approval must submit all the documentation requirements listed in the review form above.

Note: 'Formal' academic programs include the following settings: universities; community colleges; technical colleges; technical/community colleges; vocational/technical schools. These are institutional-based programs, whereas OJT programs are employer-based.

http://www.doh.wa.gov/hsqa/Professions/Pharmacy/forms.htm - Pharmacist Preceptor Application Packet and Experiential Training Manual.

NEW REQUIREMENT FOR ALL TRAINING PROGRAMS APPROVED in WASHINGTON

Cultural Competency Resources

The legislature finds that it shall be a priority for the state to develop the knowledge, attitudes, and practice skills of health professionals and those working with diverse populations to achieve a greater understanding of the relationship between culture and health and gender and health. By July 1, 2008, each program with a curriculum to train health professionals for employment in a profession credentialed by a disciplining authority under chapter 18.130 RCW shall integrate into the curriculum instruction in multicultural health as part of its basic education preparation curriculum.

The Washington State Department of Health (department) is pleased to announce a new resource to help health care providers serving diverse populations of patients. A law passed in 2006 requiring all health care providers licensed by the department to receive multicultural health awareness education and training. The Cultural Competency in Health Services and Care – A Guide for Health Care Providers is a tool in that effort. The law did not mandate anything more specific than this. There are no requirements for how the training is conducted, what resources should be used, and number of contact hours or credits. There are many resources for this. A sampling of resources is listed on the review form.

This guide is intended to increase the knowledge, understanding, and skills of those who provide health care in cross-cultural situations. The guide is available on our Web page. We hope it will broaden your awareness of health disparities, provide a better understanding of why cultural competency is important, and illustrate some of the resources available to you. There are several online resources that offer continuing education credits. There are also resources with important information and statistics on the populations you serve.

Washington State Department of Health
Pharmacy Quality Assurance Commission
PO Box 47877
Olympia, WA 98504-7863
360-236-4700

Date Stamp Here

Pharmacy Technician Education and Training Program Approval Form

The complete program of study including resource materials, content of instruction, and detailed program administration must accompany this application as well as a description of the criteria for admission or selection into the training program, and details on how the program will measure the student's proficiency.

Application Type

☐ Original ☒ Renewal

Check One

☐ Association	☐ Limited Partnership	☐ Public Hospital District
☐ Corporation	☐ Municipality (City)	☐ Sole Proprietor
☐ Federal Government Agency	☐ Municipality (County)	☐ State Government Agency
☒ Limited Liability Company	☐ Non-Profit Corporation	☐ Tribal Government Agency
☐ Limited Liability Partnership	☐ Partnership	☐ Trust

1. Demographic Information

UBI #	Federal Tax ID (FEIN) #
604227800	82-3852475

Legal Owner/Operator Name: Friday Harbor Drug, LLC DBA Friday Harbor Drug and Gifts

Mailing Address: PO Box 516

City	State	Zip Code	County
Friday Harbor	WA	98250	San Juan

Phone (enter 10 digit #)	Cell (enter 10 digit #)	Fax (enter 10 digit #)
360-378-4421		360-378-6140

Legal Name of Institution or Employer-based Program: Friday Harbor Drug

Physical Address: 210 Spring Street

City	State	Zip Code	County
Friday Harbor	WA	98250	San Juan

Facility Phone (enter 10 digit #)	Cell (enter 10 digit #)	Fax (enter 10 digit #)
360-378-4421		360-378-6140

Mailing Address: PO Box 516

City	State	Zip Code	County
Friday Harbor	WA	98250	San Juan

Email address	Web Address
contact@fridayharbordrug.com	www.fridayharbordrug.com

2. Type of Program

Please check which type of pharmacy technician education and training program or school.

☐ Formal/Academic Training ☒ On-the-job Training at a licensed pharmacy ☐ Vocational Training

☐ Military Training ☐ Other, explain _____

3. Contact Information

Name of Contact Person	Title
Josh Matlock	Pharmacy Manager

Physical Address: 210 Spring St

City	State	Zip Code	County
Friday Harbor	WA	98250	San Juan

Email Address	Phone (enter 10 digit #)
joshm@fridayharbordrug.com	360-378-4421

4. Program Director Information

Attached additional pages if the training program uses multiple directors.

Name of Program Director: Josh Matlock

Title: Pharmacy Manager

Pharmacist Credential Number	Preceptor Certification Number
PH 60828440	PH 60897910

Physical Address: 210 Spring St

City	State	Zip Code	County
Friday Harbor	WA	98250	San Juan

Email Address	Phone (enter 10 digit #)
joshm@fridayharbordrug.com	360-378-4421

5. Additional Pharmacies and Program Directors

List all pharmacies associated with this training program.

Pharmacy Name and Address	Pharmacy License #	Program Director	Pharmacist's License #
N/A			

6. Signature

I certify that I have received, read, understood, and agree to comply with state laws and rules regulating education and training programs. I also certify that the information herein submitted is true to the best of my knowledge and belief.

Joshua Matlock

Program Director/authorized representative

5/18/20

Date

Joshua Matlock

Print Name

Pharmacy Manager

Print Title

Additional Forms and Resources

Pharmacy Webpage

Guidelines to Implementation

Pharmacy Technician Training Program

Friday Harbor Drug LLC

210 Spring Street
Friday Harbor, WA 98250

Section I: Director and Other Instructors

Director:

Joshua Matlock (Josh)
License: PH60828440
Preceptor: PH60897910

Other Instructors:

Natalie Samples
License: PH60615215
Preceptor: Pending

Special Advisor:

Hollis Whitcomb Henry (Holly)
License: PH00010617

Josh graduated with a PharmD from the University of Oklahoma College of Pharmacy in 2017. Since graduation, Josh has been working in the retail setting. His passion for independent pharmacy brought him to Friday Harbor. Josh has been the pharmacy manager at Friday Harbor Drug since June 2018. Josh will serve as the program director and will ensure the progression of trainees through the program.

Natalie graduated with a Bachelors in Pharmaceutical Science from Ohio State University in 2009. She went on to study pharmacy at the University of Charleston School of Pharmacy and graduated in 2013 with her PharmD. Natalie continued her training with a residency at Delta Care Rx. Following this, she began to work in the retail setting. After Natalie's preceptor license is approved she will supervise on the job training in the retail pharmacy setting.

Holly graduated from Washington State Univeristy College of Pharmacy in 1978, and was licensed in August, 1978. She initially practiced in a chain pharmacy for 2 years. After that she worked as the Executive Assitant Director of the Washington State Pharmacists Association form May, 1980 through December, 1985. One of her primary responsibilities was to develop and coordinate professional pharmacists continuing education programs and maintain ACPE accreditation for the WSPA. From 1986 to

present, Holly has been involved in retail pharmacy as either an owner, pharmacy manager, or staff pharmacist. Holly has also served as the president of National Community Pharmacist Association and WSPA. While Holly will not be involved in hands on training of pharmacy technician candidates, she has been integral in the building of this training program.

The director will serve as the primary classroom instructor, evaluate progression in the program, and administer examinations that will test necessary on the job knowledge and important self-study concepts. The other instructor(s) are involved in direct on the job supervision and training of pharmacy technician candidates.

Section II: Facilities and Resources

Friday Harbor Drug
210 Spring St
Friday Harbor, WA 98250
Phone: 360-378-4421
Fax: 360-378-6140
contact@fridayharbordrug.com

Primary Resources:

1. Parsons, S. (2013). Pharmaceutical Calculations (0th ed., Vol. 1) [1]. Parsons Printing Press. Retrieved March 15, 2019, from http://pharmaceuticalcalculations.org/about.php
2. The Pharmacy Certified Technician (PCT) Training Manual, Michigan Pharmacists Association, 14th edition, 2018.
3. Pharmacy Certified Technician Calculations Workbook, Michigan Pharmacists Association, 5th edition, 2018.
4. Pharmacy Lawbook, Washington State Department of Health, 2017.
5. Pharmacy Math, University of Oklahoma College of Pharmacy, https://www.boomer.org/c/m/index.php?Loc=Visitor.

Other Available Online Resources

1. Lexicomp
2. Natural Medicines Database
3. Micromedex
4. Ovid Medline

Section III: Instruction and Program Administration

To be considered for the technician training program, the employee must be at least 18 years old, have a minimum education level of high school graduate or GED, and have worked in the pharmacy for a minimum of 3 months. Employees that show promise at the pharmacy assistant position may be considered for the program. Inclusion in this program is not a guarantee that trainees will become a pharmacy technician. The director will reserve the right to remove trainees from the program if they have proven to be unfit through evaluaton/testing, they represent potential danger to patient safety, or they demonstrate conduct detrimental to the pharmacy profession. If a candidate is determined by evaluation and examination to be a poor fit for the technician training program, the employee will be notified by the director of the program that they are no longer enrolled in the technician training program and may no longer operate as a pharmacy technician. Candidates are free to leave the technician training program at any time.

Technicians in training will complete a minimum of 520 hours of on the job training under the supervision of a licensed preceptor. The technician training program will run for no less than 18 weeks and no longer than 12 months. Completion of these hours will only be valid when the director of the technician training has evaluated competence in each area and initialed each. Upon successful completion of the designated 520 hours, there will be a mandatory evaluation and final examination. Failure to meet necessary criteria upon evaluation and examination will require an additional 20 hours of remedial training in the failed area of learning.

Self-study aides will be provided by the pharmacy to guide technician training outside of the pharmacy. One practice PTCE exam will be paid for by the pharmacy to help prepare candidates for the full exam. There will be a minimum of 12 hours of one on one or discussion style study with the preceptor and candidates. This time will be designated (paid) and scheduled in advance.

When candidates have met all necessary criteria and have completed final evaluation, Friday Harbor Drug will be pay for the initial national certification exam. If the exam is failed, candidate will be responsible for any additional exam fees to retest. After passing the Pharmacy Technician Certification Exam, the candidate will be eligible to apply for licensure in the state of Washington. Initial licensing fees will also be covered by the pharmacy.

Pharmacy Technician Training Topics and Minimum Hours to be Completed

Subject (hours to be completed)

A.	Orientation to pharmacy practice	(10)
B.	Pharmacy terminology and basic pharmaceutics	(15)
C.	Pharmacy law – state and federal	(8)
D.	Pharmaceutical calculations	(15)
E.	Processing the prescription/drug order	(20)
F.	Stocking/ordering/inventory	(15)
G.	Receiving merchandise	(10)
H.	Inventory control and returned goods procedure	(15)
I.	Telephone procedure and communication	(15)
J.	OTC drugs	(15)
K.	Pharmaceutical compounding	(15)
L.	Pharmacy computer system	(20)
M.	Hands on experience working in the retail setting	(QS 520)

Areas Covered During Program

- Orientation to Pharmacy Practice—Health care delivery systems, broad definitions of pharmacy practice and practice settings, communications techniques, confidentiality of information, hygienic techniques and safety considerations.
- Basic Pharmaceutics—Medical and pharmaceutical terminology and abbreviations, components of a prescription and patient medication record, drug dosage forms, routes of administration and drug product packaging, weighing and measuring, packaging and labeling, drug nomenclature, aseptic techniques, drug standards and information sources.
- Principals of Applicable Pharmacy Law—Pharmacy Act, Pharmacy Ancillary Personnel Act,
- Legend Drug Act, Controlled Substances Act and other statutes applicable to pharmacy practice, federal and state regulations and guidelines/interpretive statements.
- Pharmaceutical Calculations—Basic mathematics (fractions, decimals, percentages, proportions), and weights and measures.

Areas of Self Study and Topic Discussion for National Exam

Pharmacology

- Generic/Brand recognition
- Therapeutic equivalence
- Drug interactions (ex. Drug-Drug, Drug-Dietary, Drug-OTC)
- Common and severe side effects, allergies, and therapeutic contraindications
- Strengths and dosages of common medications
- Dosage and indication of medications
- Storage and handling of hazardous materials
- Hazardous substance exposure

Pharmacy Law and Regulations

- Controlled substance transfer regulations
- Controlled substance documentation requirements
- Record retention
- Formula to validate DEA
- Record keeping, documentation, and length to keep
- Restricted drug programs (ex. clozapine, isotretinoin)
- Standards related to data integrity, security, and confidentiality (HIPAA)
- Requirements for consultation (OBRA 90)
- FDA recall classification
- Infection control standards
- Standards regulating roles of pharmacists, techs, assistants
- Reconciliation between state and federal laws and regulations

Sterile and Non-Sterile compounding

Medication Safety

- Error prevention strategies for data entry
- Patient package insert and medication guide requirements
- Identify issues that require pharmacist interventions
- Look alike/ sound alike medications
- High-alert/risk medications
- Common safety strategies

Pharmacy Quality Assurance

- Quality assurance practices for medication and inventory control systems
- Infection control
- Risk management guidelines
- Communication channels necessary to ensure appropriate follow up
- Productivity, efficiency, and customer satisfaction

Medication Order Entry and Fill Process

- Order entry process
- Intake, interpretation, and data entry
- Calculate doses required
- Fill process

- Labeling requirements
- Packaging requirements
- Dispensing process

Pharmacy Inventory Management

- Function and application of NDC, lot numbers and expiration dates
- Formulary or approved/preferred product list
- Ordering and receiving processes
- Storage requirements (fridge, freezer)
- Removal (recalls, returns)

Pharmacy Billing and Reimbursement

- Reimbursement policies and plans
- Third party reimbursement
- Healthcare reimbursement
- Coordination of benefits

Pharmacy Information System Usage and Application

- Pharmacy related computer applications
- Databases, pharmacy computer applications, and documentation management

Schedule

Week 1:

Topics Covered:

Orientation to pharmacy practice

Assignments:

Reading- Chapter 1: Intro to Pharmacy Tech Practice

Review questions

Goals:

Acclimate to new role and know what is expected

Weeks 2-4:

Topics Covered:

Pharmacy Calculations

SIG Codes

Assignments:

Reading- Chapter 2: Pharmacy Terminology

Handout 1

Pharmacy Calculations Workbook Chapters 1-7

One on one lessons (4 hours)

Goals:

Understand basic pharmacy math

Week 5:

Exam 1:

Topics will include pharmacy practice (25%), pharmacy math (50%), and interpretation of SIG codes (25%)

Evaluation

Week 6:

Topics Covered:

Pharmacology

Pharmaceutics

Assignments:

One on one lessons (2 hour)

Finish calculation practice

Reading- Chapter 14: How Drugs Work

Chapter 15: Drugs and Drug Names

Goals:

Understand principles of pharmaceutics and pharmacology

Be able to interpret and use SIG codes effectively

Week 7-9:

Topics Covered:

Brand/Generic

Top 300 Drugs

Disease State and Treatments

Assignments:

Reading- Chapter 16-31

Goals:

Understand principles of pharmaceutics

Be able to interpret and use SIG codes effectively

Week 10:

Exam 2:

Brand Generic/Disease States(55%), pharmaceutics/pharmacology (20%), Immunizations (5%), pharmacy calculations (5%), and SIG Interpretation (5%)

Evaluation

Week 11-12:

Topics Covered:

Medication Safety

Compounding (sterile/non-sterile)

Pharmacy Quality Assurance

Assignments:

One on one lesson (6 hour)

Technician Calculations Workbook: Chapter 8

Reading- Chapter 4: Patient and Medication Safety

Chapter 7: Compounding Sterile and Non-sterile

Handout 3

Goals for week:

Understand the principles of medication safety and the steps we go through to ensure safety

Walk through the practices of sterile vs non-sterile compounding. Be able to determine BUD of products

Understand goals and metrics used to ensure high quality standards are met in accordance with state and federal regulation

Week 13

Exam 3

Topics will include medication safety (30%), sterile compounding (15%), non-sterile compounding (15%), pharmacy quality assurance (15%), pharmacy calculations (15%), and interpreting SIG (10%)

Evaluation

Week 14-15:

Topics Covered:

Pharmacy Law

Reading- Chapter 8: Immunizations

Chapter 12: Poisonings and Emergency Medicine

Pharmacy Calculations

Assignments:

One on one lesson (8 hours)

Reading-Chapter 5: Law and Ethics for Pharmacy Techs

Goals for week:

Understand state and federal laws regulating pharmacy practice

Week 16:

Topics Covered:

Medication Order Entry/Fill Process
Pharmacy Inventory Management
Pharmacy Billing and Reimbursement
Pharmacy Information System Usage and Application

Assignments:

One on one lesson (6 hour)
Reading- Chapter 10: Medical Equipment
Chapter 11: Billing and Insurance
Chapter 3: Pharmacy Operations and Administrations

Goals for Week:

Understand the roles of all staff in the pharmacy in the order entry and filling process
Understand perpetual inventory and the need for accuracy
Understand the pharmacy billing
Be able to determine what insurance paid vs what patient paid
Be able to calculate gross profit from and understand what that means for the pharmacy
Be able to understand how to operate and effectively use pharmacy information resources at your disposal

Week 17:

Exam 4

Pharmacy Law (40%), Topics will include medication order entry/fill process (10%), inventory management (10%), pharmacy billing/reimbursement (10%), pharmacy information (10%), pharmacy calculations (5%), interpreting SIG/medication order entry (5%), Immunizations (5%), Poisonings/Emergency (5%)

Evaluation

Week 18:

Final Exam:

Exam will be comprehensive and test all areas of knowledge discussed or covered during the technician training program

Final Evaluation

PTCE Practice Exam (Optional)

One practice PTCE exam will be paid for by the pharmacy but is not required to complete the technician training program

The schedule will remain flexible to adjust to individual trainee's needs and to ensure that each candidate will be prepared to enter the workforce upon exiting this program. This program will last no less than 18 weeks and will not exceed 12 months.

Final Evaluation

Area of Study	Hours	Preceptor Initials
Orientation to pharmacy practice	10	
Pharmacy terminology and basic pharmaceutics	15	
Pharmacy law – state and federal	8	
Pharmaceutical calculations	15	
Processing the prescription/drug order	20	
Stocking/ordering/inventory	15	
Receiving merchandise	10	
Inventory control and returned goods procedure	15	
Telephone procedure and communication	15	
OTC drugs	15	
Pharmaceutical compounding	15	
Pharmacy computer system	20	
Hours spent in the pharmacy	≥520	

I, _____ hereby certify that _____ has successfully met all the requirements of the technician training program as of _____ (Date). _____ has now met all requirements to sit for the PTCE.

Evaluator Signature: _____ **Date: _____**

Trainee Signature: _____ **Date: _____**

Technician in Training Evaluation Form

Name of Trainee: _____ Date: _____

Name of Evaluator: _____ Evaluation #: _____

Areas covered during evaluation period:

_____
_____
_____
_____

Score achieved on examination: _____
***Must be greater than 75%**

Areas of weakness seen by examination/observation:

_____
_____
_____
_____
_____

Areas of strength seen by examination/observation:

_____
_____
_____
_____
_____

Are there any gaps in necessary knowledge required to progress to the next step of training? YES | NO

Evaluator Signature: _____

Auxiliary Personnel (Assistants) Job Duties

1. At Friday Harbor Drug a pharmacy assistant may, under the immediate supervision and control of a licensed pharmacist, do the following manipulative, non-discretionary functions associated with the practice of pharmacy:
    - 1.1 Place, receive, unpack and store drug orders.
    - 1.2 File and retrieve various pharmacy records as required.
    - 1.3 Package completed prescriptions by facility for delivery or deliver the packaged prescription to the facility.
    - 1.4 Maintain assigned work areas and equipment in a clean and orderly condition.
    - 1.5 Deliver packaged prescriptions to facilities, adult family homes or assisted living facilities, in care of the patient's care givers. Prescriptions are not released for delivery to the facility unless, as determined by the professional judgment of the pharmacist, the pharmacist has completed oral counseling with the patient's caregiver or printed material sufficient to meet the counseling obligations is included with the packaged prescription.
    - 1.6 Handle non-professional phone calls or faxes to and from:
        - 1.6.1 A patient or agent of a patient requesting refill of a prescription.
        - 1.6.2 A physician's office requesting refill authorization.
            - 1.6.2.1 Refill requests shall be made stating the patient's name, date of birth, medication and strength, number of doses and date of last refill.
            - 1.6.2.2 Any additional inquiries by the office concerning the prescription or any changes to the prescription requested by the patient/patient's agent/patient's caregiver or prescriber must be referred to the pharmacist.
            - 1.6.2.3 Any DUR alert raised by the refill must be referred to the pharmacist for resolution by the pharmacist.
        - 1.6.3 A physician's office authorizing refills providing no changes in the prescription are involved.
        - 1.6.4 Anyone concerning price information.
        - 1.6.5 Anyone regarding business hours or delivery services.
        - 1.6.6 Anyone regarding the availability of goods and services. Depending on the subject matter this might require the assistant to transfer the call to another person.
        - 1.6.7 A patient or the agent of a patient asking if prescriptions are refillable, the number of refills left or other information concerning the availability of refills.
        - 1.6.8 Wholesalers and distributors concerning the ordering of drugs and supplies.
    - 1.7 Handle receipt of funds and reconciliation with accounts receivable.
    - 1.8 After the medication has been pulled by authorized personnel, count and pour from stock bottles for individual prescriptions, unit and multi-dose packaging, and blister packaging. This function is performed under the direct supervision of a licensed pharmacist and the accuracy of the prescription contents is checked and verified by a licensed pharmacist.
    - 1.9 Collect patient history from patient or an agent of patient. The assistant may not enter such information into the patient profile.
2. The name badge will read "Pharmacy Assistant". Any assistant who is enrolled in, or has completed a board approved technician training program working at this pharmacy site, must wear a name badge stating that they are in training. These assistants who are in training are counted in the ratio of pharmacists to technicians.
3. The assistant's license shall be displayed in the pharmacy with other licenses.
4. This plan is in effect March 9, 2018 and shall remain in effect until updated, changed or revised.

Employee Signature:_____Date:_____

Pharmacy Technician Job Duties

1. At Friday Harbor Drug a pharmacy technician may, under the immediate supervision and control of a licensed pharmacist,do the following manipulative, non-discretionary functions associated with the practice of pharmacy:

- 1.1 Place, receive, unpack and store drug orders.
- 1.2 File and retrieve various pharmacy records as required.
- 1.3 Package completed prescriptions by facility for delivery or deliver the packaged prescription to the facility.
- 1.4 Maintain assigned work areas and equipment in a clean and orderly condition.
- 1.5 Deliver packaged prescriptions to facilities, adult family homes or assisted living facilities, in care of the patient's care givers. Prescriptions are not released for delivery to the facility unless, as determined by the professional judgment of the pharmacist, the pharmacist has completed oral counseling with the patient's caregiver or printed material sufficient to meet the counseling obligations is included with the packaged prescription.
- 1.6 Handle non-professional phone calls or faxes to and from:
  - 1.6.1 A patient or agent of a patient requesting refill of a prescription.
  - 1.6.2 A physician's office requesting refill authorization.
    - 1.6.2.1 Refill requests shall be made stating the patient's name, date of birth, medication and strength, number of doses and date of last refill.
    - 1.6.2.2 Any additional inquiries by the office concerning the prescription or any changes to the prescription requested by the patient/patient's agent/patient's caregiver or prescriber must be referred to the pharmacist.
    - 1.6.2.3 Any DUR alert raised by the refill must be referred to the pharmacist for resolution by the pharmacist.
  - 1.6.3 A physician's office authorizing refills providing no changes in the prescription are involved.
  - 1.6.4 Anyone concerning price information.
  - 1.6.5 Anyone regarding business hours or delivery services.
  - 1.6.6 Anyone regarding the availability of goods and services. Depending on the subject matter this might require the technician to transfer the call to another person.
  - 1.6.7 A patient or the agent of a patient asking if prescriptions are refillable, the number of refills left or other information concerning the availability of refills.
  - 1.6.8 Wholesalers and distributors concerning the ordering of drugs and supplies.
- 1.7 Handle receipt of funds and reconciliation with accounts receivable.
- 1.8 Count and pour from stock bottles for individual prescriptions, unit and multi-dose packaging, and blister packaging. This function is performed under the direct supervision of a licensed pharmacist and the accuracy of the prescription contents is checked and verified by a licensed pharmacist.
- 1.9 Load automated dispensing robot. Use PharmAssist software to package prescriptions into vials. All vials and their contents are checked for accuracy by a licensed pharmacist and the finished product is verified electronically by this same pharmacist.
- 1.10 Reconstitute or restore the original form of a medication previously altered for preservation and storage by addition of a specific quantity of distilled water or provided diluent requiring no calculation. In 100% of the cases the accuracy of the technician is checked and the work initialed by a licensed pharmacist. No sterile compounding is performed in this pharmacy.
- 1.11 Enter prescription data into the computer and monitor label printing.
- 1.12 If a written prescription is presented or if an oral order has been reduced to writing by the pharmacist, input that prescription into the pharmacy computer system, as long as the accuracy is checked by the pharmacist.
- 1.13 Review a patient profile to retrieve specific clerical and other information as directed by a pharmacist. The technician may use such information to complete insurance billing forms.
- 1.14 Call to, or receive a call from, a physician's office dealing with profile information where no interpretation is necessary, i.e. quantity, date last filled, price.

1.15 Perform tasks under the pharmacist's supervision such as obtaining:

1.15.1 individual prepackaged and labeled medications for prescriptions; or,

1.15.2 stock bottles for prescription filling.

1.16 Collect patient history from patient or an agent of patient.

2. The name badge will read "Pharmacy Technician".
3. The ratio between technicians and pharmacists will not exceed 3 technicians to 1 pharmacist.
4. The technician's license shall be displayed in the pharmacy with other licenses.
5. This plan is in effect March 9, 2018 and shall remain in effect until updated, changed or revised.

Employee Signature:_____ Date:_____

Handout 1

Working with Prescriptions

Have you ever seen a prescription and wondered, "What the heck does that mean?", and even thought, "That doesn't even look like English!". Now it is time to owe up to the truth...much of it is not English. Prescriptions have been obfuscated by a combination of Latin and English abbreviations (sometimes they even throw in Greek words). They are commonly used on prescriptions to communicate essential information on formulations, preparation, dosage regimens and administration of the medication. Our goal is to demystify this drug nomenclature. Our goals in this chapter include:

- learning common medical abbreviations,
- learning the parts of a prescription and how to incorporate medical abbreviations,
- and the additional prescription requirements and limitations when dealing with controlled substances.

Common Medical Abbreviations

In total there are nearly 20,000 medical abbreviations; instead of providing an exhaustive and meaningless list, we will present you with the most common medical abbreviations that are necessary for interpreting prescriptions and performing calculations.

There are several key things to point out about the tables on the next several pages.

categories – for ease of memorization, the abbreviations have been broken up into five categories: route, form, time, measurement, and other.

abbreviations – the abbreviations can often be written with or without the 'periods' and in upper or lower case letters (e.g., p.o. and PO both mean 'by mouth').

meaning – sometimes you will need to place an abbreviation in context to know its meaning (e.g., IV could mean a dosage form as in an 'IV bag', it could mean a route of administration as in 'to give a medication IV', or it could even be the roman numeral meaning 'four').

Latin root – not all the words on this list are derived from Latin words, nor is it necessary to know the Latin root words to be able to understand the abbreviations, but it is simply provided to help you understand how some of these abbreviations were derived.

Route

Abbreviation	*Meaning*	*Latin Root*
a.d.[1]	right ear	auris dexter
a.s.	left ear	auris sinister
a.u.	each ear	auris utro
IM	intramuscular	
IV	intravenous	
IVP	intravenous push	
IVPB	intravenous piggyback	
KVO	keep vein open	
n.g.t.	naso-gastric tube	
n.p.o.	nothing by mouth	nasquam per os
nare	nostril	
o.d.	right eye	oculus dexter
o.s.	left eye	oculus sinister
o.u.	each eye	oculus utro
per neb	by nebulizer	
p.o.	by mouth	per os
p.r.	rectally	per rectum
p.v.	vaginally	
SC, SQ	subcutaneously	
S.L.	sublingually (under the tongue)	
top.	topically	

For

Abbreviation	*Meaning*	*Latin Root*
amp.	Ampule	
aq, aqua	water	aqua
caps	capsule	capsula
cm.[2]	cream	
elix.	elixir	
liq.	liquid	liquor
sol.	solution	
supp.	suppository	suppositorum
SR, XR, XL	slow/extended release	
syr.	syrup	syrupus
tab.	tablet	tabella
ung., oint	ointment	ungentum

Time

Abbreviation	*Meaning*	*Latin Root*
a.c.	before food, before meals	ante cibum
a.m.	morning	ante meridian
atc	around the clock	
b.i.d., bid	twice a day	bis in die
b.i.w., biw	twice a week	
h, °	hour	hora
h.s.	at bedtime	hora somni
p.c.	after meals	post cibum
p.m.	evening	post meridian
p.r.n., prn	as needed	pro re nata
q.i.d., qid	four times a day	quarter in die

[2]Always keep context in mind as '*cm*' can also mean centimeter.

q	each, every	quaque
q.d.	every day	quaque die
q_h, q_°	every__hour(s)	
qod	every other day	
stat	immediately	statim
t.i.d., tid	three times a day	ter in die
t.i.w., tiw	three times a week	

Measurement

Abbreviation	*Meaning*	*Latin Root*
i, ii, ...	one, two, etc.	
a.a., aa[3]	of each	ana
ad[4]	to, up to	ad
aq. ad	add water up to	
BSA	body surface area	
cc	cubic centimeter	
dil	dilute	dilutus
f, fl.	fluid	
fl. oz.	fluid ounce	
g, G, gm	gram	
gr.	grain	
gtt	drop(s)	guttae
l, L	liter	
mcg, µg	microgram	
mEq	milliequivalent	
mg	milligram	
ml, mL	milliliter	
q.s.	a sufficient quantity	quantum sufficiat

[3]Always keep context in mind, as '*aa*' can also mean affected area when applying topical medications.
[4]Always keep context in mind, as '*ad*' can also refer to the right ear.

q.s. ad	add sufficient quantity to make	quantum sufficiat ad
ss[5]	one-half	
Tbs, T	tablespoon	
tsp, t	teaspoon	
U	unit	
>	greater than	
<	less than	

Other

Abbreviation	*Meaning*	*Latin Root*
c	with	cum
disp.	dispense	
f, ft[6]	make, let it be made	fac, fiat, fiant
n/v	nausea and vomiting	
neb	nebulizer	
NR	no refill	
NS	normal saline	
s	without	sine
Sig	write, label	signatura
SOB	shortness of breath	
T.O.	telephone order	
ut dict, u.d.	as directed	ut dictum
V.O.	verbal order	

Practice Problems

Translate the following abbreviation statements to provide proper household directions.

1) i gtt ou bid x7d

2) i tab po q6h prn pain

3) i tab po qid pc

4) iss tsp po tid prn cough

5) iii gtt ad q4h x5d

6) i supp pr q4h prn n/v

7) i cap po tid ac + hs

8) i tab sl q5 minutes prn chest pain, may repeat up to 3 times.

9) ii tabs stat, then i tab po qid x10d

Learning the Parts of a Prescription and how to incorporate Medical Abbreviations

The word "prescription" stems from two Latin word parts, prae-, a prefix meaning before, and scribere, a word root meaning to write. Putting it all together, prescription means "to write before," which reflects the historical fact that a prescription traditionally had to be written before a drug could be mixed and administered to a patient.
Many ancient prescriptions were noted for their multiple ingredients and complexity of preparation. The importance of the prescription and the need for complete understanding and accuracy made it imperative that a universal and standard language be used. Thus, Latin was adopted, and its use was continued until approximately a generation ago.

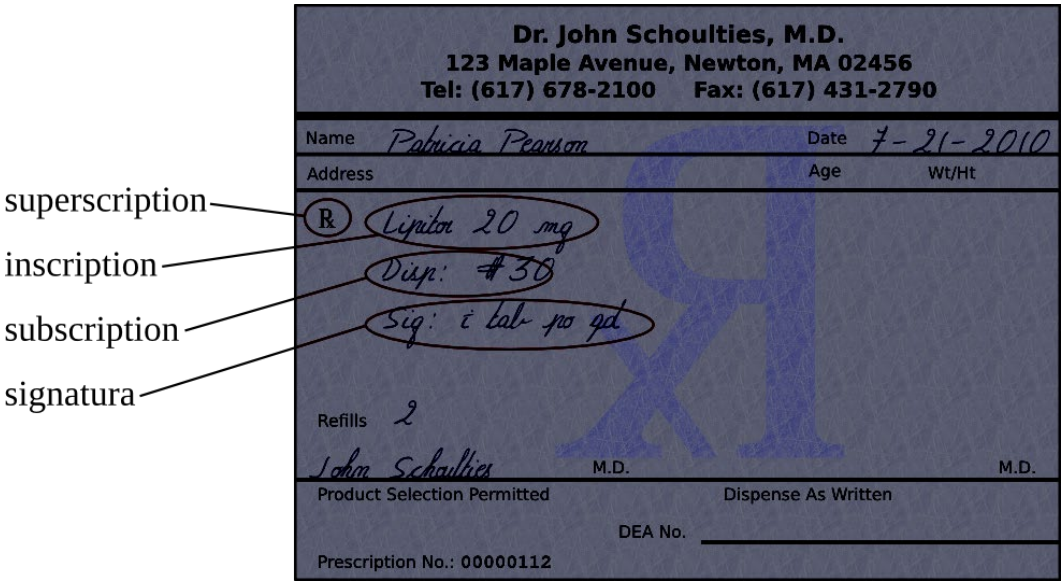
Present day prescriptions are written in English, with doses usually being given in the metric system, but often you still find contracted Latin words and Roman numerals intertwined. The ancient "Rx" and the Latin "Signatura," abbreviated as Sig., the occasional Roman numeral, and a hand full of apothecary symbols are all that remain of the ancient art of the prescription.

Traditionally, a prescription is a written order for compounding, dispensing, and administering drugs to a specific client or patient and once it is signed by the physician it becomes a legal document! Prescriptions are required for all medications that require the supervision of a physician, those that must be controlled because they are addictive

and carry the potential of being abused, and those that could cause health threats from side effects if taken incorrectly, for example, cardiac medications, controlled substances, and antibiotics.

The following is a list of the parts of a prescription, and in bold are the most significant portions:

- Patient Information
- **Superscription**
- **Inscription**
- **Subscription**
- **Signatura**
- Date
- Signature lines, signature, degree, generic substitution
- Prescriber information
- DEA# if required
- Refills
- Warnings



The **superscription** which consists of the heading where the symbol Rx (an abbreviation for recipe, the Latin for take thou) is found. The Rx symbol comes before the inscription.

The **inscription** is also called the body of the prescription, and provides the names and quantities of the chief ingredients of the prescription. Also in the inscription you find the dose and dosage form, such as tablet, suspension, capsule, syrup.

The **subscription**, which gives specific directions for the pharmacist on how to compound the medication. These directions to the pharmacist are usually expressed in contracted Latin or may consist of a short sentence such as: "make a solution," "mix and place into 10 capsules," or "dispense 10 tablets." However, that was in the old days. Today... doctors just name the pill!

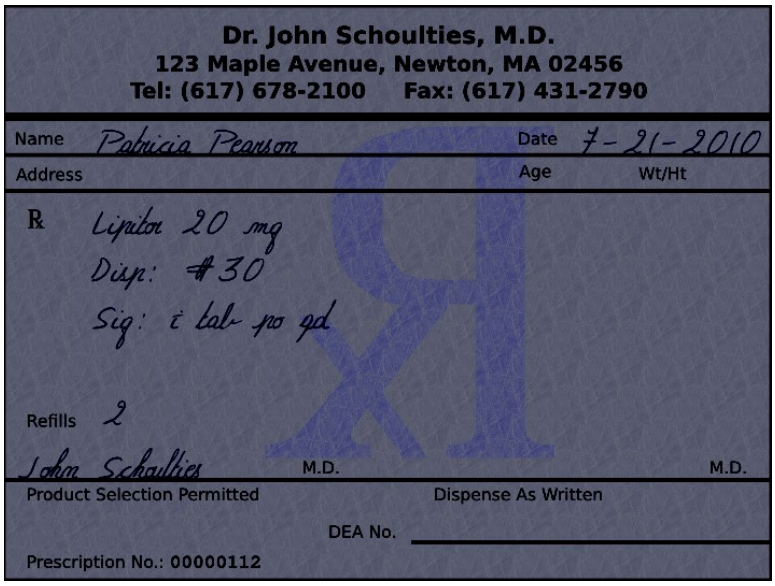
The **signatura** (also called sig, or transcription), gives instructions to the patient on how, how much, when, and how long the drug is to be taken. These instructions are preceded by the symbol “S” or “Sig.” from the Latin, meaning "write" or "label." Whenever translating the signatura into instructions for a patient, begin it with an action verb such as take, inhale, spray, inject, place, swish, or whatever other verb seems appropriate for the medication.

Below the Sig line is room for special instructions, such as the number of times the prescription may be refilled, if any. You will also find the purpose of the prescription, special instructions, and warnings, followed by the signature of the prescriber.

You should also know and understand:

- The ***date*** and ***patient information***, which consists of the name of the party for whom it is designated and the address, usually occupies the upper part of the prescription. Sometimes age or weight is also added, though rarely.
- The instruction, "***take as directed***" is not satisfactory and should be avoided. The directions to the patient should include a reminder of the intended purpose of the medication by including such phrases as "for pain," "for relief of headache," or "to relieve itching"
- And if the patient is to receive a ***brand name medication***, rather then generic, the physician enters NO SUBSTITUTIONS at the end of the prescription.
- If there are ***no refills*** to be dispensed, it is advisable not to enter the number 0, because it can be altered by adding numbers before the zero, thus making it a 10 to receive ten refills (or more!). Always write out the word *None*, or *No Refills*!!!
- The Drug Enforcement Administration (DEA) registration number system was implemented as a way to successfully ***track controlled substances*** from the time they are manufactured until the time they are dispensed to the patient.
- The ***DEA opposes use of the DEA number*** for other than its intended purpose, which is tracking controlled substances, and strongly opposes insurance company practice of requiring that a DEA number be placed on prescriptions for non-controlled substances.
- ***Not all medications require prescriptions***. There are certain medications on the market that can be purchased over the counter, thus their name, over-the-counter drugs (OTC.)

Now to put it all together, let's look at the previous example and translate the information on it:



So, if we look at this script for Patricia Pearson, we can see that it is for Lipitor (atorvastatin Ca) 20 mg tablets, and that the patient is to receive 30 of them with 2 refills. The instructions to the patient would be, "*Take 1 tablet by mouth daily*."

Other things of note include the date that the prescription is written for is July 21, 2010. Prescriptions for non-controlled substances are only good for one year, so Ms. Beaty will need a new script if she still needs this medication past July 21, 2011, regardless of how many refills were written for. Another noteworthy item is that the physician signed permitting product selection (*i.e.*, generic substitution). The last significant item on this label is that the physician did not include their DEA number. A DEA number should only be used for controlled substances.

This brings us to one last major concept in this:

The Additional Prescription Requirements and Limitations when dealing with Controlled Substances

Besides over the counter medications (OTC) such as aspirin and ibuprofen, behind the counter medications (BTC) such as Allegra-D (fexofenadine with pseudoephedrine), and prescription medications (Rx legend) such as amoxicillin and digoxin, there is another group of medications to be concerned with called controlled substances. Controlled substances are medications with further
restrictions due to abuse potential. There are 5 schedules of controlled substances with various prescribing guidelines based on abuse potential, as determined by the Drug Enforcement Administration and individual state legislative branches. Let's look at the table on the next page.

Schedule	Characteristics	Examples
CI	Unaccepted medical use Highest potential for abuse Not available by a prescription	Heroin and LSD
CII	High potential for abuse or misuse	Oxycodone, morphine, and amphetamines

CIII	Potential risk for abuse, misuse, and dependence	Tylenol with Codeine tablets and Vicodin
CIV	Low potential for abuse and limited risk of dependence	Phenobarbital, benzodiazepines, and other sedatives and hypnotics
CV	Low potential for abuse or misuse	Cough medicines that contain a limited amount of codeine, and antidiarrheal medications that contain a limited amount of an opiate such as Lomotil

- CI medications are not available via a prescription.
- CII medications may be written for a maximum 90 day supply excluding hospice patients. No refills are allowed on schedule II medications.
- CIII-IV medications may only be written for a 6 month supply.
- CV medications may be written for up to I year. Many states limit this to 6 months.

Many problems associated with drug abuse are the result of legitimately-manufactured controlled substances being diverted from their lawful purpose into the illicit drug traffic. Many of the narcotics, depressants and stimulants manufactured for legitimate medical use are subject to abuse, and have therefore been brought under legal control. The goal of controls is to ensure that these "controlled substances" are readily available for medical use, while preventing their distribution for illicit sale and abuse.

Under federal law, all businesses which manufacture or distribute controlled drugs, all health professionals entitled to dispense, administer or prescribe them, and all pharmacies entitled to fill prescriptions must register with the DEA. Authorized registrants receive a "DEA number". Registrants must comply with a series of regulatory requirements relating to drug security, records accountability, and adherence to standards. Any properly licensed medical professional that wishes to prescribe a controlled substance must include their DEA number on the prescription.

A valid DEA number consists of 2 letters, 6 digits, and 1 check digit. The first letter is a code identifying the type of registrant. The second letter is the first letter of the registrant's last name.

Here are the steps to verify a DEA number:
Step 1: add the first, third, and fifth digits of the DEA number.

Step 2: add the second, fourth, and sixth digits of the DEA number.

Step 3: multiply the result of Step 2 by two.

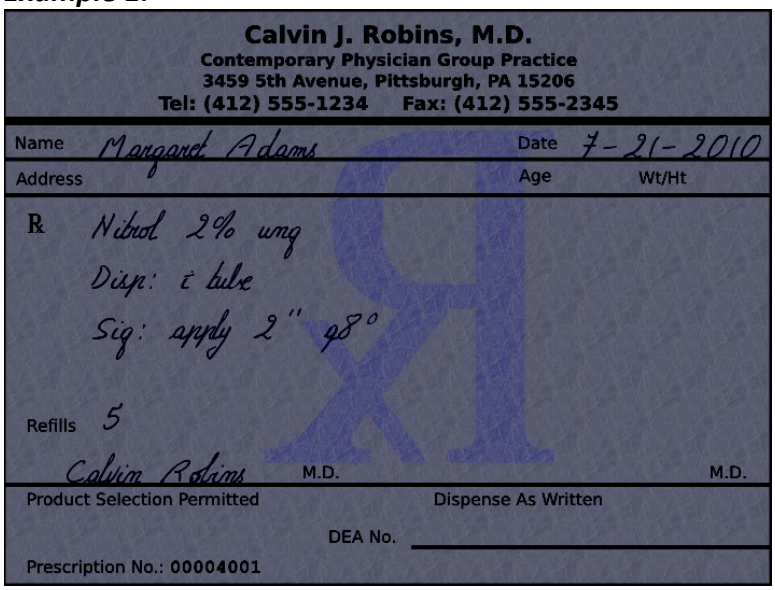
Step 4: add the result of Step 1 to the result of Step 3.

Then, the last digit of this sum must be the same as the last digit of the DEA number.

Example: DEA number AP5836727
Step 1: 5 + 3 + 7 = 15
Step 2: 8 + 6 + 2 = 16
Step 3: 16 * 2 = 32
Step 4: 15 + 32 = 47

The following prescriptions demonstrate examples of interpreting prescriptions and SIG codes.

Example 1:


Calvin J. Robins, M.D.
Contemporary Physician Group Practice
3459 5th Avenue, Pittsburgh, PA 15206
Tel: (412) 555-1234 Fax: (412) 555-2345

Name Margaret Adams Date 7-21-2010
Address Age Wt/Ht

℞ Nitrol 2% ung
Disp: 1 tube
Sig: apply 2" q8°

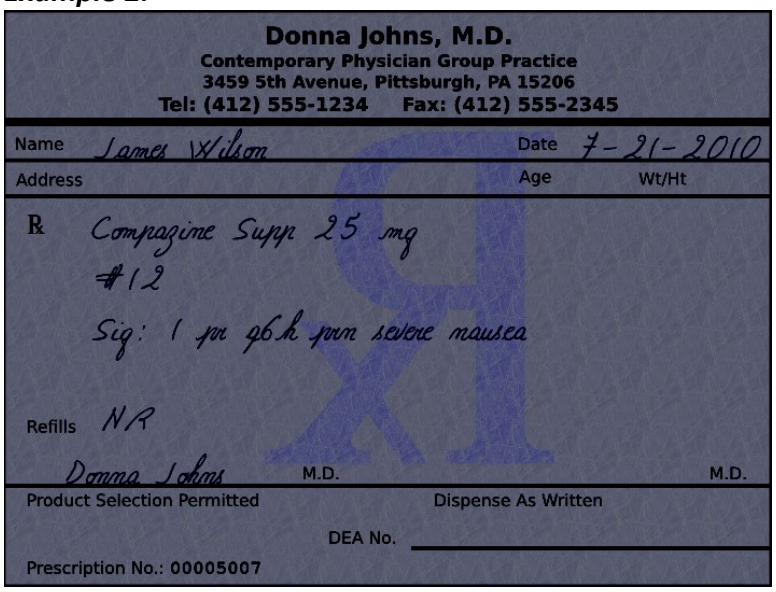
Refills 5
Calvin Robins M.D. M.D.

Product Selection Permitted Dispense As Written
DEA No.
Prescription No.: 00004001

This script for Margaret Adams is for one tube of Nitrol 2% ointment (nitroglycerin 2% ointment) and the patient is allowed 5 refills. The instructions to the patient would be, "*Apply 2 inches every 8 hours*."

Things to note: This is interesting because NTG ung is usually measured in inches. A patient should know to rotate sites and apply to well cleaned areas that have minimal hair. Also, you should probably check with the physician to see if they want the patient to receive a nitrate free interval or not.

Example 2:



Donna Johns, M.D.
Contemporary Physician Group Practice
3459 5th Avenue, Pittsburgh, PA 15206
Tel: (412) 555-1234 Fax: (412) 555-2345

Name James Wilson Date 7-21-2010
Address Age Wt/Ht

℞ Compazine Supp 25 mg
#12
Sig: 1 pr q6h prn severe nausea

Refills NR

Donna Johns M.D. M.D.

Product Selection Permitted Dispense As Written

DEA No.

Prescription No.: 00005007

Mr. James Wilson's script is for twelve 25 mg Compazine (prochlorperazine) suppositories with no refills. The instructions to the patient would be "*Insert 1 suppository rectally every 6 hours as needed for severe nausea*."

Things to note: Female patients may need to be informed to only use this suppository rectally as it will not have the correct systemic effects if given vaginally.

ISMP's List of Error-Prone Abbreviations, Symbols, and Dose Designations

The abbreviations, symbols, and dose designations found on the following tables have been reported to the Institute for Safe Medication Practices (ISMP) through the ISMP Medication Error Reporting Program (MERP) as being frequently misinterpreted and involved in harmful medication errors. According to the ISMP, they should NEVER be used when communicating medical information. This includes internal communications, telephone/verbal prescriptions, computer-generated labels, labels for drug storage bins, medication administration records, as well as pharmacy and prescriber computer order entry screens. The truth is that all the items we are about to discuss ARE ACTUALLY USED and with that in mind we should look over these to help us not make errors in interpreting these abbreviations.

Abbreviations	***Intended Meaning***	***Misinterpretation***	***Correction***
µg	Microgram	Mistaken as "mg"	Use "mcg"
AD, AS, AU	Right ear, left ear, each ear	Mistaken as OD, OS, OU (right eye, left eye, each eye)	Use "right ear", "left ear", or "each ear"
OD, OS, OU	Right eye, left eye, each eye	Mistaken as AD, AS, AU (right ear, left ear, each ear)	Use "right eye", "left eye", or "each eye"
BT	Bedtime	Mistaken as "BID" (twice daily)	Use "bedtime"

Abbreviations	*Intended Meaning*	*Misinterpretation*	*Correction*
cc	Cubic centimeter	Mistaken as “u” (units)	Use “mL”
D/C	Discharge or discontinue	Premature discontinuation of medications if D/C (intended to mean “discharge”) has been misinterpreted as “discontinued” when followed by a list of discharge medications	Use “discharge” and “discontinue”
IJ	Injection	Mistaken as “IV” or “intrajugular”	Use “injection”
IN	Intranasal	Mistaken as “IM” or “IV”	Use “intranasal” or “NAS”
HS **hs**	Half-strength At bedtime, hours of sleep	Mistaken as bedtime Mistaken as half-strength	Use “half-strength” or “bedtime”
IU	International unit	Mistaken as IV (intravenous) or 10 (ten)	Use “units”
o.d. Or OD	Once daily	Mistaken as “right eye” (OD – oculus dexter), leading to oral medications administered in the eye	Use “daily”
OJ	Orange juice	Mistaken as OD or OS (right or left eye); drugs meant to be diluted in orange juice may be given in the eye	Use “orange juice”
Per os	By mouth, orally	The “os” can be mistaken as “left eye” (OS – oculus sinister)	Use “PO,” “by mouth,” or “orally”
q.d. Or QD	Every day	Mistaken as q.i.d., especially if the period after the “q” or the tail of the “q” is misunderstood as an “i”	Use “daily”
qhs	Nightly at bedtime	Mistaken as “qhr” or every hour	Use “nightly”
qn	Nightly or at bedtime	Mistaken as “qh” (every hour)	Use “nightly” or “at bedtime”

Abbreviations	*Intended Meaning*	*Misinterpretation*	*Correction*
q.o.d. or QOD	Every other day	Mistaken as "q.d." (daily) or "q.i.d." (four times daily) if the "o" is poorly written	Use "every other day"
q1d	Daily	Mistaken as q.i.d. (four times daily)	Use "daily"
q6PM, etc.	Every evening at 6 PM	Mistaken as every 6 hours	Use "daily at 6 PM" or "6 PM daily"
SC, SQ, sub q	Subcutaneous	SC mistaken as SL (sublingual); SQ mistaken as "5 every;" the "q" in "sub q" has been mistaken as "every"	Use "subcut" or "subcutaneously"
ss	Sliding scale (insulin) or ½ (apothecary)	Mistaken as "55"	Spell out "sliding scale;" use "one-half" or "½"
SSRI **SSI**	Sliding scale regular insulin Sliding scale insulin	Mistaken as selective-seritonin reuptake inhibitor Mistaken as Strong Solution of Iodine (Lugol's)	Spell out "sliding scale (insulin)"
i/d	One daily	Mistaken as "tid"	Use "1 daily"
TIW or tiw	3 times a week	Mistaken as "3 times a day" or "twice in a week"	Use "3 times weekly"
U or u	Unit	Mistaken as the number 0 or 4, causing a 10-fold overdose or greater (e.g., 4U seen as "40" or 4u seen as "44"); mistaken as "cc" so dose given in volume instead of units (e.g., 4u seen as 4cc)	Use "unit"
UD	As directed ("ut dictum")	Mistaken as unit dose (e.g., diltiazem 125 mg IV infusion "UD" misinterpreted as meaning to give entire infusion as unit [bolus] dose)	Use "as directed"

Dose Designations and Other Information	*Intended Meaning*	*Misinterpretation*	*Correction*
Trailing zero after decimal point (e.g., 1.0 mg)	1 mg	Mistaken as 10 mg if the decimal point is not seen	Do not use trailing zero for doses expressed in whole numbers
No leading zero before a decimal point (e.g., .5 mg)	0.5 mg	Mistaken as 5 mg if the decimal point is not seen	Use zero before a decimal point when the dose is less than a whole unit
Drug name and dose run together (especially problematic for drug names that end in "l" such as Inderal40 mg; Tegretol300 mg)	Inderal 40 mg Tegretol 300 mg	Mistaken as Inderal 140 mg Mistaken as Tegretol 1300 mg	Place adequate space between the drug name, dose, and unit of measure
Numerical dose and unit of measure run together (e.g., 10mg, 100mL)	10 mg 100 mL	The "m" is sometimes mistaken as a zero or two zeros, risking a 10- to 100-fold overdose	Place adequate space between the drug name, dose, and unit of measure
Abbreviation such as mg. or mL. With a period following the abbreviation	mg mL	The period is unnecessary and could be mistaken as the number 1 if written poorly	Use mg, mL, etc. without a terminal period

Dose Designations and Other Information	*Intended Meaning*	*Misinterpretation*	*Correction*
Large doses without properly placed commas (e.g., 100000 units; 1000000 units)	100,000 units 1,000,000 units	100000 has been mistaken as 10,000 or 1,000,000; 1000000 has been mistaken as 100,000	Use commas for dosing units at or above 1,000, or use words such as 100 “thousand” or 1 “million” to improve readability
Drug Name Abbreviations	***Intended Meaning***	***Misinterpretation***	***Correction***
ARA A	vidarabine	Mistaken as cytarabine (ARA C)	Use complete drug name
AZT	zidovudine (Retrovir)	Mistaken as azathioprine or aztreonam	Use complete drug name
CPZ	Compazine (prochlorperazine)	Mistaken as chlorpromazine	Use complete drug name
DPT	Demerol-Phenergan-Thorazine	Mistaken as diptheria-pertusis-tetanus (vaccine)	Use complete drug name
DTO	Diluted tincture of opium, or deodorized tincture of opium (Paregoric)	Mistaken as tincture of opium	Use complete drug name
HCl	Hydrochloric acid or hydrochloride	Mistaken as potassium chloride (the “H” is misinterpreted as “K”)	Use complete drug name unless expressed as salt of drug
HCT	hydrocortisone	Mistaken as hydrochlorothiazide	Use complete drug name
HCTZ	hydrochlorothiazide	Mistaken as hydrocortisone (seen as HCT250 mg)	Use complete drug name
$MgSO_4$	magnesium sulfate	Mistaken as morphine sulfate	Use complete drug name
MS, MSO_4	morphine sulfate	Mistaken as magnesium sulfate	Use complete drug name
MTX	methotrexate	Mistaken as mitoxantrone	Use complete drug name

Drug Name Abbreviations	***Intended Meaning***	***Misinterpretation***	***Correction***
PCA	procainamide	Mistaken as patient controlled analgesia	Use complete drug name
PTU	propylthiouracil	Mistaken as mercaptopurine	Use complete drug name
T3	Tylenol with codeine No. 3	Mistaken as liothyronine	Use complete drug name
TAC	triamcinolone	Mistaken as tetracaine, adrenalin, cocaine	Use complete drug name
TNK	TNKase	Mistaken as "TPA"	Use complete drug name
$ZnSO_4$	zinc sulfate	Mistaken as morphine sulfate	Use complete drug name
Stemmed Drug names	***Intended Meaning***	***Misinterpretation***	***Correction***
"Nitro" drip	Nitroglycerin infusion	Mistaken as sodium nitroprusside infusion	Use complete drug name
"Norflox"	norfloxacin	Mistaken as Norflex	Use complete drug name
"IV Vanc"	intravenous vancomycin	Mistaken as Invanz	Use complete drug name
Symbols	***Intended Meaning***	***Misinterpretation***	***Correction***
ʒ ♏	Dram Minim	Symbol for dram mistaken as "3" Symbol for minim mistaken as "mL"	Use metric system
x3d	For three days	Mistaken as "3 doses"	Use "for three days"
> and <	Greater than and less than	Mistaken as opposite of intended of intended; mistakenly use incorrect symbol; "<10" mistaken as "40"	Use "greater than" or "less than"
/ (slash mark)	Separates two doses or indicates "per"	Mistaken as the number 1 (e.g., "25 units/10 units" misread as "25 units and 110 units")	Use "per" rather than a slash mark to separate doses

Symbols	*Intended Meaning*	*Misinterpretation*	*Correction*
@	At	Mistaken as “2”	Use “at”
&	And	Mistaken as “2, 3, 4, or 8”	Use “and”
+	Plus or and	Mistaken as “4”	Use “and”
°	Hour	Mistaken as a zero (e.g., q2° seen as q 20)	Use “hr,” “h,” or “hour”

Practice Problems

Match the following abbreviations with their English translations.

Route

1) _____ a.d.
2) _____ a.s.
3) _____ a.u.
4) _____ IM
5) _____ IV
6) _____ IVP
7) _____ IVPB
8) _____ KVO
9) _____ n.g.t.
10) _____ n.p.o.
11) _____ nare

a. by mouth
b. by nebulizer
c. each ear
d. each eye
e. intramuscular
f. intravenous
g. intravenous push
h. intravenous piggyback
i. keep vein open
j. left ear
k. left eye

12) _____ o.d.

13) _____ o.s.

14) _____ o.u.

15) _____ per neb

16) _____ p.o.

17) _____ p.r.

18) _____ p.v.

19) _____ SC, SQ

20) _____ S.L.

21) _____ top.

l. naso-gastric tube

m. nostril

n. nothing by mouth

o. rectally

p. right ear

q. right eye

r. subcutaneously

s. sublingually

t. topically

u. vaginally

Form

22) _____ amp

23) _____ aq, aqua

24) _____ caps

25) _____ cm.

26) _____ elix.

27) _____ liq.

28) _____ sol.

29) _____ supp.

30) _____ SR, XR, XL

31) _____ syr.

32) _____ tab.

33) _____ ung., oint

a. ampule

b. capsule

c. cream

d. elixir

e. liquid

f. ointment

g. slow/extended release

h. solution

i. suppository

j. syrup

k. tablet

l. water

Measurement

34) _____ i, ii

35) _____ a.a. or aa

36) _____ ad

37) _____ aq. ad

38) _____ BSA

39) _____ cc

40) _____ dil.

41) _____ f, fl.

42) _____ fl. oz.

43) _____ g, G, gm

44) _____ gr.

45) _____ gtt

46) _____ l, L

47) _____ mcg, µg

48) _____ mEq.

49) _____ mg

50) _____ ml, mL

51) _____ q.s.

52) _____ q.s. ad

53) _____ ss

a. a sufficient quantity

b. add sufficient quantity to make

c. add water up to

d. body surface area

e. cubic centimeter

f. dilute

g. drops

h. fluid

i. fluid ounce

j. grain

k. gram

l. greater than

m. less than

n. liter

o. microgram

p. milliequivalent

q. milligram

r. milliliter

s. of each

t. one, two, etc

54) _____ tbsp., T

55) _____ tsp., t

56) _____ U

57) _____ >

58) _____ <

u. one-half

v. tablespoon

w. teaspoon

x. to, up to

y. unit

Time

59) _____ a.c.

60) _____ a.m.

61) _____ atc

62) _____ b.i.d., bid

63) _____ b.i.w., biw

64) _____ h

65) _____ h.s.

66) _____ p.c.

67) _____ p.m.

68) _____ p.r.n., prn

69) _____ q.i.d., qid

70) _____ q

a. after meals

b. around the clock

c. as needed

d. at bedtime

e. before food, before meals

f. each, every

g. evening

h. every __ hour(s)

i. every day

j. every other day

k. four times a day

l. hour

71) _____ q.d.

72) _____ q_h

73) _____ qod

74) _____ stat

75) _____ t.i.d., tid

76) _____ t.i.w., tiw

m. immediately

n. morning

o. three time a day

p. three times a week

q. twice a day

r. twice a week

Other

77) _____ c

78) _____ disp.

79) _____ f, ft.

80) _____ neb

81) _____ n/v

82) _____ NR

83) _____ NS

84) _____ s

85) _____ Sig.

86) _____ SOB

87) _____ T.O.

88) _____ ut dict., u.d.

a. as directed

b. dispense

c. make, let it be made

d. nausea and vomiting

e. nebulizer

f. no refill

g. normal saline

h. shortness of breath

i. telephone order

j. verbal order

k. with

l. without

89) _____ V.O. m. write, label

Choose the best answer for the following multiple choice questions.

90) The directions for use of a medication are “gtt ii os bid.” The route of administration is:

a) right eye
b) left eye
c) right ear
d) left ear

91) The directions for use of a medication are “Tylenol 80 mg pr q6h prn.” What dosage form should be dispensed?

a) chew tab
b) syrup
c) suppository
d) enema

92) The directions for use are “Nitrostat 1/200 gr S.L. prn.” How should this medication be administered?

a) in the left ear
b) very slowly
c) under the tongue
d) under the skin

93) Which of the following ways would be the best way for a physician to write a prescription for levothyroxine?

a) levothyroxine .1 mg qam
b) levothyroxine 0.100 mg qam
c) levothyroxine .100 mg qam
d) levothyroxine 0.1 mg qam

Answer the following questions.

94) Why is a physician supposed to avoid using the abbreviation “U” for units?

95) Why should physicians not use apothecary symbols when writing prescriptions?

96) Should you have a trailing zero after a decimal point? Why or why not?

97) Should you place a lead zero before a number that is less than one? Why or why not?

Handout 2: Non Sterile Retail Compounding Math

The art of pharmaceutical compounding has ancient roots dating back to early hunter gatherer societies. These ancient civilizations utilized pharmaceutical compounding for religion, grooming, keeping the healthy well, treating the ill and preparing the dead. These ancient compounders produced the first oils from plants and animals. They discovered poisons and the antidotes. They made ointments for wounded patients as well as perfumes for customers.

Today compounding is still a necessary skill for many pharmacists and pharmacy technicians. Extemporaneous compounding can be defined as the preparation, mixing, assembling, packaging, and labeling of a drug product based on a prescription from a licensed practitioner for the individual patient in a form that the drug is not readily available in (extemporaneous = impromptu, compounding = the act of combining things). Extemporaneous compounding is required for prescription orders that are not commercially available in the requested strength or dosage form.

In this chapter you will learn about:

- Reconstituting powders for oral suspensions,
- Mixing liquid preparations,
- Compounding ointments, gels, and creams,
- Medication sticks, and
- Advanced compounding calculations.

While these problems will be more complex than what you've previously done, you will find that you already know all the mathematical principles required to solve these. You will find the following skills helpful:

- Dimensional Analysis (Factor Label)
- Ratios / Proportions / Parts
- Percentage Strength
- The '5 Step Method'

Reconstituting powders for oral suspensions

Reconstituting oral suspensions is a good skill to understand as all pharmacy technicians will need to do it at some point and it is good to have forewarning of a common pitfall. It is often very important to reconstitute oral suspensions properly or you will end up with an overfilled bottle with a great deal of medication stuck in the bottom of the bottle. Let's look at an example briefly.
Example

To reconstitute a 150 mL bottle of amoxicillin for oral suspension 250 mg/5 mL, the manufacturer recommends 88 mL of distilled water is added in two divided portions. First loosen the powder in the bottle, then add approximately 1/3 of the total volume of water and shake the suspension. After the powder is wet, add the remaining water. How much water should you add each time?

QUESTION
How much water should you add each time?
DATA
final volume = 150 mL concentration = 250 mg/5 mL total water = 88 mL
add 1/3 of water initially then add the rest of the water
MATHEMATICAL METHOD / FORMULA
Basic Math
DO THE MATH

$$\frac{88mL}{1} \times \frac{1}{3} = add 29mL of water initially$$

$$88mL - 29mL = then add another 59mL of water$$

DOES THE ANSWER MAKE SENSE?
Yes

Now, you should attempt the following practice problem.

Practice Problem

1) To reconstitute a 100 mL bottle of Augmentin for oral suspension 400 mg/5 mL, the manufacturer recommends 90 mL of distilled water is added in two divided portions. First loosen the powder in the bottle, then add approximately 1/3 of the total volume of water and shake the suspension. After the powder is wet, add the remaining water. How much water should you add each time?

Mixing liquid preparations

Sometimes you will need to determine how much to use of various products to fulfill a recipe written by a physician, sometimes you may take a recipe for a liquid medication and modify it for a different final volume, and other times you may need to either open

up capsules or crush tablets and dissolve or suspend them in a liquid vehicle. Let's look at an example of each scenario.

Examples

1) How much clindamycin phosphate (the stock vial concentration is 150 mg/mL) and how much Cetaphil Lotion are needed to make the following compound?

Rx clindamycin phosphate 1200 mg in Cetaphil Lotion
Disp: 120 mL
Sig: aa hs ud

First, we should figure out how many mL of the clindamycin phosphate stock solution we should use:

$$\frac{1200mg}{1} \times \frac{mL}{150mg} = 8mL of clindamycin phosphate$$

Then, we should figure out how much Cetaphil Lotion we'll need to qs this to 120 mL:

$$120mL - 8mL = 112mL of Cetaphil Lotion$$

2) A prescription is written for a mouthwash containing 170 mL diphenhydramine elixir, 50 mL lidocaine viscous, 200 mL nystatin suspension, 52 mL erythromycin ethyl succinate suspension, and 28 mL of cherry syrup to make 500 mL of mouthwash. How much of each ingredient would be needed if you only wanted to prepare 240 mL of the mouthwash?

First, I would make a ratio comparing each ingredient and specifying the total volume:

170:50:200:52:28 to make 500 mL mouthwash

Then, I would solve for how much of each ingredient is needed to make 240 mL of mouthwash:

$$\frac{170mL diphenhydramine elixir}{500mL mouthwash} = \frac{N}{240mL mouthwash}$$
$$N = 81.6mL diphenhydramine elixir$$

$$\frac{50mL lidocaine viscous}{500mL mouthwash} = \frac{N}{240mL mouthwash}$$
$$N = 24mL lidocaine viscous$$

$$\frac{200mLnystatinsuspension}{500mLmouthwash} = \frac{N}{240mLmouthwash}$$
$$N = 96mLnystatinsuspension$$

$$\frac{52mLerythromycinethylsuccinatesuspension}{500mLmouthwash} = \frac{N}{240mLmouthwash}$$
$$N = 25mLerythromycinethylsuccinatesuspension$$

$$\frac{28mLcherrysyrup}{500mLmouthwash} = \frac{N}{240mLmouthwash}$$
$$N = 13.4mLcherrysyrup$$

3) How many 25 mg tablets of metoprolol tartrate and how many milliliters of Ora-Plus and Ora Sweet are needed to compound the following prescription?

Rx metoprolol tartrate 6.25 mg/tsp in a 50:50 mixture of Ora-Plus and Ora-Sweet
Disp: 300 mL
Sig: i tsp po bid

First let's determine how many metoprolol tartrate tablets are needed:

$$\frac{tablet}{25mg} \times \frac{6.25mg}{tsp} \times \frac{tsp}{5mL} \times \frac{300mL}{1} = 15tablets$$

You will often expect the powder volume from crushed tablets and opened capsules to be negligible, but since we don't know exactly, we will simply do the math for both liquids as if all the volume was from our two suspending agents. Since they are a 50:50 mixture it means that we only need half the volume for each suspension.

$$\frac{50}{100} = \frac{N}{300mL} \qquad \frac{50}{100} = \frac{N}{300mL}$$
$$N = 150mLOra-Plus \qquad N = 150mLOra-Sweet$$

Now you should try some practice problems.

Practice Problems

1) How much tobramycin (the stock vial concentration is 40 mg/mL) and how much Cetaphil Lotion are needed to prepare the following compound?

Rx tobramycin 800 mg in Cetaphil Lotion
Disp: 60 mL
Sig: aa hs ud

2) A prescription is written for a G.I. Cocktail containing 120 mL Donnatal elixir, 120 mL of lidocaine viscous solution, and 480 mL of Mylanta to make a total of 720 mL of G.I. Cocktail. How much of each ingredient would be needed if you only need to prepare 120 mL of G.I. Cocktail?

3) A prescription is written for allopurinol liquid 20 mg/mL in Ora-Plus:Ora-Sweet 1:1 (label with a shelf life of 60 days). How many tablets of allopurinol 100 mg are needed to prepare 200 mL, and approximately how much Ora-Plus and Ora-Sweet are needed as well?

Compounding ointments, gels, and creams

Sometimes compounding a semi-solid mixture (ointment, gel, or cream) can be as straight forward as mixing two semi-solids together, and other times it may require incorporating a medication into a semi-solid base. Let's look at an example of each.

Examples

1) A prescription is written for equal parts triamcinolone 0.1% cream and Lamisil cream, dispense 30 grams. How many grams of triamcinolone 0.1% cream are needed to fill the prescription? How many grams of Lamisil cream are needed to fill the prescription? What is the final percentage strength of triamcinolone in the compound?

To solve this we need to first recognize that the ratio between the ingredients is 1:1 for a total of 2 parts. With that in mind, we know that half the total weight is how many grams of each ingredient we'll need.

$$\frac{1}{2} = \frac{N}{30g}$$
$$N = 15g$$

Therefore, we will need **15 g of triamcinolone 0.1% cm** and **15 g of Lamisil cm**

Next, we need to evaluate the final percentage strength of triamcinolone in the compound. There are 2 ways to do it, one is to calculate just how much triamcinolone is in the mixture and then figure out its percentage strength, the other is to also divide by

2 like we did the total weight. Both ways will be demonstrated, but recognize that you only have to do it one way to achieve the correct answer.

$$\frac{0.1g}{100g} = \frac{N}{15g}$$
$$N = 0.015g$$

or 0.1% ÷ 2 = **0.05% *triamcinolone***

$$\frac{0.015g}{30g} = \frac{N}{100g}$$
$$N = 0.05\%triamcinolone$$

Obviously the second way was easier, but it is good to know that you will get the same answer either way.

It is also noteworthy that the methodology used in this example will apply to any compounding problem where you are mixing ingredients in equal parts.

2) If 50 g of salicylic acid ointment contains 10 grams of salicylic acid, what is the percentage strength of salicylic acid in the ointment?

This problem is just a simple w/w percentage strength problem:

$$\frac{10gsalicylicacid}{50gointment} = \frac{N}{100gointment}$$
$$N = 20\%salicylicacid$$

Now we should once again look at some practice problems.

Practice Problems

1) How much hydrocortisone powder and how much Eucerin cream must be weighed out to prepare the following compound?

Rx hydrocortisone 2.5% in Eucerin cream
Disp: 60 g
Sig: apply sparingly b.i.d. prn

2) A prescription is written for equal parts hydrocortisone 2.5% cream and Lamisil cream, dispense 60 grams. How many grams of hydrocortisone 2.5% cream are needed to fill the prescription? How many grams of Lamisil cream are needed to fill the prescription? What is the final percentage strength of hydrocortisone in this compound?

Medication Sticks

Medication sticks are a solid dosage form used in topical application of local anesthetics, sunscreens, antivirals, antibiotics, and of course cosmetics. Although cosmetic sticks are viewed as tools to improve appearance, they also may contain pharmaceutical active ingredients that serve to heal or protect. For example, a lip balm, which moisturizes the lips, may contain both an antiviral and a sunscreen for use in the treatment and prevention of herpes simplex outbreak. Sticks offer patients, physicians, and pharmacies a unique dosage form that is convenient , relatively stable, and fairly easy to prepare. The convenience comes from the fact that there are several formulas in which all you need to do is add your active ingredients. Let's look at an example problem.

Example

1) You receive the following prescription:

Rx Acyclovir 1200 mg
silica gel micronized 0.12 g
PEG 4500 MW 6.5 g
PEG 300 MW 15 mL
Disp: tube i
Sig: Apply to lips tid prn cold sores

How many 200 mg acyclovir caps are needed to prepare this compound?

If you look at this formula, you'll realize all the calculations are done for you other than figuring out how many acyclovir caps you will need to use. This calculation is fairly straight forward:

$$\frac{1200mg}{1} \times \frac{capsule}{200mg} = 6acyclovircapsules$$

Now let's look at a practice problem.

Practice Problem

1) A prescription is written for: valacyclovir 1000 mg, Silica gel micronized 0.12 gm, Polyethylene glycol 4500 MW 6.5 gm, Polyethylene glycol 300 MW 15 mL. How many 500 mg tablets of valacyclovir are needed to prepare this compound?

With these basic compounding calculations, you are well prepared for the majority of things you will likely come in contact with in a compounding pharmacy, but some of the things that always make extemporaneous compounding exciting are the constant new and unique challenges.

Worksheet 12-1
Name:

Date:

Solve the following problems.

1) A prescription written for a toddler to receive:

Rx cephalexin 125 mg/5 mL susp.
Disp: 100 mL
Sig: tsp ss po qid x10d

You find the following reconstitution instructions: To reconstitute cephalexin 125 mg/5 mL (100 mL after reconstitution) Add 68 mL of water in two equally divided portions to the dry mixture in the bottle. Shake well after each addition. How many mL of water will you add each time?

2) How much clindamycin phosphate (the stock vial concentration is 150 mg/mL) and how much Cetaphil Lotion are needed to prepare the following compound?

Rx clindamycin phosphate 600 mg in Cetaphil Lotion
Disp: 60 mL
Sig: Apply aa hs ud

3) A prescription is written for a mouthwash containing 170 mL diphenhydramine elixir, 50 mL lidocaine viscous, 200 mL nystatin suspension, 52 mL erythromycin ethyl succinate suspension, and 28 mL of cherry syrup to make 500 mL of mouthwash. How much of each ingredient would be needed if you only wanted to prepare 4 fluid ounces of this mouthwash?

4) How many 300 mg rifampin capsules are needed to compound the following solution?

Rx Rifampin 600 mg/60 mL in Simple Syrup
Dispense 240 mL
Sig: 600 mg qd x 4 days

5) A SMOG enema is equal parts sorbitol solution, magnesium hydroxide suspension, mineral oil, and glycerin solution. How may mL of each would you need if you received an order for a 1 liter SMOG enema?

6) A prescription is written for ibuprofen 7.5% cream. How much ibuprofen powder is needed to prepare 60 grams of this compound?

7) A prescription is written for: acyclovir 1000 mg, Silica gel micronized 0.12 gm, Polyethylene glycol 4500 MW 6.5 gm, Polyethylene glycol 300 MW 15 mL. How many 200 mg capsules of acyclovir are needed to prepare this compound?

8) How much of each ingredient must be weighed out to prepare the following ointment?

Rx testosterone 2% and
menthol 4.33% in hydrophilic petrolatum
Disp: 120 g
Sig: apply q.i.d.

9) After you complete your calculations for the previous problem, you realize you are out of hydrophilic petrolatum. You find the following recipe to make 1000 g of hydrophilic petrolatum: cholesterol 30 g, stearyl alcohol 30 g, white wax 80 g, white

petrolatum 860 g. How much of each ingredient will you need if the pharmacist asks you to make only 4 ounces?

10) You need to prepare 200 mL of metformin 100 mg/mL suspension in Ora-Plus:Ora-Sweet 1:1. How many metformin 1000 mg tablets will you need and approximately how much Ora-Plus and Ora-Sweet are needed as well?

Solve the following problems.

1) You are given the following recipe for compounding diclofenac gel: diclofenac sodium USP 4.8 g, ethanol 200 proof 4.8 mL, lipoil 28.8 mL, Polox 20% gel qs ad 120 g. What is the percentage strength of diclofenac sodium in this gel?

2) You are asked to compound 8 fl. oz. of glycopyrrolate 1% topical solution. Your recipe is as follows: glycopyrrolate 1 g, benzyl alcohol 0.96 mL, purified water qs 100 mL. How much of each ingredient will you need to compound 8 fluid ounces?

3) A prescription is written for phenytoin 10% in zinc oxide qs 60 gm. How many phenytoin 50 mg tablets are needed to prepare this compound?

4) You need to prepare 100 mL of potassium bromide 250 mg / mL. How much potassium bromide should you weigh?

5) You are preparing hydrocortisone 1.6 g in 160 mL Lubriderm lotion. What is the percent strength of the hydrocortisone?

6) A prescription for 240 mL of a syrup with a concentration of 10 mg of promethazine and 6.25mg of codeine per teaspoonful is ordered. Promethazine is available in a 50 mg/mL stock solution and codeine is available in a 12 mg/5 mL stock solution. You will q.s. the syrup with cherry syrup. How many mL of codeine stock solution will you need? How much promethazine will you need? How much cherry syrup will you need?

7) You need to prepare 60 mL of baclofen 10 mg/mL. How many tablets of baclofen 10 mg/tablet will you need?

8) You need to prepare 160 mL of amiodarone 5 mg/mL suspension. How many tablets of amiodarone 200 mg/tablet will you need?

9) You need to prepare 60 mL of celecoxib 100 mg/5 mL. How many capsules of 200 mg celecoxib/capsule will you need?

10) You receive the following script:

Rx Mudd Mixture
Disp: 184 mL
Sig: swish and swallow 23 mL q6h x 2 days

For every 23 mL of Mudd mixture, you have 20 mL of nystatin (100,000 units/mL), 2 mL of gentamicin (40 mg/mL), and 1 mL of colistimethate (20 mg/mL). How many milliliters of each ingredient are you going to need to fill this script?

11) You receive a prescription requesting 120 mL of an acetazolamide suspension 25 mg/mL in a 50:50 mixture of Ora-Plus and Ora-Sweet. How many 250 mg acetazolamide tablets and approximately how many mL each of Ora-Plus and Ora-Sweet are needed to compound this prescription?

12) You receive a prescription requesting 4 fl oz of a 1 mg/mL amlodipine suspension in a 50:50 mixture of Ora-Plus and Ora-Sweet. How many 5 mg amlodipine tablets and approximately how many mL each of Ora-Plus and Ora-Sweet are needed to compound this prescription?

13) You receive the following prescription for a pediatric patient:

Rx atenolol suspension 2 mg/mL
in Oral Diluent
Disp: 150 mL
Sig; i tsp po qd

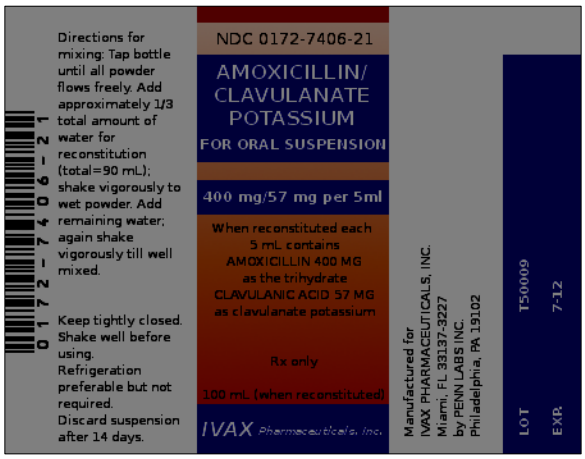
How many atenolol 25 mg tablets will you need to compound this prescription?

14) You need to prepare 120 mL of azathioprine 50 mg/mL suspension by crushing 50 mg tablets of azathioprine and then qs with cherry syrup. How many azathioprine tablets do you need to prepare this suspension?

15) You are asked to make 60 mL of a 5 mg/mL baclofen suspension with 20 mg baclofen tablets, a small amount of glycerin to function as a levigating agent and then qs with simple syrup. How many baclofen tablets are needed?

Solve the following problems.

1) Using the directions on the following label, how many mL of water will you add each time?



2) A prescription is written for a G.I. Cocktail containing 120 mL Donnatal elixir, 120 mL of lidocaine viscous solution, and 480 mL of Mylanta to make a total of 720 mL of G.I. Cocktail. How much lidocaine viscous would be needed if you only need to prepare 120 mL of the G.I. Cocktail?

3) A prescription is written for ichthammol ointment 2 oz. How much of each ingredient is needed to prepare 2 oz. if you are using the following formula: 100 g of ichthammol, 100 g of lanolin, and 800 g of white petrolatum to make 1000 g of ichthammol ointment.

4) You are asked to compound a pint of Schamberg's lotion. You are told to base your calculations off of the following formula: zinc oxide 8 g, menthol 0.25 g, phenol 0.5 g, calcium hydroxide solution 46 mL, olive oil qs ad 100 mL. How much of each ingredient will you need to prepare a pint of this compound?

5) You receive the following prescription:

Rx diclofenac sodium 8% in Pentravan cream
Disp: 60 grams
Sig: aa bid ut dict

How many grams of each ingredient will be needed to make this compound?

6) You receive the following prescription:

Rx tetracycline HCl susp. 125 mg/tsp in
50:50 mixture of Ora-Plus and Ora-Sweet
Disp: 300 mL
Sig: tsp i po bid

How many 250 mg tetracycline capsules and approximately how many mL of Ora-Plus and Ora-Sweet will you need to make this compound?

7) You receive the following prescription for hand rolled lozenges:

Rx benzocaine HCl	100 mg
powdered sugar	10 g
acacia	700 mg
water	qs
food coloring and flavoring	gtt v aa

Disp: M et Ft 10 lozenges c 10 mg benzocaine each
Sig: dissolve in mouth prn mouth sores

The pharmacists suggests you do your calculations for 12 lozenges, and when you're done you can simply discard the heaviest and the lightest lozenge. How much of each ingredient should you measure?

8) A prescription is written for: vitamin E 1,000 IU, zinc oxide 100 mg, Silica gel micronized 0.12 gm, Polyethylene glycol 4500 MW 6.5 gm, Polyethylene glycol 300 MW 15 mL. How many mL of vitamin E are needed to prepare this lip balm if your stock vitamin E has a concentration of 100 g/100 mL (1 mg = 1.1 IU)?

9) An erythromycin ophthalmic ointment requires you to mix 1 part erythromycin 2% (sterile) concentrate with 3 parts ophthalmic base (sterile) ointment. How many grams of each would you need to dispense 50 g of erythromycin ophthalmic ointment and what would be the percent concentration of erythromycin in the final product?

10) The pharmacy receives a prescription requesting 120 mL of a 0.1 mg/mL clonazepam suspension in a 50:50 mixture of Ora-Plus and Ora-Sweet. How many 1 mg clonazepam tablets and approximately how many mL each of Ora-Plus and Ora-Sweet are needed to compound this prescription?

11) You receive a request for 120 mL of 1 mg/mL bethanechol solution and you are to qs it with sterile water for irrigation. How many 10 mg bethanechol tablets are needed to compound this solution?

12) The pharmacy receives a prescription requesting 2 fl oz of a 5 mg/mL bethanechol suspension in a 50:50 mixture of Ora-Plus and Ora-Sweet. How many 10 mg bethanechol tablets are needed to compound this prescription?

13) The pharmacy receives the following prescription to prepare a 27 kg pediatric patient for a bone marrow transplant:

Rx busulfan suspension 2 mg/mL in Simple Syrup
Disp: 16 doses
Sig: 30 mg po q6h

a) How many milliliters of busulfan suspension will the patient receive for each dose?

b) How many milliliters of busulfan suspension will be needed to cover all 16 doses?

c) How many 2 mg busulfan tablets are required to make this suspension?

14) The pharmacy needs to prepare 300 mL of diltiazem suspension 12 mg/mL using 90 mg diltiazem tablets and a 50:50 mixture of Ora-Plus and Ora-Sweet. How many diltiazem tablets and approximately how many milliliters each of Ora-Plus and Ora-Sweet are needed to make this compound?

15) You receive the following prescription for a 9 lb 14 oz feline with lower back pain:

Rx Gabapentin suspension chicken flavor 10 mg/mL
Disp: 180 mL
Sig: Day 1 ~ 20 mg po, Day 2 ~ 20 mg po bid, then 20 mg po tid thereafter

Your recipe for 100 mL of this suspension is as follows: gabapentin 1g, xanthum gum 0.4 g, stevia 0.75 g, acesulfame 0.75 g, sodium saccharin 0.1 g, magnasweet solution 0.2 mL, 1% citric acid approximately 0.1 mL (use to obtain pH of 5.5 to 6.5), sodium chloride 0.5 g, bitter stopping agent flavor 1 mL, glycerin 2 mL, chicken flavor 3 mL, bacteriostatic water q.s. 100 mL. How much of each ingredient will you need to compound the requested 180 mL?

Advanced Compounding Calculations

There are several things to consider with respect to advanced compounding calculations including:

- calculations involving specific gravity,
- accounting for excipients when compounding,
- suppositories and density factors, and
- determining shell sizes for extemporaneously compounded capsules.

Calculations Involving Specific Gravity

Sometimes when compounding mixtures, the recipes will provide you with weights of all the various ingredients including liquids. Obviously, it is easier to measure a liquid by volume than mass. Water has the unique advantage that 1 gram of water has a volume of 1 milliliter, but other liquids do not share this convenient conversion. When dealing with liquids other than water, you will need to know their specific gravity.

Specific gravity is commonly defined as the mass of 1 milliliter of a particular substance. Therefore, if I stated that a particular liquid had a specific gravity of 0.8, it means that every milliliter of it weighs 0.8 grams. If a particular compound requested 5 grams of a liquid known to have a specific gravity of 0.8, I could determine the volume as follows:

$$\frac{5\text{g}}{1} \times \frac{1\text{mL}}{0.8\text{g}} = 6.25\text{mL}$$

Some common specific gravities that you may end up working with include:

Substance	***Specific Gravity*** *(g/mL)*
glycerin	1.249
honey	1.40-1.45
mineral oil	0.845-0.905
olive oil	0.910-0.915
stearyl alcohol	0.805-0.815
water	1

You will notice that with the list above there is often a slight range for specific gravity. When dealing with this range, it is generally acceptable to use the average value (add the low value of the range to the high value and divide by 2). As an example, if a prescription required 5 grams of honey, I would first determine the average specific gravity as follows:

$$\frac{1.40+1.45}{2} = 1.425$$

Then I would find the volume as follows:

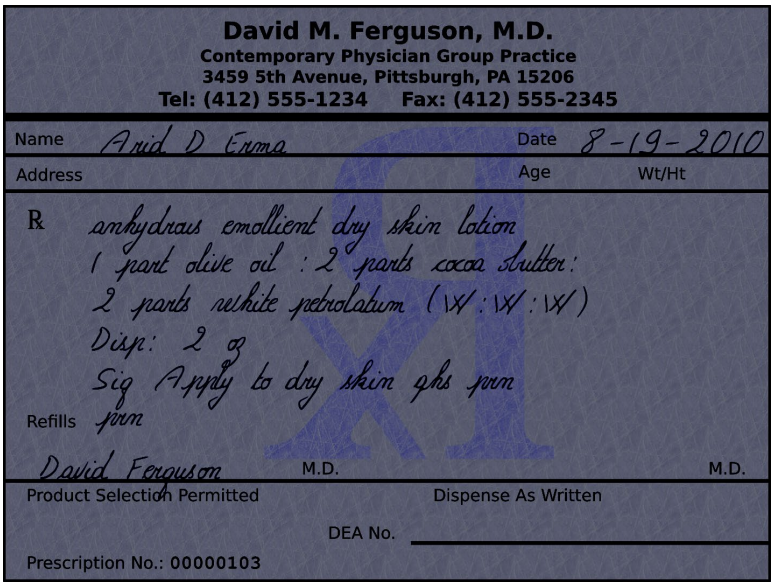
$$\frac{5g}{1} \times \frac{mL}{1.425g} = 3.5mL$$

Now let's attempt a couple of practice problems.

Practice Problems

1) A prescription is written for 60 g of zinc oxide ointment, USP. If the formula for zinc oxide ointment, USP is as follows: 200 g of zinc oxide powder, 650 g of white ointment, and 150 gram of mineral oil to make 1000 grams of zinc oxide ointment, USP; how much of each ingredient will you need to fill this order? Using the information from the previous page (mineral oil has a specific gravity of 0.845 to 0.905) determine your quantity of mineral oil required for this prescription in milliliters. (*Note, since this preparation is commercially available you would not ordinarily compound it. This problem is intended for educational purposes.*)

2) Use the prescription below and information from the specific gravity chart on the previous page to determine how many grams of cocoa butter, how many grams of white petrolatum, and how many milliliters of olive oil you'll need to compound this prescription.



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Name: Arid D Erma Date: 8-19-2010
Address: Age: Wt/Ht:

℞ anhydraus emollient dry skin lotion
1 part olive oil : 2 parts cocoa butter :
2 parts white petrolatum (W/W:W/W)
Disp: 2 oz
Sig Apply to dry skin qhs prn
Refills prn

David Ferguson M.D. M.D.

Product Selection Permitted Dispense As Written

DEA No.

Prescription No.: 00000103

Accounting for Excipients when Compounding

Before we start looking at how to do calculations where we need to account for excipients, we should define what excipients are. Excipients are “inert” or inactive ingredients other than the active drug which are included in the manufacturing process or are contained in a finished pharmaceutical dosage form. They allow the proper delivery of the active compounds contained in nearly all over the counter and prescription medications.

At the risk of sounding like *'Mary Poppins'*, almost every drug needs a few inactive ingredients to help the medicine go down. Depending on the route of administration, and form of medication, various excipients may be used. According to the USP-NF, all excipients fit into one or more of 40 categories. The ingredients are classified by the functions they perform in a pharmaceutical dosage form. Some examples are antiadherents, binders, coatings, colors, disintegrants, fillers, flavors, glidants, lubricants, preservatives, sweeteners, and printing inks.

Example

1) A compound prescription order calls for 2200 mg of naproxen. You have available in your pharmacy 500 mg naproxen tablets. Each 500 mg naproxen tablet weighs 630 mg due to all the excipients required to manufacture it. To achieve this, we need to first figure out how many naproxen tablets you will need to pull out of stock to make this (you will need to automatically round up any decimal values). Then, you can triturate the naproxen tablets in a mortar and pestle and weigh out the required quantity of crushed naproxen tablets to provide the desired quantity of medication. Below is the math required to perform this task.

$$\frac{2200mg}{1} \times \frac{tablet}{500mg} = 4.4tablets = 5tabletswillneedremovedfromstock.$$

Now that we know we will need 5 tablets from stock, you can crush them up and use a ratio proportion to determine how much you will need to weigh out.

$$\frac{500mgnaproxen}{630mgnaproxenplusexcipients} = \frac{2200mgnaproxen}{N}$$

$$N = 2772mgnaproxenplusexcipients$$

Therefore, after you triturate 5 naproxen tablets in your mortar and pestle, you will need to weigh out 2,772 mg of the crushed powder to acquire 2,200 mg of naproxen.

Let's proceed to the next page where you can do a practice problem involving calculations where you need to account for excipients.

Practice Problem

1) You need to prepare 120 mL of metronidazole suspension with a concentration of 59 mg/5 mL. How many 250 mg tablets will you need, and if each tablet weighs 430 mg, how will you determine the appropriate weight of the tablets to use after you triturate them for the requested suspension?

Suppositories and Density Factors

Suppositories are defined by the USP-NF as follows:

Suppositories are solid bodies of various weights and shapes, adapted for introduction into the rectal, vaginal, or urethral orifice of the human body. They usually melt, soften, or dissolve at body temperature. A suppository may act as a protectant or palliative to the local tissue at the point of introduction or as a carrier of therapeutic agents for systemic or local action.

Suppositories may be used when a local effect is needed in the rectum, vagina, or urethra.

Rectal suppositories (and to a lesser extent, vaginal suppositories) may also be used as carriers of systemic drugs. Rectal suppositories offer an alternative for the systemic delivery of drugs in patients who can not take drugs orally. Examples include patients who are unconscious, those who are vomiting or having seizures, and those who have obstructions in the upper gastrointestinal tract.

Some drugs that are ineffective orally may be successfully administered rectally or vaginally. Examples include drugs that are extensively metabolized by first-pass effect and drugs that are destroyed in the stomach or intestine. An example of a drug that is usually administered either rectally or vaginally for those reasons include progesterone.

Compounding suppositories is usually done as a last resort. This is because suppositories are, in general, more difficult to prepare than other dosage forms.

Suppositories are usually made of one of two bases:

- *polyethylene glycol (PEG)* which dissolves, or
- *cocoa butter* which melts at body temperature.

There are also two common methods for preparing suppositories:

- *hand-rolling suppositories*, which does not require any special equipment, but lacks pharmaceutical elegance, or
- *fusion suppositories*, provide much greater pharmaceutical elegance, but require either aluminum or disposable molds, and also require more calculations.

In this chapter, we are going to look at the more common (although more complex to calculate) cocoa butter based fusion suppositories. When doing these calculations, you will need to know how many grams of your base can be held by the suppository molds, and then figure out how much of your base to use when mixed with the active ingredients added to a suppository. Unfortunately, I can not just subtract the weight of the active ingredient from the weight of our aforementioned total weight to figure out how much cocoa butter is needed because the active ingredient does not occupy the same volume as that mass of cocoa butter (they have different densities). We can use the table on this page to find the active ingredient's density factor (DF) when compared to cocoa butter.

Density Factors for Cocoa Butter Suppositories[7] compared to the amount of weight (g) required to fill the same volume as 1 gram of cocoa butter.

Medication	Factor	Medication	Factor
Aloin	1.3	Iodoform	4.0
Alum	1.7	Menthol	0.7
Aminophylline	1.1	Morphine hydrochloride	1.6
Aminopyrine	1.3	Opium	1.4
Aspirin	1.1	Paraffin	1.0
Barbital	1.2	Pentobarbital	1.2
Belladonna extract	1.3	Perovian balsam	1.1
Benzoic acid	1.5	Phenobarbital	1.2
Bismuth carbonate	4.5	Phenol	0.9
Bismuth salicylate	4.5	Potassium bromide	2.2
Bismuth subgallate	2.7	Potassium iodide	4.5

[7]If a medicament of unknown density compared to cocoa butter is used, you may multiply the medicament's desired weight by 0.7 to obtain an estimate of how much cocoa butter is being displaced.

Bismuth subnitrate	6.0	Procaine	1.2
Boric acid	1.5	Quinine hydrochloride	1.2
Castor oil	1.0	Resorcinol	1.4
Chloral hydrate	1.3	Salicylic acid	1.3
Cocaine hydrochloride	1.3	Secobarbital sodium	1.2
Codeine phosphate	1.1	Sodium bromide	2.3
Digitalis leaf	1.6	Spermaceti	1.0
Dimenhydrinate	1.3	Sulfathiazole	1.6
Diphenhydramine hydrochloride	1.3	Tannic acid	1.6
Gallic acid	2.0	White wax	1.0
Glycerin	1.6	Witch hazel fluid extract	1.1
Hydrocortisone acetate	1.5	Zinc oxide	4.0
Ichthammol	1.1	Zinc sulfate	2.8

Example

1) You receive a prescription requiring you to compound 6 cocoa butter based suppositories with 100 mg of aspirin in each. You know from previous work with these particular suppository molds that they can each hold 2 grams of cocoa butter. How much cocoa butter and how much aspirin powder will you need to compound this order?

First, we should determine how much cocoa butter these six suppositories could hold.

$$\frac{6supp}{1} \times \frac{2g}{1supp} = 12gcocoabutter$$

Now we should look at how much aspirin powder is required.

$$\frac{6supp}{1} \times \frac{100mg}{1supp} = 600mgaspirinpowder$$

Since cocoa butter and aspirin have different densities, we will need to look at the chart on the previous page to determine how much mass of cocoa butter is displaced by our 600 mg of aspirin powder.

$$\frac{600mgaspirin}{1} \times \frac{1gcocoabutter}{1.1gaspirin} = 545mgcocoabutter$$

Now we can subtract the 545 mg from our previous number of 12 g to determine how much cocoa butter we actually need.

$$12g - 0.545g = 11.455gcocoabutterrequired$$

So now we know how much of each ingredient we need.

11.455 g cocoa butter
600 mg aspirin

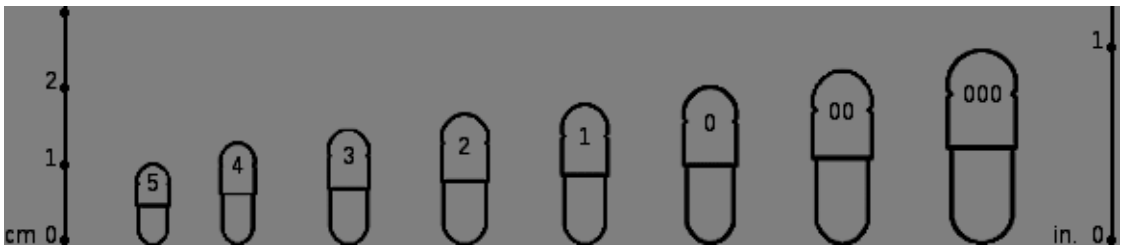
Now, you should attempt a practice problem.

Practice Problem

1) You receive a prescription requiring you to compound 12 cocoa butter based suppositories with 30 mg of phenobarbital in each. You know from previous work with these particular suppository molds that they can each hold 2.08 grams of cocoa butter. How much cocoa butter and how much phenobarbital powder will you need to compound this order?

Determining Shell Sizes for Extemporaneously Compounded Capsules

The gelatin shells used in capsules are made of two parts. The base is the longer end and fits into the shorter end which is referred to as the cap. The cap is designed to fit over the base and then snap or lock into place with added pressure.



Capsules are oval in shape and available in eight different sizes for human use. These sizes are #5, #4, #3, #2, #1, #0, #00, and #000, with the smallest being a #5 and the largest being #000. The numbers used to designate size have no bearing on the volume that may be contained within. The capacity of a capsule is dependent on the density and physical characteristics of the powders used in the formula. (Larger capsules are available for veterinary use.)

The approximate capacity of various capsules can be found on the following chart:

Capsule Size

Drug Substance	5	4	3	2	1	0	00	000
	Capacity in grams of drug powder							
Acetaminophen	0.13	0.18	0.24	0.31	0.42	0.54	0.75	1.10
Aluminum hydroxide	0.18	0.27	0.36	0.47	0.64	0.82	1.14	1.71
Ascorbic acid	0.13	0.22	0.31	0.40	0.53	0.70	0.98	1.42
Aspirin	0.10	0.15	0.20	0.25	0.33	0.55	0.65	1.10
Bismuth subnitrate	0.12	0.25	0.40	0.55	0.65	0.80	1.20	1.75
Calcium carbonate	0.12	0.20	0.28	0.35	0.46	0.60	0.79	1.14
Calcium lactate	0.11	0.16	0.21	0.26	0.33	0.46	0.57	0.80
Corn starch	0.13	0.20	0.27	0.34	0.44	0.58	0.80	1.15
Lactose	0.14	0.21	0.28	0.35	0.46	0.60	0.85	1.25
Quinine sulfate	0.07	0.10	0.12	0.20	0.23	0.33	0.40	0.65
Sodium bicarbonate	0.13	0.26	0.32	0.39	0.52	0.70	0.97	1.43

When looking at the shell capacities for various drugs on the chart above, note that the number listed is the maximum quantity that you can pack in a shell that size. For example, if you wanted to place 300 mg (0.300 g) of acetaminophen in a capsule, you could fit it in a size #2 capsule, but if you wanted to put 325 mg (0.325 g) of acetaminophen, you would need to use a size #1 capsule.

When determining capsule size, it becomes more complex when looking at capsules with multiple drug additives. If one additive is going to take the majority of the volume, you may simply want to add the weights of all your drugs and then base your capsule size on the ingredient requiring the majority of the room. Let's look at an example problem to demonstrate this.

Example

1) You receive an order for a hospice patient requesting compounded capsules with 15 mg of hydrocodone bitartrate and 325 mg of acetaminophen. What size capsule shell will you need?

As acetaminophen is the ingredient that is going to make up the bulk of the capsule, we will base our capsule size off that. First we need to determine our total weight.

$$325mg + 15mg = 340mg$$

Based on the chart from the previous page, you will need to use a size #1 capsule shell.

Practice Problems

1) What size capsule shell will you need if a physician requests 2 grains of aspirin to be dispensed in a capsule for a patient?

2) You receive an order for a hospice patient requesting 30 compounded capsules with 20 mg of oxycodone, 120 mg aspirin, and 300 mg acetaminophen. What size capsule shell will you need?

Solve the following problems.

1) You receive a request to make 'Pittsburgh Paste', which gets its name from its golden yellow color. It consists of Aquaphor, cholestyramine powder, and mineral oil (which acts as a levigating agent). You find the following compounding recipe for it:

PITTSBURGH PASTE

Aquaphor	80 g
Cholestyramine Powder	5.9 g
Mineral Oil	20 mL

Auxiliary Labeling: TOPICAL USE ONLY

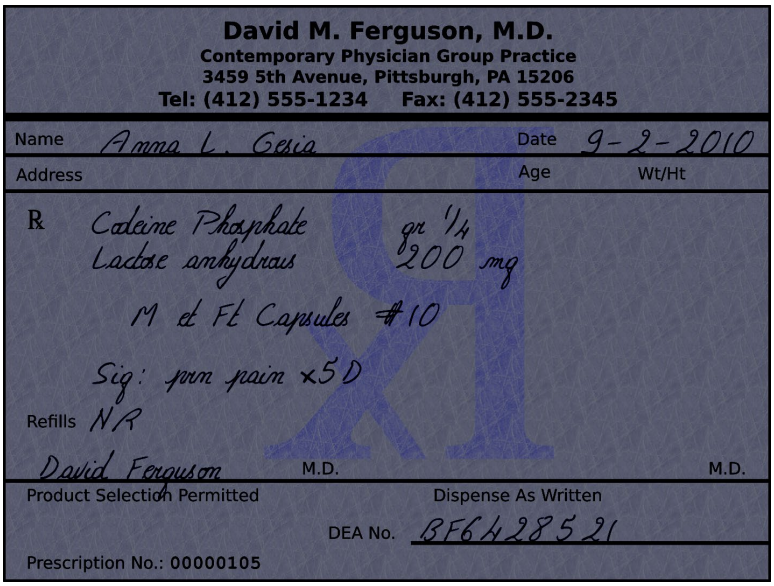
Expiration: 28 DAYS

Mineral oil has a specific gravity of 0.845-0.905, so what is the percent concentration of cholestyramine powder in this compound?

2) A prescription is written for ibuprofen 7.5% cream. You are out of ibuprofen powder and will need to crush 200 mg ibuprofen tablets (each tablet weighs 0.33 g) to prepare this compound. How many tablets are you going to triturate and how much weight of these crushed tablets are needed to prepare 30 grams of this compound?

3) A pharmacy receives a prescription for 12 cocoa butter based suppositories with 200 mg of procaine each. The suppository mold in the pharmacy can hold 2.27 g of cocoa butter per suppository. How much cocoa butter and how much procaine will be needed to make these suppositories?

4) Based on the prescription below and the capsule chart earlier in this chapter, what size capsule shell should be used when preparing these capsules?



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Name Anna L. Gesia Date 9-2-2010

Address Age Wt/Ht

℞ Codeine Phosphate gr ½
Lactose anhydrous 200 mg
M et Ft Capsules #10
Sig: prn pain x5D

Refills NR

David Ferguson M.D. M.D.

Product Selection Permitted Dispense As Written

DEA No. BF6428521

Prescription No.: 00000105

5) While rarely seen today, Brompton Cocktails are still occasionally ordered for terminally ill patients, to provide them with comfort and promote sociability at end of life. Brompton Cocktail's received their name from where it was originally created during the early 19th century at the Royal Brompton Hospital in London, England. The recipe for the cocktail tends to vary between institutions. You are working at a hospital with a terminally ill cancer patient and the physician wants to give the patient a Brompton Cocktail. After a brief discussion, the pharmacist and the physician settle on the following recipe:

BROMPTON'S COCKTAIL

Morphine Solution 10 mg/mL	6 mL
Cocaine HCl powder	67.2 mg
Simple Syrup	15 mL
90% Ethanol	39 mL
TOTAL VOLUME	60 mL

Auxiliary Labeling: Keep Refrigerated, Oral Use Only

Expiration: Seven Days

The pharmacist is very busy and needs you to calculate several things for labeling the bottle.

a) What is the new percentage strength of the ethanol?

b) How many mg of morphine are in a dose of 1 teaspoon?

c) You are told that 1.12 g of cocaine HCl equals 1 g of cocaine, so how many mg of cocaine are in 1 teaspoon?

6) A prescription is written for a patient that has a hard time swallowing tablets and suffers from hypothyroidism:

Rx: Levothyroxine Na Suspension
Disp: 30 day supply
Sig: 100 mcg po qd

You find the following recipe in your compounding log:

LEVOTHYROXINE NA 25 MCG / mL SUSPENSION

Levothyroxine Na 0.1 mg tablets	25 tabs
Glycerin	40 mL
Distilled Water	q.s. 100 mL

Instructions: Crush levothyroxine Na tablets and triturate with glycerin, which acts as a levigating agent and rinse for mortar and pestle. Q.S. with distilled water to obtain a total volume of 100 mL.

Auxiliary Labeling: Shake Well, Oral Use Only, Protect From Light, Keep Refrigerated

How would you rewrite the recipe to provide the requested 30 day supply?

7) The pharmacist requests that you prepare 500 g of bentonite magma (used as a suspending medium for other drugs). The recipe for bentonite magma NF is as follows:

BENTONITE MAGMA

Bentonite	50 g
Purified Water	q.s. ad 1,000 g

Rewrite this recipe for 500 g, and how many mL of water will be needed since water has a specific gravity of 1?

8) A compound prescription order calls for 90 g of a 7% naproxen ointment. You have available in your pharmacy 500 mg naproxen tablets. Each 500 mg naproxen tablet weighs 630 mg due to all the excipients required to manufacture it. To achieve this, we need to first figure out how many naproxen tablets you will need to pull out of stock to make this. Then, you can triturate the naproxen tablets in a mortar and pestle and weigh out the required quantity of crushed naproxen tablets to provide the desired quantity of medication to compound this prescription. How many tablets will need triturated and what weight of crushed up tablets will then need to be weighed out?

9) A pharmacy receives a prescription for 12 cocoa butter based Rectal Rocket® suppositories with 200 mg of procaine, 100 mg of hydrocortisone acetate, and 60 mg of witch hazel fluid extract (witch hazel has a specific gravity of 0.979-0.983) each. These suppository molds can hold 4 g of cocoa butter per suppository.

    a) How many grams of procaine will be needed to make these suppositories?

    b) How many grams of hydrocortisone acetate will be needed to make these suppositories?

    c) How many grams and how many milliliters of witch hazel fluid extract are needed to make these suppositories?

    d) How many grams of cocoa butter will be needed to make these suppositories?

10) A physician has a patient with legitimate pain issues but also has a history of prescription drug abuse. After a brief discussion between the pharmacist and the patient's physician, they decide on dispensing 30 capsules with 5 mg of hydrocodone bitartrate, 325 mg of acetaminophen, and 5 mg of capsaicin each. What size capsule shells will you need to compound this prescription?

Solve the following problems.

1) A prescription written for a pediatric patient to receive:

    Rx cefadroxil 250 mg/5 mL susp.
    Disp: 100 mL

Sig: i tsp po bid x10d

When you retrieve the bottle from the shelf you find the following reconstitution instructions: To reconstitute cefadroxil 250 mg/5 mL (100 mL after reconstitution) tap bottle lightly to loosen powder. Add 61 mL of water in two equally divided portions to the dry mixture in the bottle. Shake well after each addition. How many mL of water will you add each time?

2) A prescription written for a pediatric patient to receive:

Rx cefixime 100 mg/5 mL susp.
Disp: 75 mL
Sig: iss tsp po qd x10d

When you retrieve the bottle from the shelf you find the following reconstitution instructions: To reconstitute cefixime 100 mg/5 mL (75 mL after reconstitution) tap bottle lightly to loosen powder. Add 52 mL of water in two equally divided portions to the dry mixture in the bottle. Shake well after each addition. How many mL of water will you add each time?

3) How much lidocaine HCl (the stock vial concentration is 40 mg/mL) and how much Cetaphil Lotion are needed to prepare the following compound?

Rx lidocaine HCl 1200 mg in Cetaphil Lotion
Disp: 120 mL
Sig: apply lightly to aa q4h prn itching and burning

4) From the following formula, calculate the number of grams of each ingredient required to prepare 60 grams of this ointment:

Precipitated sulfur	10 g
Salicylic acid	2 g
Hydrophilic ointment	88 g

5) Using the same formula as in the previous problem, determine how many grams of each ingredient would be required to prepare a pound of this ointment.

6) A patient comes in suffering from mouth sores and presents the following prescription:

Rx Magic Mouthwash
Disp: 480 mL
Sig: i Tbs swish and spit q6h prn mouth pain

Magic Mouthwash is a 1:1:1 ratio of mixing viscous lidocaine, diphenhydramine elixir, and magnesium aluminum hydroxide suspension. How many mL of each are needed to prepare this solution?

7) You receive the following script:

Rx Mudd Mixture
Disp: 4 day supply
Sig: swish and swallow 23 mL q6h

For every 23 mL of Mudd Mixture, you have 20 mL of nystatin (100,000 units/mL), 2 mL of gentamicin (40 mg/mL), and 1 mL of colistimethate (20 mg/mL).

a) How many milliliters of Mudd Mixture do you need to dispense in total?

b) How many milliliters of each ingredient are you going to need to fill this script?

c) Nystatin is available in 1 pint bottles, gentamicin is available in 20 mL vials, and colistimethate comes as a lyophilized powder with 150 mg/vial. How many bottles of nystatin, vials of gentamicin, and vials of colistimethate will you need to compound this order?

8) Due to a product shortage, the pharmacist asks you to compound 60 mL of a 15 mg/mL oseltamivir suspension using 75 mg capsules and cherry syrup. How many 75 mg oseltamivir capsules will be needed for compounding this suspension?

9) The following is a recipe intended for veterinary use:

METRONIDAZOLE AND SILVER SULFADIAZINE CREAM

Metronidazole	1 g
Silver sulfadiazine	1 g
Glycerin	5 g
Hydrophyllic ointment	q.s. 100 g

a) How many grams of each ingredient would be needed to prepare 2 oz of this cream?

b) Considering that glycerin has a specific gravity of 1.249, how many mL of glycerin will be needed for this preparation?

10) You receive the following prescription for hand rolled lozenges:

Rx lidocaine HCl	100 mg
powdered sugar	10 g
acacia	700 mg
water	qs
food coloring and flavoring	gtt v aa

Disp: M et Ft 10 lozenges c 10 mg lidocaine each
Sig: dissolve in mouth prn mouth sores

The pharmacists suggests you do your calculations for 12 lozenges and when you're done you can simply discard the heaviest and the lightest lozenge.

a) How much of each ingredient should you measure?

b) If your stock lidocaine HCl solution has a concentration of 40 mg/mL how many milliliters will you need?

11) A prescription is written for: diphenhydramine 250 mg, Silica gel micronized 0.12 gm, Polyethylene glycol 4500 MW 6.5 g, Polyethylene glycol 300 MW 15 mL. How many 50 mg tablets of diphenhydramine are needed to prepare this compound?

12) The pharmacy needs to make a 150 mL of a 0.05 mg/mL alprazolam suspension. If each 2 mg alprazolam tablet weighs 80 mg, how many 2 mg alprazolam tablets will you need to pull out of stock, and after they are triturated how many grams of crushed alprazolam tablets will you weigh out?

13) Calculate the quantities required to make six cocoa butter based suppositories (each mold can hold 2.17 g of cocoa butter), each containing 100 mg aminophylline (aminophylline has a density factor of 1.1 when compared to 1 g of cocoa butter).

14) A physician has a patient with legitimate pain issues but also has a history of prescription drug abuse. Because of other medications the patient may be taking that contain acetaminophen, the physician does not want any additional acetaminophen in this product. After a brief discussion between the pharmacist and the patient's physician, they decide on dispensing 30 capsules with 5 mg of hydrocodone bitartrate, 325 mg of aspirin, and 5 mg of capsaicin each. What size capsule shells will you need to compound this prescription?

15) A pharmacist asks you to prepare a bottle of “Mile's Solution”. You find the following recipe in the book:

MILE'S SOLUTION

Prednisone Elixir 5 mg/5 mL	120 mL
Tetracycline 500 mg caps	3 caps
Cherry Syrup	60 mL
Nystatin Suspension 100,000 u/mL	30 mL
Diphenhydramine Elixir 12.5 mg/5 mL	75 mL
Sterile Water for Irrigation	240 mL
TOTAL VOLUME	525 mL

Auxiliary Labeling: Shake Well, Oral Use Only, Protect From Light

Expiration: Two Weeks

You gather all the supplies, and find that the only prednisone elixir you have in stock has a concentration of 5 mg/mL. You bring this to the pharmacist's attention and she tells you to adjust how much prednisone you add so that you end up with the correct concentration and change the amount of cherry syrup added to make up the difference in the total volume.

a) How much prednisone elixir 5 mg/mL are you going to add?

b) How much cherry syrup are you going to add?

Handout 3: Sterile Compounding and Hospital Math

DRIP RATES & INFUSION RATES

Physicians may order medications to be infused at a specific rate or over a set period of time. In other instances, institutions may have defined infusion rate protocols for a particular medication. There may even be recommendations from the drug manufacturer itself (listed in the drug literature) providing infusion rate information. Pharmacies often have the role of assisting with infusion rate calculations and verifying the appropriateness of various rates. The pharmacy will typically help determine items such as (but not limited to):

- milliliters per hour (mL/hr)
- milliliters per day (mL/day)
- drops per minute (gtt/min)
- grams per hour (g/hr)
- infusion time (minutes, hours, days)

When infusion rates were mentioned in an earlier chapter, some important concepts were mentioned that should be revisited, including a broad definition of infusion rates and the definition of the term drip rate. When discussing parenterals infusions, rates can be defined as a quantity of drug (mL, gtt, g, mcg, mEq, IU, etc.) provided over a quantity of time (minutes, hours, days, etc.).

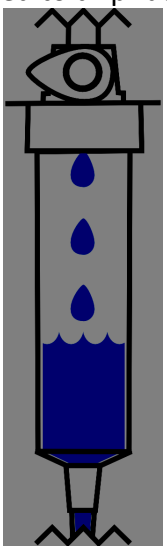
$$\frac{\text{QuantityofDrug}}{\text{Time}} = \text{InfusionRate}$$

Therefore, if you were told that a 1,000 mL bag were being infused over 8 hours, you could accurately state that the infusion rate is 125 milliliters per hour.

$$\frac{1000\text{mL}}{8\text{hr}} = 125\,\text{mL/hr}$$

Occasionally though, a parenteral may be timed with a venoclysis set (drip chamber) if an infusion pump is not readily available. A drip rate would then need to be calculated, and as drops are actually physically counted over a period of time, drip rates are done in

drops per minute (gtt/min). Something certainly noteworthy is that a drip rate always needs to be calculated as a whole number of drops per minute, as a caregiver (most likely a nurse) will not be able to count a fraction of a drop when timing the drip. General rounding rules are applied to drip rates.



$$\frac{\text{quantityofdrops}}{\text{minute}} = \text{driprate}$$

drip chamber pictured above (*a.k.a., venoclysis set)*

As you probably remember, you will need to know the drop factor on your tubing in order to accurately perform the necessary calculations. A drop factor is the number of drops required to add up to 1 mL. Common drop factors for standard tubing include 10, 15, and 20 drops per milliliter. Microdrip tubing sets have a drop factor of 60 drops per milliliter.

$$\frac{\#\text{ofdrops}}{1\text{mL}} = \text{dropfactor}$$

Anything that has a drop factor can automatically be expressed as drops per milliliter (gtt/mL). Let's look at a couple of example problems involving infusion rates from various perspectives.

Examples

A 250 mL IV bag with 2 mg of isoproterenol is to be infused at a rate of 5 mcg/minute.

1) How long will it take to infuse?

$$\frac{\text{minute}}{5\text{mcg}} \times \frac{1000\text{mcg}}{1\text{mg}} \times \frac{2\text{mg}}{1} = 400\text{minutes} = 6\text{hours}40\text{minutes}$$

2) What is its infusion rate in mL/hr?

$$\frac{250\text{mL}}{6.67\text{hrs}} = 37.5\,\text{mL/hr}$$

3) If the bag were infused using a venoclysis set, what would be the drip rate if the tubing had a drop factor of 20?

$$\frac{37.5\text{mL}}{\text{hr}} \times \frac{\text{hr}}{60\text{min}} \times \frac{20\text{gtt}}{\text{mL}} = 12.5\,\text{gtt/min} = 13\,\text{gtt/min}$$

Example problem 3 is a good reminder that you need to round your drip rate to a whole number of drops. Attempt the practice problems below.

Practice Problems

1) A medication order requests a 1 liter bag of NS to be infused over 8 hours. What is it infusion rate in milliliters per hour?

2) Ten mL of MVI, 1 mL of folic acid, 1 mL of trace elements, and 8 mL of 50% magnesium sulfate are being added to a 500 mL bag of D5W. If this bag were being infused over 5 hours via a venoclysis set with a drop factor of 15, what should the drip rate be?

3) A 1 liter IV solution was hung at 1300 on Tuesday and has an infusion rate of 75 mL/hr. When will the bag finish?

4) If a particular medication is to be infused at a rate of 50 mcg/kg/min, what would be the infusion rate for a 100 mL IV bag with 500 mg of drug if the patient receiving it weighed 180 lbs?

5) A 500 mL bag of 20% mannitol is ordered at a rate of 4 g/hr for a particular patient.

    a) What is the infusion rate in mL/hr?

b) How long will the bag take to infuse?

Solve the following problems.

1) A 50 mL IVPB with 1 g of nafcillin in NS is set to run over 30 minutes. What is its infusion rate in mL/hr?

2) A physician wants to slowly infuse a 2.5 liter TPN solution over 24 hours. What is the infusion rate in mL/hr?

3) The drip rate on a particular IV is 20 gtt/min. If the tubing set has a drop factor of 10, what is the infusion rate in mL/hr?

4) The recommended infusion rate for IV vancomycin when administered through a peripheral line is either 60 minutes or 10 mg/min, whichever is longer. What should the infusion rate be for a 200 mL premixed bag containing 1 g of vancomycin?

5) The OR intends to infuse a 6% hetastarch solution at a rate of 45 g/hr for the next two hours.

   a) What is the infusion rate in mL/hr?

   b) How many 500 mL bags of 6% hetastarch are they going to need for the full duration of the infusion?

6) A patient received a 1 liter infusion at a rate of 42 mL/hr.

    a) How long did it take to infuse?
    b) If it were infused using a venoclysis set with microdrip tubing that has a drop factor of 60, what was its drip rate?

7) A 1 liter bag of D5W¼NS with 10 mEq of KCl is requested by a physician to infuse over 8 hours. What is the infusion rate?

8) An IV bag was infused on a patient for three and a half hours at an infusion rate of 50 mL/hr. How many milliliters were infused?

9) A physician orders a continuous infusion of D10W at a rate of 200 mL/hr on a patient for the next 24 hours.

    a) How many 1 liter bags will you need to send to the floor for this patient?

    b) If the first bag is hung at 0900 on Saturday, when will each of the other bags need to be scheduled?

10) A 500 mL solution is to be infused over 4 hours. If the administration set has a drop factor of 20, what should the drip rate be?

11) A 250 mL bag of D5W was administered at an infusion rate of 25 mL/hr. If the bag was hung at 0800 hours, when should it finish infusing?

12) A 176 pound patient with unstable angina is admitted to the hospital. The cardiologist orders a heparin bolus of 60 units/kg initially, followed by a maintenance infusion of 12 units/kg/hr. Answer the following questions if both the bolus dose and the infusion are administered from the same premixed heparin IV that has a concentration of 50 units/mL and is in a volume of 250 mL.

    a) How many milliliters of heparin will be infused for the bolus?

    b) What is the flow rate of the heparin bag for the maintenance dose?

    c) How long will this specific bag last?(*Hint: remember to remove the appropriate volume from the bag for the bolus dose prior to determining how long the bag will last.*)

13) A physician orders a daily amphotericin B lipid complex 5 mg/kg IV for a 165 pound patient with a systemic infection. Amphotericin B lipid complex comes in 50 mg vials that have a concentration of 5 mg/mL, and when shot into an IV bag should be diluted out with D5W to a final concentration of 1 mg/mL. The recommended infusion practice is to infuse it at a rate of 2.5 mg/kg/hr.

    a) How many mg of amphotericin B lipid complex should the patient receive daily?

    b) How many 50 mg vials of amphotericin B lipid complex will you need for each dose?

    c) How many mL of amphotericin B lipid complex and how many mL of D5W will you need to reach the final desired concentration?

d) What will the infusion rate of this bag be in mL/hr?

e) How long will it take to infuse this IV?

f) If this IV were infused with a venoclysis set that had a drip factor of 20, what would be the drip rate?

14) A medication cassette with 2 mg of epoprostenol in a total volume of 100 mL was just titrated up to a new dose of 14 ng/kg/min on a 75 kg patient.
    a) How many mL/hour should the infusion pump be set for?

    b) How many mL are being infused each day?

15) A nephrologist orders continuous venous to venous hemodialysis (CVVHD) on a patient at a rate of 1500 mL/hr. You should be able to get the first bag to the floor by noon. The dialysis bags that you are preparing are 5 liters each. Your shift that day is 0630 to 1500, and you are to make enough bags to get the patient four hours past the end of your shift.

    a) How many bags should you send initially?

    b) Then, at 1400 the nephrologist decides to increase the rate to 2000 mL/hr. How many bags should be left at 1400 from what you originally prepared?

    c) How many additional bags will you need to prepare?

Solve the following problems.

1) A 50 mL IVPB is set to run over 20 minutes. What is its infusion rate in mL/hr?

2) A 50 mL minibag with 1.5 grams of an antibiotic is set to be infused over 15 minutes.

    a) What is its infusion rate in mL/hr?

    b) If your infusion set had a drop factor of 10, what would the drip rate be?

3) Some institutions have a policy of infusing hyperalimentations over 16 hours. In an institution with such a policy, what would the infusion rate be for a 2.5 liter hyperalimentation?

4) The drip rate on a particular IV is 30 gtt/min. If the tubing set has a drop factor of 20, what is the infusion rate in mL/hr?

5) The recommended infusion rate for IV vancomycin when administered through a peripheral line is either 60 minutes or 10 mg/min, whichever is longer. What should the infusion rate be for a 100 mL premixed bag containing 500 mg of vancomycin?

6) Using the infusion rate guidelines from the previous problem, what should the drip rate be for a 150 mL premixed bag containing 750 mg of vancomycin if you were infusing it using a venoclysis set with a drop factor of 10?

7) A patient received a 1 liter infusion at a rate of 120 mL/hr.

a) How long did it take to infuse?

b) If it were infused using a venoclysis set with a drop factor of 15, what should the drip rate have been?

8) A 1 liter bag of D5W¼NS with 20 mEq of KCl is requested by a physician to infuse over 8 hours. How many mEq of potassium chloride is the patient receiving each hour?

9) An IV bag was infused on a patient for three and a half hours at an infusion rate of 80 mL/hr. How many milliliters were infused?

10) A 500 mL bottle containing 18 g of tromethamine is to be infused on a 154 lb patient at the maximum allowable rate of 500 mg/kg/hr. What will the infusion rate be in mL/hr?

11) A patient is receiving a continuous infusion of NS at 125 mL/hr. If a patient receives a 1 gram dose of cefazolin in a 100 mL IVPB every 12 hours, how long will each dose take to infuse if it uses the Y-site on the continuous infusion's tubing? (*Hint: under these circumstances the IVPB will infuse at the same rate as what the continuous infusion is running.*)

12) A physician orders a 24 hour continuous infusion of LR solution running at 125 mL/hr starting at 1100 on day 1.

a) How many bags will the patient need over a 24 hour period if the bags are 1 liter in size?

b) What time should each bag be hung?

c) If the bags are being infused with tubing that has a drop factor of 10, what should the drip rate be?

13) A physician orders a 24 hour continuous infusion of D5W½NS running at 60 mL/hr starting at 0900 on day 1.

a) How many bags will the patient need over the 24 hour period if the bags are 1 liter in size?

b) What time should each bag be hung?

c) If the bags are being infused with tubing that has a drop factor of 20 gtt/mL, what should the drip rate be?

14) A solution containing 500,000 units of polymixin B is added to a 250 mL bag of D5W. The final volume is 260 mL and is to be infused over 2 hours.

a) What is the infusion rate in mL/hr?

b) If the infusion set is calibrated to have a drop factor of 10, what should the drip rate be?

15) If a patient received a 500 mL transfusion of whole blood starting at 2113 at a drip rate of 30 gtt/min via an administration set with a drop factor of 10, when should the transfusion finish?

16) You are working in the pharmacy when a nurse calls and asks how many mL/day she should set her CAD pump for to infuse her patient's troprostenil? The nurse says the physician ordered 104 ng/kg/min. You pull up the patient profile and see that the pharmacy sent a troprostenil cassette with 20 mg of troprostenil and 98 mL of NS for a total volume of 100 mL, and you confirm the patient's weight of 58 kg that you have on file is correct. What is the infusion rate in mL/day?

17) A 154 pound patient is to receive 2000 mg/kg/dose of immune globulin every 2 months. The immune globulin solution in the pharmacy has a 5% concentration.

    a) How many grams of immune globulin should the patient receive for a dose?

    b) How many milliliters of 5% solution will be required for each dose?

    c) During the first 30 minutes of infusion, the IV should run at a rate of 30 mg/kg/min. If well tolerated, the rate may be increased to 60 mg/kg/min for the next 30 minutes. If the infusion is still well tolerated, the rate may then be increased to 90 mg/kg/min. After another 30 minutes, if the infusion is still well tolerated, the rate may be increased to a maximum of 200 mg/kg/min. What is the least amount of time that this immune globulin IV would take to infuse?

18) A nephrologist orders continuous venous to venous hemodialysis (CVVHD) on a patient at a rate of 2000 mL/hr. You should be able to get the first bag to the floor by 1000. The dialysis bags that you are preparing are 5 liters each. Your shift that day is 0630 to 1500, and you are to make enough bags to get the patient four hours past the end of your shift.

    a) How many bags should you send initially?

b) Then, at 1230 the nephrologist decides to increase the rate to 2500 mL/hr. How many bags should be left at 1230 from what you originally prepared?

c) How many additional bags will you need to prepare?

PARENTERAL NUTRITION

A simple definition of parenteral nutrition (PN) would be a method of acquiring nutrition in a route other than through the digestive tract. It is intended for patients that are unable to obtain an adequate quantity of nutrients through their digestive tract. Indications for parenteral nutrition may include diseases and conditions associated with a nonfunctional gastrointestinal tract (bowel obstruction, severe pancreatitis, severe malabsorption), cancer therapy (radiation therapy, antineoplastic drugs, bone marrow transplantation), organ failure, hyperemesis during pregnancy, severe eating disorders (anorexia nervosa) when the patient cannot tolerate enteral nutrition, or failure when a patient attempted a trial of enteral nutrition.

This chapter will present the following concepts related to parenteral nutrition:

- various terms used to refer to parenteral nutrition,
- macronutrients and micronutrients commonly used,
- quantities and concentrations of nutrients in PN,
- precipitation concerns,
- osmolarity and implications involving infusion options,
- determining appropriate PN volume for a patient, and
- calculating calorie requirements for patients.

Commonly used terms for parenteral nutrition

Parenteral nutrition is referred to by many different names including:

- **total parenteral nutrition** (TPN) – As the name implies, it involves a patient receiving all of their nutritional needs parenterally
- **partial parenteral nutrition** (PPN) – This is when a patient is receiving part of their dietary needs through their digestive tract, but it is insufficient for all their needs, so they also receive a portion of their dietary needs parenterally
- **hyperalimentation** (HAL) or **intravenous hyperalimentation** (IVH) – This term may be defined in the same broad way as parenteral nutrition. The name itself is referring to the idea that the patient is receiving something outside of their alimentary canal.

- **total nutrient admixture** (TNA) – This is a term that could be used interchangeably with total parenteral nutrition.
- **3-in-1 admixture** or **all-in-one admixture** – This name is intended to inform the medical staff and caregivers that all three major bases (dextrose, amino acids, and lipids) along with micronutrients are included directly in the parenteral nutrition, as sometimes the lipids are infused separately from the rest of the PN.
- **centrally infused parenteral nutrition** (CPN) – Parenteral nutrition is always infused either centrally or peripherally. This name ensures that everyone knows the proper route of administration, which is important when looking at the osmolarity.
- **peripherally infused parenteral nutrition** (PPN) – Parenteral nutrition is always infused either centrally or peripherally. This name ensures that everyone knows the proper route of administration, which is important when looking at the osmolarity. It is important to know whether the term PPN is being used to refer to a partial parenteral nutrition or a peripherally infused parenteral nutrition.

Macronutrients and micronutrients

Many people are used to looking at the nutrition labels on the foods they buy. You will notice that there are usually major items like carbohydrates, protein, and fat followed by other items like vitamins and minerals. Parenteral nutrition still functions on the same concepts but often uses different terms for the nutrients. The table below provides a comparison of these items between what we traditionally call them when dealing with a typical diet compared to the terms we'll use to prepare PN therapy.

enteral nutrition	***parenteral nutrition***	***function/purpose***
Macronutrients		
water	water	Water is the most necessary substance for life as it forms the solution base for all metabolic processes and makes up around 50 – 60% of body weight.
protein	amino acids	Amino acids form proteins and provide the major structural building blocks of the body and are needed for the daily activities of living.
carbohydrates	dextrose	Carbohydrates are the primary source of cellular energy. Dextrose, a simple sugar, provides this role in PN.
fat	lipids	Fatty acids perform important physiological functions.
Micronutrients		
vitamin	multivitamin injection (MVI)	Vitamins are important for biochemical processes within the human body. MVI typically includes fat soluble (A,D,E, and K) and water soluble (thiamine, riboflavin, niacin, pantothenic acid, pyridoxine, ascorbic acid, folic acid, B12, and biotin) vitamins.

enteral nutrition	*parenteral nutrition*	*function/purpose*
trace elements	trace elements	These are elements that you only require small quantities of. MTE7 includes Zinc (Zn), copper (Cu), manganese (Mn), chromium (Cr), selenium (Se), iodine (I), and molybdenum (Mo). Other trace elements include Cobalt (Co), Vanadium (V), Nickel (Ni), and Flouride (F).
electrolytes	electrolytes	Electrolytes are necessary for optimal physiological fuction. Common electrolytes include sodium (na), potassium (K), chloride (Cl), magnesium (Mg), phosphate (PO_4), calcium (Ca), etc. There is a potential concern of the calcium and phosphate electrolytes forming a precipitate (discussed further later).
N/A	drug additives	While not technically a nutrient, PN will often include drug additives such as regular insulin, H2 antagonists, heparin, etc.

Quantities and concentrations of nutrients in parenteral nutrition

Now that we have introduced the most common ingredients of parenteral nutrition, let's take a moment and look at a PN that has been ordered and determine the quantities and concentrations of its nutrients.

Example

The pharmacy receives a request for a partial parenteral nutrition to be infused through a central line over 16 hours. On the left are the requested quantities/concentration and on the right are the available components.

Requested PN	*Source components*
amino acids 2.125%	8.5% amino acid solution
dextrose 20%	50% dextrose solution
sodium chloride 15 mEq	14.6% sodium chloride (2.5mEq/mL, 146 mg/mL)
potassium phosphate 15 mMol	potassium phosphate 3 mMol/mL
calcium gluconate 2.5 mEq	10% calcium gluconate (4.65 mEq/10 mL)
MVI 10 mL	MVI 10 mL vial
trace elements 1 mL	trace elements 1 mL vial
regular insulin 15 units	Humulin R U-100 (100 units/mL)
SWFI qs 1000 mL	Sterile Water for Injection

$$aminoacids$$

$$\frac{2.125\text{g}}{100\text{mL}} = \frac{\text{N}}{1000\text{mL}}$$

$$N = 21.25g$$

$$\frac{21.25\text{g}}{\text{N}} = \frac{8.5\text{g}}{100\text{mL}}$$

$$N = 250mLof8.5\%aminoacid$$

$$dextrose$$

$$\frac{20\text{g}}{100\text{mL}} = \frac{\text{N}}{1000\text{mL}}$$

$$N = 200g$$

$$\frac{200\text{g}}{\text{N}} = \frac{50\text{g}}{100\text{mL}}$$

$$N = 400mLof50\%dextrose$$

$$sodiumchloride$$

$$\frac{15\text{mEq}}{1} \times \frac{\text{mL}}{2.5\text{mEq}} = 6mLsodiumchloride$$

$$potassiumphosphate$$

$$\frac{15\text{mM}}{1} \times \frac{\text{mL}}{3\text{mM}} = 5mLpotassiumphosphate$$

$$calciumgluconate$$

$$\frac{2.5\text{mEq}}{1} \times \frac{10\text{mL}}{4.65\text{mEq}} = 5.4mLcalciumgluconate$$

$$MVI$$

$$10mLMVI$$

$$traceelements$$

$$1mLtraceelements$$

$$regularinsulin$$

$$\frac{15\text{units}}{1} \times \frac{\text{mL}}{100\text{units}} = 0.15mLregularinsulin$$

$$
\begin{array}{r}
sterilewater \\
1000mL \\
-250mL \\
-400mL \\
-6mL \\
-5mL \\
-5.4mL \\
-10mL \\
-1mL \\
-0.15mL \\
\hline
322.45\text{mL}sterilewater
\end{array}
$$

Calcium and phosphate solubility

Another thing to look at briefly is the solubility of phosphate and calcium in a parenteral nutrition admixture. These two ions have a strong affinity for each other and they may form a solid that precipitates out of solution. The following factors affect it including: order of mixing, pH, dextrose concentration, calcium salt form, storage temperature and time, amino acid profile, and drug additives. There is a formula that many institutions employ to estimate whether or not a solution is likely to form a precipitate.

calcium-phosphate solubility estimate

$$\frac{\left(\frac{2\text{mEq}}{1\text{mMol}} \times \text{phosphatemMol}\right) + \text{calciummEq}}{\text{volumeinliters}} < 46\ \text{mEq/liter}$$

As various factors in PN may affect the nature of the phosphates (monobasic vs dibasic) you automatically double the millimoles of phosphates when converting them to milliequivalents, treating them as all being in the dibasic form. While this formula does not claim to be perfect, it does provide a good estimate. Typically if the phosphate values and the calcium values total to less than 46 mEq per liter, you expect your PN to be stable for its intended purpose. It is also noteworthy that there are other variations on this formula along with visual charts. Familiarize yourself with the tools used wherever you practice. Let's go back and look at the PPN in the previous example and make sure that the calcium and phosphates should be stable.

Example

Using the numbers from the previous example problem, determine if the PPN should precipitate.

There were 15 mMol of potassium phosphate and 2.5 mEq of calcium gluconate in a total volume of 1 liter.

$$\frac{\left(\frac{2\text{mEq}}{1\text{mMol}} \times 15\text{mMolofphosphate}\right) + 2.5\text{mEqofcalcium}}{1\text{liter}} = 32.5\ \text{mEq/liter}$$

It should not precipitate, as 32.5 mEq/liter is less than 46 mEq/liter.

A lot of material has already been covered in this chapter. Attempt a practice problem to help ensure that all the concepts make sense so far.

Practice Problem

A patient is to receive a 2000 mL all-in-one TPN admixture infused through a central line infused over 24 hours. On the left are the requested quantities/concentration and on the right are the available source components. Answer the following questions (the answers are on the next page):

a) What is the infusion rate in mL/hr?
b) Determine the quantity of each ingredient required.
c) Using the information here determine whether or not the calcium and phosphate is likely to precipitate.

Requested PN	*Source Components*
4% amino acid	8.5% amino acid solution
19% dextrose	70% dextrose solution
250 mL of 20% lipid emulsion	250 mL of 20% lipid emulsion
sodium chloride 100 mEq	14.6% sodium chloride (2.5mEq/mL, 146 mg/mL)
potassium acetate 80 mEq	potassium acetate 2 mEq/mL
calcium gluconate 9.4 mEq	10% calcium gluconate (4.65 mEq/10 mL)
magnesium sulfate 16 mEq	50% magnesium sulfate (4.06 mEq/mL)
sodium phosphate 30 mMol	sodium phosphate 3 mMol/mL
MVI 10 mL	MVI 10 mL vial
trace elements 1 mL	trace elements 1 mL
famotidine 40 mg	famotidine 20 mg/2 mL
SWFI qs 2000 mL	Sterile Water for Injection

Solve the following problems involving parenteral nutrition using the source components listed on this page. Be aware that even though most institutional facilities offer various concentrations of amino acid bases and lipid emulsions, the orders on this worksheet will specify which ones to use.

Source Components

Macronutrients
10% amino acid solution
8.5% amino acid solution
5.2% amino acid solution (renal formula)
70% dextrose
10% lipid emulsion
20% lipid emulsion
sterile water for injection
Micronutrients
potassium chloride 2 mEq/mL
sodium chloride 14.6% (2.5 mEq/mL)
calcium gluconate 10% (4.65 mEq/10 mL)
magnesium sulfate 50% (4.06 mEq/mL)
sodium acetate 2 mEq/mL
sodium phosphate 3 mMol/mL (4 mEq/mL)
potassium acetate 19.6% (2 mEq/mL)
potassium phosphate 3 mMol/mL (4.4 mEq/mL)
multivitamin injection (MVI) – standard 10 mL
trace elements – standard 1 mL
vitamin C 250 mg/2 mL
folic acid 5 mg/mL
insulin regular U-100 (100 units/mL)
famotidine 20 mg/2 mL

1) Answer the questions pertaining to the hyperalimentation ordered below:

Additive	*Ordered Quantity*	*Volume*
Macronutrients		
Amino Acid 10%	1000 mL	
Dextrose 70%	1000 mL	
Sterile Water for Injection	qs 2500 mL	
Micronutrients		
sodium chloride	50 mEq	
potassium chloride	60 mEq	
magnesium sulfate	24 mEq	

potassium phosphate	30 mMol
calcium gluconate	46.5 mEq
MVI	10 mL
trace elements	1 mL
vitamin C	250 mg
regular insulin	55 units
folic acid	5 mg
sodium acetate	80 mEq
potassium acetate	28 mEq
sodium phosphate	6 mMol

a) What is the appropriate volume of each ingredient? List them on the chart above.

b) If this is to be infused over a 24 hour period, what is the infusion rate?

c) What are the final concentrations of amino acid and dextrose?

d) Based on the calcium-phosphate solubility estimate, is this HAL likely to precipitate?

2) Answer the questions pertaining to the parenteral nutrition ordered below:

Additive	*Ordered Quantity*	*Volume*
Macronutrients		
Amino Acid 5.2%	800 mL	
Dextrose 70%	700 mL	

Sterile Water for Injection	qs 2000 mL
Micronutrients	
sodium chloride	24 mEq
potassium chloride	40 mEq
magnesium sulfate	40 mEq
potassium phosphate	17.6 mEq
calcium gluconate	1.4 g
MVI	10 mL
trace elements	1 mL
vitamin C	500 mg
regular insulin	95 units
folic acid	7.5 mg
sodium acetate	70 mEq
potassium acetate	40 mEq
sodium phosphate	40 mEq

a) What is the appropriate volume of each ingredient? List them on the chart above.

b) If this is to be infused over a 24 hour period, what is the infusion rate?

c) What are the final concentrations of amino acid and dextrose?

d) Based on the calcium-phosphate solubility estimate, is this PN likely to precipitate? (*Hint: Be careful to convert both of your phosphates into mMol prior to plugging them into the formula.*)

3) Answer the questions pertaining to the parenteral nutrition admixture ordered below:

Additive	*Ordered Quantity*	*Volume*
Macronutrients		
Amino Acid 8.5%	1000 mL	
Dextrose 70%	1000 mL	
Sterile Water for Injection	qs 3000 mL	
Micronutrients		
sodium chloride	60 mEq	
potassium chloride	40 mEq	
magnesium sulfate	4 g	
potassium phosphate	30 mMol	
calcium gluconate	5 g	
MVI	10 mL	
trace elements	1 mL	
vitamin C	250 mg	
regular insulin	40 units	
folic acid	2 mg	
sodium acetate	60 mEq	
potassium acetate	28 mEq	
sodium phosphate	15 mMol	

a) What is the appropriate volume of each ingredient? List them on the chart above.

b) If this is to be infused over a 24 hour period, what is the infusion rate?

c) What are the final concentrations of amino acid and dextrose?

d) Based on the calcium-phosphate solubility estimate, is this parenteral nutrition admixture likely to precipitate?

Osmolarity of parenteral nutrition

Osmolarity is the measure of osmoles of solute per liter of solution (osmol/L). Osmoles are only looking at the moles of chemical compound that contribute to the osmotic pressure of a solution. When looking at the constituents of parenteral nutrition, dextrose and amino acids are the primary contributors to osmolarity. Lipids do not contribute to the solution's osmolarity, but electrolytes do. You can usually use the concentrations of dextrose and amino acid to estimate the osmolarity of PN. When looking at IV infusions, we traditionally measure the osmolarity in milliosmoles per liter (mOsmol/L).

Extracellular fluid generally has an osmolality of approximately 285-295 mOsmol/kg[8]. A challenge is that parenteral nutrition has a much higher concentration making it hypertonic and therefore potentially irritating to the veins it is being infused through, this despite its slow infusion rate. While institutions may have varying policies, a common practice is if a PN has an osmolarity less than a 1000 mOsmol/L it can be infused peripherally, versus an osmolarity of 1000 mOsmol/L or more is infused through a central line (an IV line that feeds into the superior vena cava). You can quickly estimate the osmolarity of PN by multiplying the grams of dextrose per liter by 5 and adding it to the grams of amino acid per liter multiplied by 10. Let's look at a quick example problem.

Example

If a TNA has a final concentration of 10% dextrose and 2.75% amino acid, what is the estimated osmolarity and could it be infused peripherally?

$$\frac{10\text{g}}{100\text{mL}} = \frac{\text{N}}{1000\text{mL}} \quad \textit{dextrose}$$

$$N = 100g$$

$$\frac{100\text{g}}{\text{L}} \times \frac{5\text{mOsmol}}{\text{g}} = 500\ \text{mOsmol/L}$$

$$\frac{2.75\text{g}}{100\text{mL}} = \frac{\text{N}}{1000\text{mL}} \quad \textit{aminoacid}$$

$$N = 27.5g$$

$$\frac{27.5\text{g}}{\text{L}} \times \frac{10\text{mOsmol}}{\text{g}} = 275\ \text{mOsmol/L}$$

$$500\ \text{mOsmol/L} + 275\ \text{mOsmol/L} = 775\ \text{mOsmol/L}$$

This TNA could be infused peripherally.

Now attempt a practice problem.

[8]Extracellular fluids are generally measured in osmolality (mOsmol/kg) as opposed to IV fluids measuring osmolarity (mOsmol/L). The two numbers are typically very close, as a liter of water weighs 1 kilogram. The mass of the dissolved solutes makes a slight difference.

Practice Problem

If a TPN has a final concentration of 15% dextrose and 4% amino acid, what is the estimated osmolarity and could it be infused peripherally?

Fluid requirements

The fluid requirements for parenteral nutrition are usually calculated as either 30 mL/kg of body weight, 1500 mL per m^2 of BSA, or 1 mL/kcal of nutrition required. These are just guidelines and may be adjusted for various reasons such as dehydration or fluid restriction. Let's look at these guidelines with an example.

Example

Use all three methods for determining PN fluid volume for a 6'1" patient weighing 168 pounds (BSA of 2 m^2) if they are receiving 2400 kilocalories per day.

$$\frac{168\text{lb}}{1} \times \frac{1\text{kg}}{2.2\text{lb}} \times \frac{30\text{mL}}{\text{kg}} = 2291\text{mL}$$

$$\frac{2\text{m}^2}{1} \times \frac{1500\text{mL}}{\text{m}^2} = 3000\text{mL}$$

$$\frac{2400\text{kcal}}{1} \times \frac{1\text{mL}}{\text{kcal}} = 2400\text{mL}$$

You will notice a a range of answers using the above guidelines. It is a good practice to learn which guidelines are used at the institution where you practice.

Practice Problem

Use all three methods for determining PN fluid volume for a 5'4" patient weighing 125 pounds (BSA of 1.6 m^2) if they are receiving 1800 kilocalories per day.

Caloric requirements

The kilocalorie (kcal, or Calorie, C, or Cal) is the basic unit used for quantifying the amount of energy that is in a potential sustenance. A patient's energy requirements may vary based on their body type/size, medical condition (called stress factors), and activity level. While there are other ways to determine a patient's Calorie needs, the Harris-Benedict equation is a very common methodology taking the patient's basal energy expenditure (BEE) multiplied by an activity factor and multiplied again by a stress factor. On the next page we will look at this equation.

Harris-Benedict equation

$$\mathrm{BEE} \times \mathrm{activityfactors} \times \mathrm{stressfactors} = \mathrm{TotalDailyEnergyExpenditure}$$

Basal Energy Expenditure is determined the following way:

$$formales$$

$$66.67 + (13.75 \times weight\mathrm{inkg}^{*}) + (5 \times height\mathrm{in}cm) - (6.76 \times age\mathrm{in}years) = BEE$$

$$forfemales$$

$$655.1 + (9.56 \times weight\mathrm{inkg}^{*}) + (1.86 \times height\mathrm{in}cm) - (4.68 \times age\mathrm{in}years) = BEE$$

*If a patient is obese, their ideal body weight (IBW) will be used instead.

Activity factors:

- Confined to bed: 1.2
- Ambulatory: 1.3

Stress factors:

- Surgery 1.2
- Infection 1.4-1.6
- Trauma: 1.3-1.5
- Burns: 1.5-2.1

This provides the total daily energy expenditures for a patient, but does not account for the make-up of amino acids, dextrose, and lipids. Traditionally, you determine how many calories the patient needs from amino acids and lipids, and whatever is left is provided by the dextrose.

Amino acid requirements

Use the following guidelines to estimate the patient's amino acid needs (use IBW if obese):

1.8 g/kg in an unstressed patient
0.8 to 1 g/kg for a mildly stressed patient
1.2 g/kg for a renal dialysis patient
1.1 to 1.5 g/kg for a moderately stressed patient
1.5 to 2 g/kg for a severely stressed patient
3 g/kg for a severely burned patient

Amino acid provides 4 kcal/g, therefore 50 g of amino acid would provide 200 kilocalories.

Lipid requirements

The proportion of calories provided by lipids are in the 30 to 40% range of the patient's total caloric intake. Many people will simply split the difference and base it on 35%. Each gram of lipids provides 9 kilocalories, therefore a patient that requires 900 kilocalories of lipids would only need 100 g of lipids.

Dextrose quantity

After the kcal from both the amino acids and the lipids have been subtracted from the total daily expenditure, the rest is provided by dextrose. Each gram of dextrose given parenterally provides 3.4 kilocalories. Therefore, if a patient receiving 2800 kcal per day had 200 calories of amino acids and 900 kcal of lipids, they would need 1700 kcal of dextrose or 500 g of dextrose.

Micronutrients

A patient will ordinarily receive a standard quantity of multivitamins and trace elements every day. There are also standard quantities of electrolytes in each liter of PN (35 mEq of sodium, 30 mEq of potassium, 5 mEq of magnesium, 3 mEq of calcium, 15 mM of phosphorous, and a 1:1 ratio of acetate to chloride). The quantity of various electrolytes may be adjusted based on disease state and lab values. Physician's may choose to add additional vitamins, electrolytes, elements, and drug additives to the bag.

Let's do a practice problem to emphasize all these ideas. This problem will be broken into many steps so you can review each concept.

Practice Problem

The 6'1”, 165 lb author of this text is severely burned (use a stress factor of 2) in a fire at the age of 35 and the medical staff at the burn center where he is hospitalized has

confined him to bed and is initiating parenteral nutrition on him using an all-in-one admixture that is to be infused over 24 hours.

a) Determine his BEE.

b) Determine his total daily energy expenditure.

c) How many grams of amino acid does he require and how many kcal does that translate into?

d) If the facility decides 35% of his kcal should come from lipids, how many kcal does he require and how many grams of lipids does that translate into?

e) How many kcal should he receive from dextrose and how many grams does that translate into?

f) If they decide to base the fluid volume of his PN on 1 mL/kcal of nutrition, how many mL will this entire admixture need to be?

g) How many mEq or mMol of each electrolyte will the patient require if his electrolytes are ordered as follows: sodium chloride 35 mEq/L , potassium acetate 20 mEq/L , calcium gluconate 4.5 mEq/L , potassium phosphate 15 mMol/L , and magnesium sulfate 5 mEq/L?

h) Using the concentrations of the source components you've already calculated along with a vial of MVI and a vial of trace elements, fill in the ordered quantities and determine the appropriate volume of each ingredient to make this PN.

Source Components	*Fill in the Ordered Quantity*	*Volume Required*
Macronutrients		
Amino Acid 10%		
Dextrose 70%		
Lipid Emulsion 20%		
Sterile Water for Injection		
Micronutrients		
sodium chloride 23.4% (4 mEq/mL)		
potassium acetate 2 mEq/mL		
calcium gluconate 4.65 mEq/10 mL		
potassium phosphate 3 mMol/mL		
magnesium sulfate 50% (4.06 mEq/mL)		
MVI 10 mL/vial		
trace elements 1 mL/vial		

This is what the chart on the previous page should look like when completed.

Source Components	*Fill in the Ordered Quantity*	*Volume Required*
Macronutrients		
Amino Acid 10%	225 g	2250 mL
Dextrose 70%	555.9 g	794.1 mL
Lipid Emulsion 20%	166.9 g	834.5 mL
Sterile Water for Injection	q.s. 4292 mL	253.6 mL
Micronutrients		
sodium chloride 23.4% (4 mEq/mL)	150.2 mEq	37.6 mL

potassium acetate 2 mEq/mL	85.8 mEq	42.9 mL
calcium gluconate 4.65 mEq/10 mL	19.3 mEq	41.5 mL
potassium phosphate 3 mMol/mL	64.4 mMol	21.5 mL
magnesium sulfate 50% (4.06 mEq/mL)	21.5 mEq	5.3 mL
MVI 10 mL/vial	1 vial	10 mL
trace elements 1 mL/vial	1 vial	1 mL

i) What will the infusion rate be in mL/hr?

j) If the tubing being used has a drop factor of 20, what will the drip rate be?

k) Use the calcium-phosphate solubility formula to check whether or not this solution is likely to precipitate.

l) What are the final percentage strengths of both the dextrose and the amino acid of this admixture?

m) Based on the estimated osmolarity of this bag, could it be infused peripherally?

Review the patient case and determine the correct quantities for preparing parenteral nutrition for the patient. Your answers should be based on the Harris-Benedict Equation.

Pt Case: An obese patient with a GI obstruction due to complications from a gastric bypass has developed severe pneumonia, and her care team has decided she should be placed on parenteral nutrition using a 3-in-1 admixture as opposed to a starvation diet. The patient is a 5'6”, 290 lbs, 40 year old female and is to continue to be ambulatory.

She does not have an allergy to eggs, as an allergy to eggs would impact her ability to receive the lipid emulsion.

1) Since this patient is obese, you will need to use her ideal body weight (IBW) for determining her BEE and her amino acid requirements. Use the Devine formula for determining her IBW (it is on page 531 if you need to look it up).

2) Using her IBW, calculate her basal energy expenditure.

3) Determine her total daily energy expenditure now that she is ambulatory after her recent surgery, but has has developed pneumonia. With these factors in mind, treat her as having a stress factor of 1.6.

4) How many grams of amino acid does she require, and how many kcal does that translate into remembering to use her IBW? She is considered a moderately stressed patient, so her amino acids should be calculated as 1.3 g/kg.

5) If the facility decides 30% of her kcal should come from lipids, how many kcal does she require and how many grams of lipids does that translate into?
6) How many kcal should she receive from dextrose and how many grams does that translate into?

7) What is her BSA? Remember to use her actual body weight. You may need to refer to the nomogram on page 523. (Your answer may vary depending on method used, but for consistency, with the answer key, use 2.34 m^2.)

8) If they decide to base the fluid volume of her PN on 1500 mL per m^2 of BSA, how many mL will this entire admixture need to be?

9) How many mEq or mMol of each electrolyte will the patient require if her electrolytes are ordered as follows (according to her lab values her sodium was a little high and her potassium was a little low): sodium chloride 25 mEq/L , potassium chloride 10 mEq/L, potassium acetate 20 mEq/L , calcium gluconate 4.5 mEq/L , potassium phosphate 15 mMol/L , and magnesium sulfate 5 mEq/L?

10) Using the concentrations of the source components you've already calculated, along with 5 mg of folic acid, a vial of MVI, a vial of trace elements, and 40 mg of famotidine, fill in the ordered quantities and determine the appropriate volume of each ingredient on the chart on the next page.

Source Components	*Fill in the Ordered Quantity*	*Volume Required*
Macronutrients		

Amino Acid 8.5%
Dextrose 70%
Lipid Emulsion 20%
Sterile Water for Injection
Micronutrients
sodium chloride 23.4% (4 mEq/mL)
potassium chloride 2 mEq/mL
potassium acetate 2 mEq/mL
calcium gluconate 4.65 mEq/10 mL
potassium phosphate 3 mMol/mL
magnesium sulfate 50% (4.06 mEq/mL)
folic acid 5 mg/mL
MVI 10 mL/vial
trace elements 1 mL/vial
famotidine 20 mg/2 mL

11) What will the infusion rate be in mL/hr if the facility wants to infuse it over 24 hours?

12) If the tubing being used has a drop factor of 20, what will the drip rate be?

13) Use the calcium-phosphate solubility formula to check whether or not this solution is likely to precipitate.

14) What are the final percentage strengths of both the dextrose and the amino acid of this admixture?

15) Based on the estimated osmolarity of this bag, could it be infused peripherally?

Answer/solve the following questions/problems.

1) What are the various names and corresponding acronyms for parenteral nutrition?

2) Are lipids always mixed directly into a parenteral nutrition admixture?

3) List several reasons for placing a patient on parenteral nutrition.

4) What are the macronutrients used in parenteral nutrition and what are the corresponding designations of a traditional enteral diet?

5) Which two ions commonly used in parenteral nutrition raise a concern about precipitation?

6) Is PN hypertonic, isotonic, or hypotonic?

7) What is the common cut off for when PN can be infused peripherally or centrally?

8) Pt. Case: A patient's estimated nutritional requirements have been assessed at approximately 95-105 grams protien/day and 1800-2100 nonprotien kcal/day. The patient has no history of hyperlipidemia or allergy to eggs and is not fluid restricted. The PN solution will be compounded as an individualized regimen using a single bag, 24-hour infusion of amino acid/dextrose/intravenous lipid emulsion combination. All lab values for vitamins and electrolytes are within normal ranges.

   a) Determine the appropriate volume for each ingredient.

Source Components	*Ordered Quantity*	*Volume Required*
Macronutrients		
Amino Acid 8.5%	4% final conc.	
Dextrose 70%	19% final conc.	
Lipid Emulsion 10%	250 mL	
Sterile Water for Injection	q.s. 2000 mL	
Micronutrients		
sodium chloride 14.6% (2.5 mEq/mL)	50 mEq/L	
potassium acetate 2 mEq/mL	40 mEq/L	
calcium gluconate 4.65 mEq/10 mL	4.7 mEq/L	
sodium phosphate 3 mMol/mL	15 mMol/L	
magnesium sulfate 50% (4.06 mEq/mL)	8 mEq/L	
MVI 10 mL/vial	1 vial	
trace elements 1 mL/vial	1 vial	
famotidine 20 mg/2 mL	40 mg	

   b) What is the appropriate infusion rate in mL/hr?

c) Are the calcium and phosphate ions likely to precipitate?

d) Could this bag be infused peripherally?

9) Pt Case: Patient's first attempt at enteral feeding has failed as patient is unable to attain a sufficient quantity of nutrition through their GI tract. Physician has decided to place patient on a PPN during the night.

a) Determine the appropriate volume for each ingredient.

Source Components	*Ordered Quantity*	*Volume Required*
Macronutrients		
Amino Acid 8.5%	4% final conc.	
Dextrose 70%	5% final conc.	
Sterile Water for Injection	q.s. 1000 mL	
Micronutrients		
sodium chloride 14.6% (2.5 mEq/mL)	50 mEq/L	
potassium acetate 2 mEq/mL	40 mEq/L	
calcium gluc. 10% (4.65 mEq/10 mL)	1 g/L	
sodium phosphate 3 mMol/mL	15 mMol/L	
magnesium sulfate 50% (4.06 mEq/mL)	2 g/L	
MVI 10 mL/vial	1 vial	
trace elements 1 mL/vial	1 vial	

b) What is the appropriate infusion rate in mL/hr if the physician requests this admixture to be infused over 8 hours?

c) Are the calcium and phosphate ions likely to precipitate?

d) Could this bag be infused peripherally?

10) Pt Case: A 58 year old female who is 5' 3" tall and weighs 140 lbs has been determined to have the following nutritional requirements for her TPN (the Harris-Benedict equation was employed to derive these numbers).

a) Determine the appropriate volume for each ingredient.

Source Components	*Ordered Quantity*	*Volume Required*
Macronutrients		
Amino Acid 8.5%	50.91 g	
Dextrose 70%	186.65 g	
Lipid Emulsion 10%	41.03 g	
Sterile Water for Injection	q.s. ad 30 mL/kg	
Micronutrients		
sodium chloride 14.6% (2.5 mEq/mL)	35 mEq/L	
potassium acetate 2 mEq/mL	35 mEq/L	
calcium gluconate 4.65 mEq/10 mL	9.6 mEq/L	
potassium phosphate 3 mMol/mL	6.7 mMol/L	
magnesium sulfate 50% (4.06 mEq/mL)	8 mEq/L	
folic acid 5 mg/mL	1.7 mg	
MVI 10 mL/vial	1 vial	
trace elements 1 mL/vial	1 vial	
regular insulin U-100	40 units	

b) What is the appropriate infusion rate in mL/hr if the physician requests this admixture to be infused over 24 hours?

c) Are the calcium and phosphate ions likely to precipitate?

d) Could this bag be infused peripherally? Why or why not?

Top 300 Drug List

The attached list represents most of the drugs you will encounter as interns, techs, and later as pharmacists. You will also encounter them repeatedly throughout the curriculum. At the conclusion of the first semester, you will be expected to know the commercial (trade) name and generic name of each drug and to be able to spell them correctly. You will also be expected to know the therapeutic category for each drug. The sooner you start learning this information, the easier your first and subsequent semester will be. During the third year lab, you will be expected to also know the counseling points for each drug. Abbreviations in parentheses indicate an alternate dosage form of the drug. Abbreviations are listed at the bottom of this document.

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
1	Flagyl, Flagyl ER	Metronidazole	Anti-infective	Antibacterial, Antiprotozoal	Finish course as prescribed. Avoid alcohol during therapy and for 2 days after. May discolor urine reddish-brown.
2	Diflucan	Fluconazole	Anti-infective	Antifungal	Finish course as prescribed. May cause headache and GI upset. CYP interactions: strongly inhibits 2C9, 2C19 (ex. Clopidogrel, warfarin and phenytoin); moderately inhibits 3A4. May prolong QT interval.
3	Nizoral	Ketoconazole	Anti-infective	Antifungal	Available topically and orally. Tablets should be taken with food. Drug is absorbed best in acidic conditions; avoid antacids, PPI's and H2 blockers for 2 hours before and after administration. **Major CYP 3A4 drug interactions.** Topical formulations are flammable. Potential for hepatotoxicity.
4	Mycostatin, Nystop	Nystatin	Anti-infective	Antifungal	Available in many different dosage forms (topical, oral, suspension, powder) and some combination products. Suspension can be dosed as "swish and spit" for oral candidiasis or "swish and swallow" for esophageal candidiasis.
5	Lamisil	Terbinafine	Anti-infective	Antifungal	Finish course as prescribed. Topical formulation available OTC and is most common use.
6	Zovirax	Acyclovir	Anti-infective	Antiviral against HSV	Available topically and orally. Avoid intercourse during herpes outbreaks. Dose and duration depends on indication. CNS side-effects especially in elderly and renal impairment. Interacts with herpes zoster vaccine. Stay well hydrated.

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
7	Valtrex	Valacyclovir	Anti-infective	Antiviral against HSV	Avoid intercourse during herpes outbreaks. Dose and duration depends on indication. CNS side-effects especially in elderly and renal impairment. Interacts with herpes zoster vaccine. Stay well hydrated.
8	Keflex	Cephalexin	Anti-infective	Cephalosporin antibiotic, 1st generation	Finish course as prescribed. May cause GI upset. Hypersensitivity reactions may occur if allergic to penicillin and/or other cephalosporins. May decrease absorption of oral contraceptives.
9	Ceftin	Cefuroxime axetil	Anti-infective	Cephalosporin antibiotic, 2nd generation	Finish course as prescribed. May cause GI upset. Hypersensitivity reactions may occur if allergic to penicillin and/or other cephalosporins. May decrease absorption of oral contraceptives.
10	Omnicef	Cefdinir	Anti-infective	Cephalosporin antibiotic, 3rd generation	Finish course as prescribed. May cause GI upset. Hypersensitivity reactions may occur if allergic to penicillin and/or other cephalosporins. May decrease absorption of oral contraceptives.
11	Cipro (XR)	Ciprofloxacin	Anti-infective	Fluoroquinolone antibiotic	Finish course as prescribed. Monitor glucose. Do not take within 2 hours of consuming foods or other products containing di- or trivalent cations (ex. milk, calcium antacids, multivitamins and supplements). May cause sun sensitivity and CNS side-effects. FDA requires assessment of risk of QTc prolongation. Black box warning for tendonitis/tendon rupture. Available orally and in ophthalmic and otic suspensions.
12	Levaquin	Levofloxacin	Anti-infective	Fluoroquinolone antibiotic	Finish course as prescribed. Monitor glucose. Do not take within 2 hours of consuming foods or other products containing di- or trivalent cations (ex. milk, calcium antacids, multivitamins and supplements). May cause sun sensitivity and CNS side-effects. FDA requires assessment of risk of QTc prolongation. Black box warning for tendonitis/tendon rupture. Available orally and in ophthalmic suspension.

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
13	Avelox	Moxifloxacin	Anti-infective	Fluoroquinolone antibiotic	Finish course as prescribed. Monitor glucose. Do not take within 2 hours of consuming foods or other products containing di- or trivalent cations (ex. milk, calcium antacids, multivitamins and supplements). May cause sun sensitivity and CNS side-effects. FDA requires assessment of risk of QTc prolongation. Black box warning for tendonitis/tendon rupture. Available orally and in ophthalmic solution (Vigamox, Moxeza).
14	Zithromax, Zmax, Azasite	Azithromycin	Anti-infective	Macrolide antibiotic	Finish course as prescribed. No CYP 3A4 inhibition. QT prolongation possible. Opthalmic solution, Azasite, is refrigerated.
15	Biaxin (XL)	Clarithromycin	Anti-infective	Macrolide antibiotic	Finish course as prescribed. May impart metallic taste. Inhibits CYP 3A4. QT prolongation possible.
16	Cleocin, Cleocin T, Evoclin, Clindagel	Clindamycin	Anti-Infective	Other antibiotic	Available in many dosage forms (oral, topical, vaginal suppository, powder for suspension) and combination products. Oral therapy may cause C. diff-associated severe diarrhea. Suspension has horrible taste, little flavoring options available.
17	Macrobid, Macrodantin, Furadantin	Nitrofurantoin	Anti-infective	Other antibiotic	Take with food to enhance absorption. May cause peripheral neuropathy or pulmonary fibrosis. Shake suspension thoroughly.
18	Amoxil	Amoxicillin	Anti-infective	Penicillin antibiotic	Finish course as prescribed. May cause GI upset; take with food. Hypersensitivity reactions possible. May decrease efficacy of oral contraceptives. Secondary vaginal yeast infection may develop. Shake susp well and keep refrigerated, note exp date after reconstitution
19	Augmentin, Augmentin XR	Amoxicillin + Clavulanate	Anti-infective	Penicillin antibiotic	Finish course as prescribed. May cause GI upset; take with food. More likely to have diarrhea b/c of clavulanate- maintain hydration. Clavulanic acid doses vary among formulations; double-check if using alternate formulation to achieve prescribed dose (ex. 400mg-57mg/5ml suspension cannot be substituted for 600mg-42.9mg/5ml suspension). Shake susp well and keep refrigerated, note exp date after reconstitution
20	Veetids, Pen-Vee K	Penicillin V Potassium	Anti-infective	Penicillin antibiotic	Finish course as prescribed. May cause GI upset; take with food. C. diff-associated diarrhea may develop. Hypersensitivity reactions possible.

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
21	Bactrim, Bactrim DS, Septra, Septra DS	Sulfamethoxazole + Trimethoprim	Anti-infective	Sulfonamide antibacterial	Finish course as prescribed. Take with plenty of water. Increases sensitivity to sunlight. Increased risk of hypoglycemia if taken with other sulfonylureas. Severe life-threatening skin reactions possible.
22	Vibramycin, Doryx, Adoxa, Monodox, Oracea, Periostat	Doxycycline	Anti-infective	Tetracycline antibiotic	May increase sensitivity to sunlight. Do not take within 2 hours of consuming foods or other products containing di- or trivalent cations (ex. milk, calcium antacids, multivitamins and supplements). Hyclate and monohydrate salts **not** interchangeable.
23	Metrogel, Metrogel-Vaginal, Metrocream, Metrolotion	Metronidazole	Anti-infective	Topical antibiotic	Use condoms during vaginal therapy. Some drug is absorbed systemically; avoid alcohol consumption during therapy and for 2 days after. Also used topically on the face for rosacea.
24	Bactroban	Mupirocin	Anti-infective	Topical antibiotic	Used most in hospital to reduce the risk of MRSA infection from carriers
25	Mycolog II	Nystatin + Triamcinolone	Anti-infective	Topical antifungal + steroid combination	Use a sparing amount, avoid application around eyes.
26	Peridex, PerioGard	Chlorhexidine Gluconate	antibacterial oropharyngeal	Tx for gingivitis/Periodontitis	Swish/spit 15 mls BID
27	Tamiflu	Olsetamivir	anti-infective	antiviral against influenza	BID dosing for Tx, QD dosing for prophylaxis, tx within 24-48 hours of sx, rarely causes behavioral disturbances inc delirium, risk of anaphylaxis and allergic skin rxns
28	Truvada	Emtricitabine + Tenofovir	Antiretroviral	Reverse transcriptase inhibitor	Adherence important to prevent resistance. May be taken without regard to food. May cause decrease in bone mineral density, fat redistribution, lactic acidosis, hepatomegaly, and renal toxicity. Recently approved for pre-exposure HIV prophylaxis for those whose partner has HIV; must have regular testing every 3 months.
29	Combivir	Zidovudine + Lamivudine	Antiretroviral	Reverse transcriptase inhibitor	Adherence important to prevent resistance. May be taken without regard to food. May cause fat redistribution, lactic acidosis, hepatomegaly, myopathy, and hematologic toxicity.

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
30	Vasotec	Enalapril	Cardiovascular	ACE Inhibitor, antihypertensive	Pregnancy category D. May cause a dry cough, first-dose hypotension (especially in CHF and hypervolemia) and hyperkalemia (avoid salt substitutes). Angioedema is a serious reaction; discontinue immediately and medical intervention may be necessary. Drug has renoprotective properties, but may also cause acute renal failure; monitor serum creatinine and discontinue if >30% increase.
31	Altace	Ramipril	Cardiovascular	ACE Inhibitor, antihypertensive	Pregnancy category D. May cause a dry cough, first-dose hypotension (especially in CHF and hypovolemia) and hyperkalemia (avoid salt substitutes). Angioedema is a serious reaction; discontinue immediately and medical intervention may be necessary. Drug has renoprotective properties, but may also cause acute renal failure; monitor serum creatinine and discontinue if >30% increase. May have greater benefit if dosed at bedtime.
32	Accupril, Accuretic	Quinapril	Cardiovascular	ACE Inhibitor, antihypertensive; Accuretic-combo with diuretic	Pregnancy category D. May cause a dry cough, first-dose hypotension (especially in CHF and hypovolemia) and hyperkalemia (avoid salt substitutes). Angioedema is a serious reaction; discontinue immediately and medical intervention may be necessary. Drug has renoprotective properties, but may also cause acute renal failure; monitor serum creatinine and discontinue if >30% increase.
33	Lotensin, Lotensin HCT	Benazepril, Ben/HCTZ	Cardiovascular	ACE Inhibitor, antihypertensive; HCT-combo with diuretic	Pregnancy category X. May cause a dry cough, first-dose hypotension (especially in CHF and hypovolemia) and hyperkalemia (avoid salt substitutes). Angioedema is a serious reaction; discontinue immediately and medical intervention may be necessary. Drug has renoprotective properties, but may also cause acute renal failure; monitor serum creatinine and discontinue if >30% increase.

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
34	Zestril or Prinivil, Zestoretic	Lisinopril, Lis/HCTZ	Cardiovascular	ACE Inhibitor, antihypertensive; Zestoretic-combo with diuretic	Pregnancy category D. May cause a dry cough, first-dose hypotension (especially in CHF and hypovolemia) and hyperkalemia (avoid salt substitutes). Angioedema is a serious reaction; discontinue immediately and medical intervention may be necessary. Drug has renoprotective properties, but may also cause acute renal failure; monitor serum creatinine and discontinue if >30% increase.
35	Cardura, Cardura XL	Doxazosin Mesylate	Cardiovascular	Alpha 1 Blocker antihypertensive, also used in BPH	May cause postural hypotension/orthostasis after first dose or an increase in dose. Dizziness and headache common.
36	Hytrin	Terazosin	Cardiovascular	Alpha 1 Blocker antihypertensive, also used in BPH	May cause postural hypotension/orthostasis after first dose or an increase in dose. Dizziness and headache common.
37	Catapres, Catapres TTS, Nexiclon XR, Kapvay ER	Clonidine	Cardiovascular	Alpha II agonist, antihypertensive	May cause drowsiness, dry mouth, or skin reactions. Rotate patch application sites and discard patches carefully. Do not discontinue abruptly.
38	Cordarone	Amiodarone	Cardiovascular	Antiarrhythmic	Many drug interactions, complicated by extremely long half life of 40-50 days. Hepatic and pulmonary damage possible; notify MD if jaundice, dark urine or trouble breathing occur. May cause thyroid problems, hypotension, bradycardia, ocular disease and exacerbate arrhythmia. Have regular ophthalmic visits. May cause skin to turn bluish-grey in color
39	Coumadin	Warfarin Sodium	Cardiovascular	Anticoagulant	Risk of bleeding, especially GI. Very narrow therapeutic index; INR must be monitored regularly and vitamin K intake should be uniform. Many drug interactions; always check with MD or RPh when taking a new medication.
40	TRICOR, Trilipix	Fenofibrate	Cardiovascular	Antihyperlipidemic	Risk of myopathy; taking with statins increase risk. Discontinue immediately and report any signs (muscle pain, brown urine) to MD and/or RPh. Increases action of sulfonylureas; monitor for hypoglycemia. No good outcome data; FIELD and ACCORD Lipid were not positive. Safer to combine with a statin than gemfibrozil, but not evidence based. Many different "Brand" formulations.

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
41	Lopid	Gemfibrozil	Cardiovascular	Antihyperlipidemic	Increases effects of statins and therefore myopathy risk; discontinue immediately and report any signs (muscle pain, brown urine) to MD and/or RPh. Should be taken 30 minutes before breakfast and dinner. Increased risk of gall stones.
42	Niaspan ER	Niacin	Cardiovascular	Antihyperlipidemic	Causes flushing in most individuals (>80%); take at bedtime with a low-fat snack and 325mg aspirin to reduce effects. Doses higher than 2g/day may cause hepatotoxicity.
43	Lipitor	Atorvastatin	Cardiovascular	Antihyperlipidemic - HMG CoA reductase inhibitor	Pregnancy category X. Myopathy is a serious reaction; discontinue immediately and report any signs (muscle pain, brown urine) to MD and/or RPh. May be taken at any time of day. Avoid excessive alcohol and grapefruit juice. Some CYP 3A4 interactions.
44	Mevacor, Altoprev ER	Lovastatin	Cardiovascular	Antihyperlipidemic - HMG CoA reductase inhibitor	Pregnancy category X. Myopathy is a serious reaction; discontinue immediately and report any signs (muscle pain, brown urine) to MD and/or RPh. Take in the evening. Avoid excessive alcohol and grapefruit juice. Several CYP 3A4 interactions.
45	Pravachol	Pravastatin	Cardiovascular	Antihyperlipidemic - HMG CoA reductase inhibitor	Pregnancy category X. Myopathy is a serious reaction; discontinue immediately and report any signs (muscle pain, brown urine) to MD and/or RPh. Avoid excessive alcohol. Significantly fewer drug interactions compared to other statins (cleared by kidney rather than liver).
46	Crestor	Rosuvastatin	Cardiovascular	Antihyperlipidemic - HMG CoA reductase inhibitor	Pregnancy category X. Myopathy is a serious reaction; discontinue immediately and report any signs (muscle pain, brown urine) to MD and/or RPh. May be taken at any time of day. Avoid excessive alcohol and grapefruit juice.
47	Vytorin	Simvastatin/ezetimibe	Cardiovascular	Antihyperlipidemic - HMG CoA reductase inhibitor and cholesterol absorption inhibitor	Pregnancy category X. Myopathy is a serious reaction; discontinue immediately and report any signs (muscle pain, brown urine) to MD and/or RPh. Take in the evening. Avoid excessive alcohol and grapefruit juice. Several CYP 3A4 interactions. Lacks data that combination is superior to simvastatin alone.

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
48	Zocor	Simvastatin	Cardiovascular	Antihyperlipidemic - HMG reductase inhibitor	Pregnancy category X. Myopathy is a serious reaction; discontinue immediately and report any signs (muscle pain, brown urine) to MD and/or RPh. Take in the evening. Avoid excessive alcohol and grapefruit juice. Several CYP 3A4 interactions.
49	Ecotrin	Aspirin	Cardiovascular	Antiplatelet	Used for cardiovascular or cerebrovascular accident treatment/prophylaxis. 75-325 mg pod daily. Risk/benefit important for prophylaxis decisions. Increased risk of bleeding. Be aware of hypersensitivity reactions especially in patients with allergic triad of as a allergy, nasal polyps, and asthma, avoid in children due to risk of Reye syndrome.
50	Exforge, Exforge HCT	Amlodipine + Valsartan	Cardiovascular	ARB + calcium channel blocker combo; HCT also contains diuretic	see amlodipine and valsartan
51	Diovan, Diovan HCT	Valsartan, Val/HCTZ	Cardiovascular	ARB Antihypertensive, HCT also contains diuretic	Black box warning in pregnancy. May cause dizziness, hypotension, hyperkalemia (avoid salt substitutes, potassium sparing diuretics), and renal dysfunction (discontinue if serum creatinine increases >30%). NSAIDs reduce antihypertensive effect and increase risk of renal dysfunction. Taking with ACE inhibitor or renin inhibitor increases side effects with little benefit.
52	Avapro, Avalide	Irbesartan, Irbesartan/HCTZ	Cardiovascular	ARB Antihypertensive; Avalide-combo with diuretic	Black box warning in pregnancy. May cause dizziness, hypotension, hyperkalemia (avoid salt substitutes, potassium sparing diuretics), and renal dysfunction (discontinue if serum creatinine increases >30%). NSAIDs reduce antihypertensive effect and increase risk of renal dysfunction. Taking with ACE inhibitor or renin inhibitor increases side effects with little benefit.
53	Atacand, Atacand HCT	Candesartan, Can/HCTZ	Cardiovascular	ARB Antihypertensive; HCT-combo with diuretic	Black box warning in pregnancy. May cause dizziness, hypotension, hyperkalemia (avoid salt substitutes, potassium sparing diuretics), and renal dysfunction (discontinue if serum creatinine increases >30%). NSAIDs reduce antihypertensive effect and increase risk of renal dysfunction. Taking with ACE inhibitor or renin inhibitor increases side effects with little benefit.

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
54	Benicar, Benicar HCT	Olmesartan	Cardiovascular	ARB Antihypertensive; HCT-combo with diuretic	Black box warning in pregnancy. May cause dizziness, hypotension, hyperkalemia (avoid salt substitutes, potassium sparing diuretics), and renal dysfunction (discontinue if serum creatinine increases >30%). NSAIDs reduce antihypertensive effect and increase risk of renal dysfunction. Taking with ACE inhibitor or renin inhibitor increases side effects with little benefit. Sprue -like enteropathy (unexplained wt loss and diarrhea)
55	Cozaar, Hyzaar	Losartan, Los/HCTZ	Cardiovascular	ARB Antihypertensive; Hyzaar-combo with diuretic	Black box warning in pregnancy. May cause dizziness, hypotension, hyperkalemia (avoid salt substitutes, potassium sparing diuretics), and renal dysfunction (discontinue if serum creatinine increases >30%). NSAIDs reduce antihypertensive effect and increase risk of renal dysfunction. Taking with ACE inhibitor or renin inhibitor increases side effects with little benefit.
56	Tenormin	Atenolol	Cardiovascular	Beta Blocker, Beta-1 Selective	May cause drowsiness. Masks symptoms of hypoglycemia. Do not discontinue abruptly. Limited evidence/data.
57	Toprol XL	Metoprolol Succinate	Cardiovascular	Beta Blocker, Beta-1 Selective	May cause drowsiness. Masks symptoms of hypoglycemia. Do not discontinue abruptly. Succinate and tartrate salts are not interchangeable!
58	Lopressor	Metoprolol Tartrate	Cardiovascular	Beta Blocker, Beta-1 selective	May cause drowsiness. Masks symptoms of hypoglycemia. Do not discontinue abruptly. Succinate and tartrate salts are not interchangeable!
59	Zebeta, Ziac	Bisoprolol, Bisoprolol + HCTZ	Cardiovascular	Beta Blocker, Beta-1 selective; Ziac is combo with diuretic	May cause drowsiness. Masks symptoms of hypoglycemia. Do not discontinue abruptly due to risk of tachycardia and hypertension. Bisoprolol has outcome data in heart failure; target dose of 10mg/day
60	Tenoretic	Atenolol/chlorthalidone	Cardiovascular	Beta Blocker, Beta-1 Selective/ thiazide diuretic	see atenolol and chlorthalidone
61	Inderal, Inderal LA, Innopran, Innopran XL	Propranolol	Cardiovascular	Beta Blocker, nonselective	May cause drowsiness. Masks symptoms of hypoglycemia. Do not discontinue abruptly. LA and immediate release formulations are not mg-mg equivalent; dose may need to be increased by up to 30% when converting from immediate release to LA.

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
62	Coreg (CR)	Carvedilol	Cardiovascular	Beta Blocker, nonselective; Alpha-1 blocker	May cause drowsiness. Masks symptoms of hypoglycemia. Do not discontinue abruptly. CR and immediate release formulations are not mg-mg equivalent; CR 10mg equivalent to 3.125mg BID of immediate release.
63	Normodyne or Trandate	Labetalol	Cardiovascular	Beta Blocker, nonselective; Alpha-1 blocker	May cause drowsiness. Masks symptoms of hypoglycemia. Do not discontinue abruptly.
64	Lanoxin or Lanoxicap	Digoxin	Cardiovascular	Cardiac glycoside: + Inotropic, - chronotropic	Narrow therapeutic index, many drug interactions. Digoxin toxicity possible (anorexia, nausea, fatigue, vision disturbances, bradycardia, arrhythmias).
65	Azor, Tribenzor	Amlodipine + Olmestartan	Cardiovascular	Combination of ARB + calcium channel blocker; Tribenzor also contains diuretic	see amlodipine and olmesartan
66	Norvasc	Amlodipine	Cardiovascular	Dihydro calcium channel blocker	May cause drowsiness, risk of hypotension and orthostasis. Risk of peripheral edema that is not responsive to diuretics but may be relieved by ACEi or ARB.
67	Procardia, Procardia XL, Adalat CC	Nifedipine	Cardiovascular	Dihydro calcium channel blocker	May cause drowsiness. Risk of peripheral edema that is not responsive to diuretics; ACEi or ARB used to reverse. Adalat and Procardia not equivalent, double-check when dispensing generics.
68	Lotrel	Amlodipine + Benazepril	Cardiovascular	Dihydro calcium channel blocker + ACE inhibitor combo	see amlodipine and benazepril
69	Caduet	Amlodipine + Atorvastatin	Cardiovascular	Dihydro calcium channel blocker + HMG-CoA reductase inhibitor combo	see amlodipine and atorvastatin, titrate amlodipine to response over 1-2 weeks and atorvastatin in 6-8 weeks
70	Pradaxa	Dabigatran	Cardiovascular	Direct thrombin inhibitor	Monitor for bleeding. May cause some GI upset. Store capsules in original container or blister pack; discard unused medication after 4 months. Do not crush, chew or open capsules. If a dose is missed, do not take a double dose if more than 6 hours have passed. Drug interactions with p-glycoprotein substrates (dronedarone, ketoconazole, rifampin). Dose should be adjusted for kidney function. Discontinuation for surgery determined by creatinine clearance.
71	Klor-Con	Potassium Chloride	Cardiovascular	Electrolyte supplement	May cause GI upset, take with food. Monitor salt intake.

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
72	Xarelto	Rivaroxaban	Cardiovascular	Factor Xa inhibitor	Monitor for bleeding. Doses of 15 mg or more must be taken with food. Compliance extremely important, but do not take a double dose if a dose is missed. Discontinue at least 24 hours before surgeries. Drug interactions with CYP 3A4 substrates, but benefit outweighs cost in some cases.
73	Eliquis	Apixaban	Cardiovascular	Factor Xa inhibitor	Monitor for bleeding. 5 mg orally twice daily. A dose of 2.5 mg twice daily is recommended for patients at least 80 years old, who weigh no more than 60 kg, or who have serum creatinine of at least 1.5 mg/dL, as well as those receiving strong dual inhibitors of cytochrome P450 3A4 and P-glycoprotein. Boxed warning - inc risk of stroke if DC'd. Not indicated in patients with prosthetic heart valves.
74	Lasix	Furosemide	Cardiovascular	Loop diuretic	May cause hypokalemia; monitor potassium levels and kidney function. Also watch salt intake. May be used as needed in congestive heart failure. Hypersensitivity reaction may occur in individuals with sulfa allergy. Lasix short for "last six hours".
75	Lovenox	Enoxaparin	Cardiovascular	Low molecular weight heparin	Increased risk of bleeding. Counsel on injection technique. Often used when beginning warfarin to achieve goal INR more quickly. In community pharmacy, double-check to make sure proper package size and quantity are being dispensed/billed.
76	Imdur, ISMO	Isosorbide Mononitrate	Cardiovascular	Nitroglycerin antianginal/vasodilator	Frequently causes dizziness and/or headache. Dosed twice daily, but must be taken "asymmetrically" to prevent tolerance; take second dose 8 hours after first dose rather than every 12 hours.
77	Nitrostat	Nitroglycerin SL	Cardiovascular	Nitroglycerin antianginal/vasodilator	Frequently causes dizziness and/or headache. If chest pain persist after first dose, take second dose in 5 minutes. Call 911 if symptoms persist after second dose. Store in original container.
78	Nitro-Dur	Topical Nitroglycerin	Cardiovascular	Nitroglycerin antianginal/vasodilator	Finish course as prescribed. Apply patch for 12 hours and remove for 12 hours for nitrate-free period.
79	Cardizem, Cardizem SR, Cardizem CD, Cardizem LA, Tiazac	Diltiazem	Cardiovascular	Non-dihydro Calcium Channel Blocker	May cause drowsiness/dizziness or headache. Do not discontinue therapy without discussing with MD. Many formulations that may not be equivalent; double-check when dispensing generics.

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
80	Calan, Calan SR, Isoptin SR	Verapamil	Cardiovascular	Non-dihydro Calcium Channel Blocker	May cause drowsiness/dizziness, headache, or constipation. Do not discontinue therapy without discussing with MD.
81	Plavix	Clopidogrel	Cardiovascular	Platelet Inhibitor	Monitor for bleeding. Compliance extremely important. CYP 2C19 inhibitors such as omeprazole and esomeprazole greatly decrease efficacy. Check with MD or RPh before starting new medications or taking OTC medications.
82	Dyazide capsules or Maxzide tablets	Triamterene + HCTZ	Cardiovascular	Potassium-sparing + thiazide diuretic combo	Take in the early morning. Monitor renal function, potassium levels, and salt intake; not to be used if renal function impaired. Risk of kidney stones; drink plenty of fluids to reduce risk. Double-check patient profile when dispensing generics; patients should remain on tablets or capsules unless MD changes.
83	Aldactone, Aldactazide	Spironolactone, Spir/HCTZ	Cardiovascular	Potassium-sparing diuretic; Aldactazide also contains diuretic	Take in the early morning. Monitor renal function, potassium levels, and salt intake. May cause gynecomastia in males, menstrual irregularities in females (antiandrogenic properties). Evidence-based data for heart failure, post MI, and resistant hypertension. Aldactazide may cause hypersensitivity reactions in individuals with sulfa allergy.
84	Lozol	Indapamide	Cardiovascular	Thiazide diuretic	Take in the early morning. Monitor renal function, potassium levels, and salt intake; not to be used in severe renal impairment, but may be used in minimally impaired renal function. Hypersensitivity reaction may occur in individuals with sulfa allergy.
85	Thalidone, Hygroton	Chlorthalidone	Cardiovascular	Thiazide diuretic	Take in the early morning. Monitor renal function, potassium levels, and salt intake; not to be used if renal function impaired. Hypersensitivity reaction may occur in individuals with sulfa allergy. Chlorthalidone is twice as potent as HCTZ.
86	Oretic, Microzide	Hydrochlorothiazide (aka HCTZ)	Cardiovascular	Thiazide diuretic	Take in the early morning. Monitor renal function, potassium levels, and salt intake. Hypersensitivity reaction may occur in individuals with sulfa allergy.

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
87	Zaroxolyn	Metolazone	Cardiovascular	Thiazide diuretic	Take in the early morning. Monitor renal function, electrolytes (esp. potassium and magnesium) and salt intake. Hypersensitivity reaction may occur in individuals with sulfa allergy. Often used in diuretic-resistant patients in combination with loop diuretics.
88	Zofran, Zofran ODT	Ondansetron	CNS	5-HT3 antagonist Antiemetic	May cause headache, fatigue. Dissolve ODT under the tongue, store in original container until ready to use. QT prolongation possible.
89	Aricept	Donepezil	CNS	Acetylcholinesterase inhibitor	Take in the evening. Significant nausea, vomiting and diarrhea possible, as well as anorexia. May also cause bradycardia and fainting. Set realistic expectations for Alzheimer's patients. Keep in mind positive statistical significance vs. clinical significance.
90	Exelon, Exelon Patch	Rivastigmine	CNS	Acetylcholinesterase Inhibitor	Take capsules in the evening. Rotate patch application sites. Significant nausea, vomiting and diarrhea possible, as well as anorexia. May also cause bradycardia and fainting. Set realistic expectations for Alzheimer's patients. Keep in mind positive statistical significance vs. clinical significance.
91	Fiorinal, Fiorinal with codeine	Butalbital + aspirin + caffeine, available with or without codeine	CNS	Analgesic Combo for Tension Headaches, C-III	May cause drowsiness or dizziness; avoid alcohol use during therapy. Caution against taking other products containing aspirin.
92	Fioricet, Fioricet with codeine	Butalbital + acetaminophen + caffeine (sometimes called B-A-C), available with or without codeine	CNS	Analgesic Combo for Tension Headaches, C-III if it has codeine	May cause drowsiness or dizziness; avoid alcohol use during therapy. Do not exceed 4g of APAP per day, 3g if frequent alcohol drinker, 2g if taking warfarin. New black box warning with acetaminophen due to hepatotoxicity.
93	Buspar	Buspirone	CNS	Antianxiety- serotonin 5-HT1A receptor partial agonist	May cause drowsiness or dizziness, slow onset, mildly effective, little potential for abuse.
94	Transderm-Scop	Scopolamine	CNS	Anticholinergic	May cause drowsiness or dizziness. wash your hands after application as touching your eyes after application may result in blurred vision (dilation)
95	Remeron	Mirtazapine	CNS	Antidepressant	May cause drowsiness or dizziness, dry mouth, constipation and weight gain. Do not discontinue abruptly. Open from blister and dissolve SolTab on the tongue.
96	Desyrel	Trazodone	CNS	Antidepressant/Sleep Aid	May cause dizziness/drowsiness/orthostasis, priapism risk.

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
97	Wellbutrin (SR) (XL) or Zyban	Bupropion	CNS	Antidepressant/smoking cessation aid	Take XL tabs in AM to avoid insomnia, do not crush or chew SR or XL tabs, do not take doses too close or exceeding maximum doses because of seizure risk. Potential side-effects inc nervousness, constipation, trouble sleeping, dry mouth, tremor.
98	Tegretol (XR)	Carbamazepine	CNS	Antiepileptic	Take with food, may cause drowsiness, avoid alcohol. Serious and sometimes fatal dermatologic reactions (including Stevens-Johnson syndrome and toxic epidermal necrolysis) have been reported, especially in patients with the inherited allelic variant HLA-B*1502. Genetically at-risk patients (IE those form Asia including China) should be screened prior to receiving carbamazepine.
99	Lamictal	Lamotrigine	CNS	Antiepileptic	Report hypersensitivity/rash to MD, may cause drowsiness, do not operate heavy machine
100	Keppra	Levetiracetam	CNS	Antiepileptic	May cause dizziness/drowsiness, do not operate heavy machinery, do not abruptly discontinue therapy
101	Trileptal	Oxcarbazepine	CNS	Antiepileptic	May cause dizziness/drowsiness, do not operate heavy machinery, do not abruptly discontinue therapy
102	Dilantin Kapseals	Phenytoin Sodium	CNS	Antiepileptic	May cause dizziness/drowsiness, do not operate heavy machinery. Emphasize good oral hygiene to reduce risk of gingival hyperplasia
103	Depakote (ER)	Divalproex	CNS	Antiepileptic, mood stabilizer	Do not abruptly discontinue therapy, avoid alcohol use, may cause drowsiness
104	Phenobarbital	Phenobarbital	CNS	Antiepileptic/hypnotic; C-IV	May cause drowsiness or dizziness, *avoid alcohol use during therapy*
105	Topamax	Topiramate	CNS	Antiepileptic/Migraine prophylactic	May cause drowsiness or dizziness, avoid alcohol use during therapy. Confusion ("Dopamax") and it is now FDA approved in a combination with phentermine in extended release - Qsymia (C-IV)
106	Neurontin	Gabapentin	CNS	Antiepileptic/neuropathic analgesic	May cause drowsiness or dizziness, avoid alcohol use during therapy. Edema, weight gain and confusion as common side effects, as well as generally need to titrate slowly to higher doses as this agent has dose related kinetics
107	Atarax	Hydroxyzine hydrochloride	CNS	Antihistamine	May cause anticholinergic side-effects.

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
108	Vistaril	Hydroxyzine pamoate	CNS	Antihistamine/antianxiety	May cause anticholinergic side-effects.
109	Relpax	Eletriptan	CNS	Antimigraine, 5-HT1 agonist	Take at onset of migraine. If headache is relieved but returns after 1st dose, repeat in 2 hours. Do not exceed 2 doses or 80mg in a 24 hour period. If 1st dose does not relieve symptoms, reevaluate condition. Ischemic cardiovascular events possible. Drug interactions with CYP 3A4 substrates and ergot derivatives.
110	Maxalt, Maxalt MLT	Rizatriptan	CNS	Antimigraine, 5-HT1 agonist	Take at onset of migraine. If headache is relieved but returns after 1st dose, repeat in 2 hours. Do not exceed 2 doses or 30mg in a 24 hour period. If 1st dose does not relieve symptoms, reevaluate condition. Ischemic cardiovascular events possible. Drug interactions with ergot derivatives. Dissolvable tablets contain phenylalanine.
111	Imitrex	Sumatriptan	CNS	Antimigraine, 5-HT1 agonist	Take at onset of migraine. If headache is relieved but returns after 1st dose, repeat in 2 hours. Do not exceed 2 doses or 200mg in a 24 hour period. If 1st dose does not relieve symptoms, reevaluate condition. Ischemic cardiovascular events possible. Drug interactions with ergot derivatives. Available in oral tablet, injection kit, and nasal spray.
112	Cogentin	Benztropine	CNS	Antiparkinson Agent	May take with food to decrease GI symptoms. Potential anticholinergic side-effects
113	Sinemet (CR)	Levodopa/Carbidopa	CNS	Antiparkinson Agent	Avoid products containing B6 as they reduce the effectiveness of levodopa, may be taken with food/milk if GI upset occurs
114	Mirapex	Pramipexole	CNS	Antiparkinson Agent	Hallucinations may occur, report any changes in vision to MD, may cause drowsiness and even sleep attacks (falling asleep without warning)
115	Requip	Ropinirole	CNS	Antiparkinson/Restless Leg agent	May cause drowsiness or dizziness, avoid alcohol use during therapy, orthostasis may occur. May also cause sleep attacks.
116	Zyprexa	Olanzapine	CNS	Antipsychotic	Initially may cause dizziness, use caution when operating heavy machinery due to drowsiness, may cause wt gain, DM and dyslipidemia
117	Seroquel (XR)	Quetiapine	CNS	Antipsychotic	Initially may cause dizziness, use caution when operating heavy machinery due to drowsiness

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
118	Risperdal	Risperidone	CNS	Antipsychotic	First doses may cause fainting, may impair judgment, avoid alcohol use
119	Geodon	Ziprasidone	CNS	Antipsychotic	May cause arrhythmias, do not discontinue use abruptly, take with food
120	Abilify	Aripiprazole	CNS	Antipsychotic for bipolar, schizophrenia, and major depressive disorder	Avoid alcohol, D/I 3A4, QT prolongation, do not discontinue abruptly
121	Antivert	Meclizine	CNS	Antivertigo Agent	Potential anticholinergic side-effects
122	Xanax (XR)	Alprazolam	CNS	Benzodiazepine Antianxiety, C-IV	Do not exceed prescribed dose, do not take with alcohol, may cause drowsiness/dizziness, do not operate heavy machinery, avoid abrupt discontinuation
123	Klonopin	Clonazepam	CNS	Benzodiazepine Antianxiety; C-IV	Do not exceed prescribed dose, do not take with alcohol, may cause drowsiness/dizziness, do not operate heavy machinery
124	Valium	Diazepam	CNS	Benzodiazepine Antianxiety; C-IV	Do not exceed prescribed dose, do not take with alcohol, may cause drowsiness/dizziness, do not operate heavy machinery
125	Ativan	Lorazepam	CNS	Benzodiazepine Antianxiety; C-IV	Do not exceed prescribed dose, do not take with alcohol, may cause drowsiness/dizziness, do not operate heavy machinery
126	Restoril	Temazepam	CNS	Benzodiazepine Antianxiety; C-IV	Do not exceed prescribed dose, do not take with alcohol, may cause drowsiness/dizziness, do not operate heavy machinery
127	Adipex-P	Phentermine	CNS	CNS stimulant - Obesity Management; C-IV	Cardiovascular risk caution, take in the morning,
128	Concerta or Ritalin (ER) or Metadate CD	Methylphenidate	CNS	CNS Stimulant for ADD, C-II	Take as directed, don't share your pills
129	Strattera	Atomoxetine	CNS	CNS Stimulant, used for ADD	May impair cognitive & motor function, use caution when operating machinery, *not* a drug of abuse
130	Adderall (XR)	(Dex)/Amphetamine Mixed salts	CNS	CNS Stimulant, used for ADD; C-II	Take as directed, don't share your pills
131	Vyvanse	Lisdexamfetamine	CNS	CNS Stimulant, used for ADHD; C-II	Take as directed, don't share your pills
132	Provigil	Modafinil	CNS	CNS Stimulant, used for narcolepsy; C-IV	Take in morning or 1 hour prior to work, avoid driving until deemed safe by MD
133	Focalin (XR)	Dexmethylphenidate	CNS	CNS stimulant; C-II	Take as directed, don't share your pills
134	Sonata	Zaleplon	CNS	hypnotic, nonbenzodiazepine; C-IV	Take 30min to 1h prior to desired sleep, Allocate at least 5 hours after a dose to sleep (T ½ ~1 hour)

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
135	Flexeril	Cyclobenzaprine	CNS	Muscle Relaxant	May cause drowsiness or dizziness and other anticholinergic side-effects, avoid alcohol use during therapy
136	Skelaxin	Metaxalone	CNS	Muscle Relaxant	Least drowsy muscle relaxant, requires frequent dosing
137	Soma	Carisoprodol	CNS	Muscle Relaxant; C-IV	Drug of abuse, may be scheduled in some states, caution for drowsiness
138	Duragesic	Fentanyl	CNS	Narcotic Analgesic; C-II	Caution for respiratory depression, do not exceed prescribed dose. Avoid exposing patch on the skin to heat as it will increase the delivery of the fentanyl and increase the risk of toxicity, dispose of the used patch by folding over and flushing it, be careful when starting therapy and remember the patch is used for several days normally 72 hours but may see it changed every 48 hours in some patients. Caution in narcotic naive patients as it is 80-100 times more potent analgesic than morphine.
139	MS Contin	Morphine Sulfate	CNS	Narcotic Analgesic; C-II	Risk of CNS and respiratory depression, avoid alcohol, may cause drowsiness/dizziness, do not operate heavy machinery, constipation
140	Oxycontin	Oxycodone	CNS	Narcotic Analgesic; C-II	CNS depression, avoid alcohol, may cause drowsiness/dizziness, do not operate heavy machinery, constipation
141	Percocet or Roxicet	Oxycodone/APAP	CNS	Narcotic Analgesic; C-II	CNS depression, avoid alcohol, may cause drowsiness/dizziness, do not operate heavy machinery, constipation. APAP combination dose will be reduced to no more than 325mg per tablet in the next year. Consider the total daily dose of acetaminophen from all sources.
142	Tylenol with Codeine	Acetaminophen/ Codeine	CNS	Narcotic Analgesic; C-III	CNS depression, avoid alcohol, may cause drowsiness/dizziness, do not operate heavy machinery, constipation. Consider the total daily dose of acetaminophen from all sources.
143	Tussionex	Hydrocodone / chlorpheniramine Polistirex	CNS	Narcotic Analgesic; C-III	CNS depression, avoid alcohol, may cause drowsiness/dizziness, do not operate heavy machinery, constipation, taking with food may decrease some GI upset, Max dose 5mls BID

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
144	Vicoprofen	Hydrocodone/Ibuprofen	CNS	Narcotic Analgesic; C-III	CNS depression, avoid alcohol, may cause drowsiness/dizziness, do not operate heavy machinery, constipation, taking with food may decrease some GI upset
145	Lortab or Vicodin or Lorcet	Hydrocodone/APAP	CNS	Narcotic/APAP Analgesic - CIII	#1 prescribed drug! CNS depression, avoid alcohol, may cause drowsiness/dizziness, do not operate heavy machinery, avoid concomitant said drugs, constipation. Vicodin reformulated to contain only 300mg of APAP per dose to avoid generic competition and to meet new FDA requirement.
146	Lyrica	Pregabalin	CNS	Neuropathic Analgesic - CV	May cause drowsiness, do not discontinue therapy abruptly. Weight gain, edema and confusion are potential side-effects
147	Chantix	Varenicline Tartrate	CNS	Nicotinic receptor agonist, Smoking cessation	Usually titrated upward. Most effective smoking cessation agent to date ~ 44% at 12 weeks, also watch for night mares and any changes in affect and/or behavior and report them to the prescriber. Side-effects may be dose related.
148	Namenda	Memantine	CNS	NMDA receptor antagonist; anti-Alzheimer's agent	Take in the evening, potential N & D, dizziness and agitation possible. Set realistic expectations. Keep in mind positive statistical significance vs. clinical significance. Take without regard to food
149	Voltaren, Cataflam	Enteric Diclofenac sodium, Diclofenac potassium (non-enteric coated formulation)	CNS	NSAID	Take with food, monitor for s/sx of GI bleed. CV and renal risks. Enteric coated diclofenac sodium, slow onset not for PRN pain, greater risk of hepatotoxicity vs. other NSAIDs, use the Cataflam-diclofenac potassium non-enteric coated formulation if for PRN use for pain
150	Lodine (XL)	Etodolac	CNS	NSAID	Take with food, monitor for s/sx of GI bleed. CV and renal risks.
151	Indocin	Indomethacin	CNS	NSAID	Take with food, monitor for s/sx of GI bleed.CV and renal risks. Most likely NSAID to cause headache and CNS side-effects.
152	Toradol	Ketorolac Tromethamine	CNS	NSAID	Take with food, monitor for s/sx of GI bleed. Very high risk of GI bleeding limits this drug to 5 days max of therapy. CV and renal risks.
153	Mobic	Meloxicam	CNS	NSAID	Take with food, monitor for s/sx of GI bleed. CV and renal risks.

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
154	Relafen	Nabumetone	CNS	NSAID	Take with food, monitor for s/sx of GI bleed. CV and renal risks.
155	Naprosyn, Anaprox/Aleve	Naproxen and Naproxen sodium	CNS	NSAID	Take with food, monitor for s/sx of GI bleed. CV and renal risks. Naproxen sodium Aleve/Anaprox fast onset sodium salt vs. regular naproxen-Naprosyn which is slow onset and used for chronic Rx of OA and RA not acute pain relief
156	Feldene	Piroxicam	CNS	NSAID	Take with food, monitor for s/sx of GI bleed, CV and renal risks.
157	Motrin or Advil	Ibuprofen	CNS	NSAID	Take with food, monitor for s/sx of GI bleed. CV and renal risks. Motrin at low doses (IE OTC it is analgesic and antipyretic) but if you need anti-inflammatory effects then you need higher doses 2400 to 3200 mg/day
158	Celebrex	Celecoxib	CNS	NSAID Cox - II selective	Report s/sx of GI bleed, caution for CV risk like all NSAIDS, Not safer for renal function but may be slightly safer for GI bleeding risks
159	Arthrotec	Diclofenac/Misoprostol	CNS	NSAID/prostaglandin combo	Take with food, Misoprostol may decrease GI bleeding risks. CV and renal risks. Avoid in pregnancy. Diarrhea may be a common side effect of the prostaglandin component
160	Ultram, Ultram ER	Tramadol	CNS	Opioid analgesic	May cause drowsiness; avoid alcohol. Drug is scheduled in some states but not by the DEA. Some risk of dependence due to weak opioid receptor agonist activity. Drug also has some serotonin reuptake inhibitor properties; caution against GI effects, serotonin syndrome, increased seizure risk, and drug interactions (especially with SSRIs, SNRIs, 5-HT1 agonists/triptans)
161	Ultracet	Tramadol + acetaminophen	CNS	Opioid analgesic combo	May cause drowsiness; avoid alcohol. Drug is scheduled in some states but not by the DEA. Some risk of dependence due to weak opioid receptor agonist activity. Drug also has some serotonin reuptake inhibitor properties; caution against GI effects, serotonin syndrome, increased seizure risk, and drug interactions (especially with SSRIs, SNRIs, 5-HT1 agonists/triptans). Do not exceed 4g of APAP per day, 3g if frequent alcohol drinker, 2g/day if taking warfarin. New black box warning with acetaminophen due to hepatotoxicity.

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
162	Tylenol	Acetaminophen	CNS	Pain, antipyretic	Limit total daily dose <4 g, 3 g in elderly or frequent ETOH, 2 g if taking warfarin, Consider the total daily dose of acetaminophen from all sources. Black box warning with acetaminophen due to hepatotoxicity and New warning related to angioedema
163	Lunesta	Eszopiclone	CNS	Sedative Hypnotic	Do not take with alcohol, take 30min prior to bed. has a long half-life of ~6 hours and thus an increased risk of morning residual sedation, ~40% of patients complain of a bitter taste the morning after, Need to have at least 8 hours to sleep after a dose and all of these agents can cause complex sleep behaviors (walking, eating, driving, etc.) Do not put yourself in a position where impairment may lead to increased risk of an accident until you know how you respond to the medication.
164	Ambien (CR)	Zolpidem	CNS	Sedative Hypnotic; C-IV	Do *not* take with alcohol, take 30min prior to bed. Same issues as Lunesta. New lower dosing guidelines for women.
165	Pristiq	Desvenlafaxine	CNS	SNRI antidepressant	Avoid alcohol, do not discontinue abruptly, no added benefit over venlafaxine -recommend generic venlafaxine
166	Cymbalta	Duloxetine	CNS	SNRI Antidepressant	Do not abruptly discontinue therapy. report any changes in affect and or behavior as psychiatric side effects including suicidal ideation is possible
167	Effexor (XR)	Venlafaxine	CNS	SNRI Antidepressant	Avoid alcohol, do not discontinue abruptly, monitor BP
168	Celexa	Citalopram	CNS	SSRI Antidepressant	May cause drowsiness, do not discontinue therapy abruptly. new dosage guidelines of no more than 40 mg/day and avoid in patients with CV disease as it has been shown to increase QT interval (previously recommended for patients with CV disease now only sertraline remains in this category)
169	Lexapro	Escitalopram	CNS	SSRI Antidepressant	May cause drowsiness, do not discontinue therapy abruptly, recommend generic Celexa for cost savings
170	Prozac or Sarafem	Fluoxetine	CNS	SSRI Antidepressant	May cause drowsiness or dizziness, avoid alcohol use during therapy. Prozac longest half-life SSRI (metabolite norfluoxetine T1/2 is ~ 9 days) hence the Prozac weekly dosage form; also most activating of the SSRIs AM dosing not PM and a major inhibitor of CYP 2D6

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
171	Paxil (CR)	Paroxetine	CNS	SSRI Antidepressant	May cause drowsiness, do not discontinue therapy abruptly. Paxil most likely agent to cause discontinuation syndrome, short half-life and also most tricyclic like of the SSRI's I.e. sedation, and a major inhibitor of CYP 2D6. New 7.5 mg dose and Brand name drug approved for hot flashes related to menopause.
172	Zoloft	Sertraline	CNS	SSRI Antidepressant	May cause drowsiness or dizziness, avoid alcohol use during therapy. Drug of choice for patients with CV disease and MDD (SAD Heart and ENRICHED Trials, as well as ACC/AHA/APA Guidelines
173	Lidoderm Patches	Lidocaine	CNS	Topical analgesic	Do not apply to broken skin, do not leave patches on for more than 12 hours in a 24 hour period
174	Elavil	Amitriptyline	CNS	Tricyclic Antidepressant	May cause drowsiness or dizziness, avoid alcohol use during therapy. Rarely used for depression and usually used in low doses for off label uses (headaches, pain, neuropathy) as it is a side effect of this agent and it is not well tolerated secondary to anticholinergic effects, risk of overdose causing CV death and arrhythmias, caution for suicidal ideation.
175	Tofranil (PM)	Imipramine	CNS	Tricyclic Antidepressant	May cause drowsiness or dizziness, avoid alcohol use during therapy. Also has significant anticholinergic effects and risk of overdose like Elavil
176	Eskalith or Lithobid	Lithium Carbonate	CNS	Mood Stabilizer	Do not exceed recommended doses, consume 2-3 quarts of water qday. monitor serum levels and watch out for drug interactions with thiazide diuretics which require a dosage reduction of lithium
177	Differin	Adapalene	Dermatological	Topical Acne Product	Acne may worsen before it improves; using more than recommended increases risk of skin reactions. Use as little product as can cover the face or affected areas with a thin film. Caution against sun exposure and recommend using sunscreen.
178	Benzaclin	Clindamycin/Benzoyl Peroxide	Dermatological	Topical Acne Product	May cause skin irritation, use a sparing amount. Topical acne products remind patients that their acne may get worse before it gets better and exceeding the recommended doses will increase the risk of severe adverse effects

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
179	Benzamycin	Erythromycin/Benzoyl Peroxide	Dermatological	Topical Acne Product	May cause skin irritation, use a sparing amount. Topical acne products remind patients that their acne may get worse before it gets better and exceeding the recommended doses will increase the risk of severe adverse effects
180	Clobex	Clobetasol	Dermatological	Topical Corticosteroid	Use a sparing amount, avoid application on face and around eyes
181	Elocon	Mometasone	Dermatological	Topical Corticosteroid	Use a sparing amount, avoid application on face and around eyes
182	Kenalog	Triamcinolone	Dermatological	Topical Corticosteroid	Use a sparing amount, avoid application around eyes, available in ointment, cream and lotion
183	Elidel	Pimecrolimus	Dermatological	Topical skin product	Black Box warning due to cancer risk
184	Lotrisone	Clotrimazole/Betamethasone Diproprionate	Dermatological	Topical Antifungal/Corticosteroid	Use a sparing amount, avoid application on face and around eyes
185	Lidex, Lidex-E, Vanos	Fluocinonide topical	Dermatological	Topical Corticosteroid	Use a sparing amount, avoid application on face and around eyes
186	Propecia or Proscar	Finasteride	Endocrine	5 alpha reductase inhibitor	Pregnant women should not handle, will not regrow hair but will prevent additional hair loss. new data on sexual dysfunction which may not be reversible in men, when used for BPH they are not rapidly effective and may take 6 plus months to shrink and enlarged prostate and produce a reduction in symptoms, probably best when used in combo with an alpha blocker to reduce symptoms and prevent or delay the need for surgical intervention
187	Accutane or Claravis	isotretinoin	Endocrine	Acne treatment	Must follow REMS system for isotretinoin dispensing and counseling. teratogenic category X, adverse lipid effects especially increased TG and psychiatric effects and as with the topical products acne may get worse before it gets better
188	AndroGel	Testosterone	Endocrine	Androgen; C-III	Use as directed to upper arm and shoulder and not to genitals. Women and children should avoid contact with this medication; men with BPH may get worse
189	Glucophage (XR), Fortamet	Metformin	Endocrine	Antidiabetic - Biguanide	Counsel on GI upset, diarrhea and best titration to minimize symptoms, may lead to B12 deficiency related neuropathy
190	Januvia, Janumet (XR)	Sitagliptin, Sit+Metformin	Endocrine	Antidiabetic - Dipeptidyl peptidase IV inhibitor	Take without regard to food, risk of pancreatitis

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
191	Onglyza	Saxagliptin	Endocrine	Antidiabetic - Dipeptidyl peptidase IV inhibitor	Take without regard to food, risk of pancreatitis, concomitant use of CYP3A4 Inh - use 2.5mg instead of 5 mg QD.
192	Amaryl	Glimepiride	Endocrine	Antidiabetic - Sulfonylurea	Take with breakfast, avoid alcohol use, counsel on hypoglycemic risk
193	Glucotrol (XL)	Glipizide	Endocrine	Antidiabetic - Sulfonylurea	May cause hypoglycemia due to active metabolites
194	Micronase, Glucovance	Glyburide, Glyburide/Metformin	Endocrine	Antidiabetic - Sulfonylurea	Take with breakfast, avoid alcohol use. Has an active metabolite which is renally eliminated and thus increased risk of hypoglycemia and weight gain as patients age, may also increase CV events and no longer a recommended agent by the ADA
195	Actos	Pioglitazone	Endocrine	Antidiabetic - Thiazolidinedione	Take without regard to meals, increased risk of fractures, macular edema, heart failure, weight gain and edema as well as bladder CA in men.
196	Byetta, Bydureon	Exenatide, Exenatide weekly	Endocrine	Antidiabetic Glucagon-Like Peptide-1 Receptor Agonist	Counsel on pen injection technique. Nausea and vomiting tend to be dose related and transient start with 5 mcg daily dose and after a month increase to 10 mcg dose, watch for signs of pancreatitis and can be dosed 60 min or less before meals twice a day
197	Victoza	Liraglutide	Endocrine	Antidiabetic Glucagon-Like Peptide-1 Receptor Agonist	Counsel on pen injection technique. Nausea and vomiting tend to be dose related and transient, watch for signs of pancreatitis. Box warning - Rodent studies - risk of thyroid C-cell tumors.
198	Fosamax	Alendronate	Endocrine	Bisphosphonate Osteoporosis Agent	Take on an empty stomach with a full glass of water, must sit or stand for 30 minutes following the dose, osteonecrosis of jaw and atypical fractures
199	Boniva	Ibandronate	Endocrine	Bisphosphonate Osteoporosis Agent	Take on an empty stomach with a full glass of water, must sit or stand for 60 minutes following the dose. osteonecrosis of jaw and atypical fractures
200	Actonel, Atelvia	Risedronate, delayed release enteric coated risedronate	Endocrine	Bisphosphonate Osteoporosis Agent	Take on an empty stomach with a full glass of water, must sit or stand for 30-60 minutes following the dose. Atelvia is enteric coated formulation which should be taken after breakfast but not available as generic. osteonecrosis of jaw and atypical fractures
201	Estratest (HS)	Estrogen/Methyltestosterone	Endocrine	Combination Hormone	CV, thromboembolic caution
202	Combipatch	Estradiol/Norethindrone	Endocrine	Estrogen and Progestin Combination	Stable at room temperature for 3 months
203	Premarin	Conjugated Estrogens	Endocrine	Estrogen hormone	May take with food to decrease GI symptoms

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
204	Climara, Estrace	Estradiol	Endocrine	Estrogen Hormone	CV, thromboembolic caution
205	Evista	Raloxifene	Endocrine	Estrogen receptor modulator, Post-menopausal Osteoporosis	CV risk and thromboembolic black box warnings, may inc TGs, myalgia. May cause or worsen hot flashes
206	Prempro or Premphase	Conjugated Estrogens with medroxyprogesterone	Endocrine	Estrogen-Progestin hormone combo	increased risk of CV and DVT as well as dementia with long term therapy, report any abnormal vaginal bleeding
207	Colcrys	Colchicine	Endocrine	Gout - Inflammatory Mediator	Long-term therapy requires blood work. no more than 3 tablets for an acute attack with similar efficacy to 8 tablets but with much less risk of GI toxicity
208	Zyloprim	Allopurinol	Endocrine	Gout - Xanthine Oxidase Inhibitor	Consume large amounts of fluids to prevent kidney stone formation. start with 100 mg QD after an acute gout attack has subsided and gradually increase the dose at no more than weekly interval to about 300 mg QD to reduce the risk of mobilization gout, may also add low dose colchicine 1-2 tabs per day for prevention of mobilization gout, D/C at first signs of a rash
209	Uloric	Febuxostat	Endocrine	Gout - Xanthine Oxidase Inhibitor	Same as allopurinol but may be safe in patients with a history of adverse skin reactions to allopurinol.
210	Provera	Medroxyprogesterone Acetate	Endocrine	Hormone/Progestin	May take with food to decrease GI symptoms, preg cat: X, may lead to uterine bleeding irregularities, long term use may decrease bone mineral density
211	Humulin R	Insulin - regular	Endocrine	Insulin - Fast Acting	counsel on injection technique and hypoglycemia, take 15-30 min prior to meal
212	Humulin N	Insulin - NPH	Endocrine	Insulin - Intermediate Acting	counsel on injection technique and hypoglycemia
213	Levemir	Insulin Detemir	Endocrine	Insulin - Intermediate-Long acting	cannot be mixed with another insulin
214	Lantus	Insulin Glargine	Endocrine	Insulin - Long Acting	cannot be mixed with another insulin, May have an increase in injection site pain/rxn
215	Novolog	Insulin Aspart	Endocrine	Insulin - Rapid Acting	Take immediately before meals, counsel on injection technique and hypoglycemia
216	Humalog	Insulin Lispro	Endocrine	Insulin - Rapid Acting	Take immediately before meals, counsel on injection technique and hypoglycemia
217	Apidra	Insulin Glulisine	Endocrine	Insulin - Rapid Acting	Take immediately before meals, counsel on injection technique and hypoglycemia
218	Yasmin, Ocella, Yaz	Ethinyl Estradiol/ Drospirenone	Endocrine	Oral contraceptive	Take everyday - counsel on missed dose protocol, caution with antibiotics. new warnings about increased risk of VTEs especially in older women and those who smoke ; risk of hyperkalemia

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
219	Kariva, Ortho-Cept, Mircette, Desogen or Apri	Ethinyl Estradiol / Desogestrel	Endocrine	Oral contraceptive	Take everyday - counsel on missed dose protocol, caution with antibiotics. new warnings about increased risk of VTEs especially in older women and those who smoke ; risk of hyperkalemia
220	Aviane, Alesse	Ethinyl Estradiol / Levonorgestrel	Endocrine	Oral contraceptive	Take everyday - counsel on missed dose protocol, caution with antibiotics. new warnings about increased risk of VTEs especially in older women and those who smoke ; risk of hyperkalemia
221	Loestrin FE	Norethindrone/Ethinyl Estradiol,Fe+	Endocrine	Oral contraceptive	Take at same time everyday, counsel on missed dose protocol. Caution with antibiotics, smoking
222	TriNessa, Tri-Sprintec	Norgestimate & Ethinyl Estradiol	Endocrine	Oral contraceptive	Take at same time everyday, counsel on missed dose protocol. Caution with antibiotics, smoking
223	Ortho Tri-Cyclen (Lo)	Norgestimate/Ethinyl Estradiol	Endocrine	Oral contraceptive	Take at same time everyday, counsel on missed dose protocol. Caution with antibiotics, smoking
224	Ortho Evra	Ethinyl Estradiol / Norelgestromin	Endocrine	Patch contraceptive	Each patch should remain in place for 7 days, CV risk, smoking risk
225	Novolin 70/30, Humulin 70/30	Insulin 70% NPH/ 30 % Regular	Endocrine	Pre-Mixed insulin	counsel on injection technique and hypoglycemia, 1st # is percent of intermediate release insulin and second is fast acting
226	Novalog Mix 70/30, Humalog Mix 75/25	Insulin 70% protamine/ 30 % rapid acting	Endocrine	Pre-Mixed insulin	counsel on injection technique and hypoglycemia, 1st # is percent of intermediate release insulin and second is rapid acting
227	Depo-Provera	Medroxyprogesterone	Endocrine	Progestin Contraceptive	May cause weight gain, preg cat: X, may lead to uterine bleeding irregularities, long term use may decrease bone mineral density
228	Deltasone	Prednisone	Endocrine	Steroid Anti-inflammatory	Take with food, may cause agitation, insomnia
229	Medrol	Methylprednisolone	Endocrine	Steroid anti-inflammatory/allergy	Take with food, may cause agitation, insomnia
230	Armour thyroid	Desiccated thyroid	Endocrine	Thyroid Hormone	Take on an empty stomach in the morning

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
231	Synthroid or Levoxyl	Levothyroxine	Endocrine	Thyroid Hormone (synthetic T4)	Narrow Therapeutic Index Drug: Take on an empty stomach in the morning with full glass of water at least 30 minutes prior to food (Do not take close to Calcium), Stay on specific brand or generic due to bioavailability issues, TSH monitoring (many dosages available from 25mcg to 300 mcg for fine tuning), adverse drug reactions early on often due to too high of dosing (med induced hyperthyroidism - heat intolerance and sweating, frequent bowel movements, restlessness, tachycardias, hair loss). Pregnancy Cat A:may need to increase dose in pregnancy, drug instable in light and humidity. Levothyroxine FDA Orange Book 4 sub categories of AB ratings (i.e. AB1, AB2,AB3 and AB4) so be careful when switching between brands and generic manufacturers stay within the same AB subclass; takes 4 weeks to reach new steady state levels and TSH may lag another 2-3 weeks
232	Vivelle-Dot, Estraderm	Estradiol	Endocrine	Topical estrogen patch	Counsel on twice weekly patch application. Note: Climara is once-weekly patch
233	NuvaRing	Ethinyl Estradiol / Etonogestrel	Endocrine	Vaginal contraceptive	Counsel on vaginal application, 3 weeks in, 1 week off
234	Vagifem	Estradiol	Endocrine	Vaginal estrogen	Counsel on vaginal tablet use with Vagifem
235	Bentyl	Dicyclomine	Gastrointestinal	Anticholinergic for cramping/irritable bowel	May cause dry mouth, dizziness. Avoid alcohol use.
236	Levsin/Levbid/Levsinex	Hyoscyamine	Gastrointestinal	Anticholinergic for cramping/irritable bowel	Take before meals. May experience dizziness, blurred vision, constipation.
237	Imodium	Loperamide	Gastrointestinal	Antidiarrheal	May cause drowsiness, contact MD if diarrhea persists longer than 48 hours
238	Lomotil	Diphenoxylate/Atropine	Gastrointestinal	Antidiarrheal; C-V	Do not exceed prescribed dose, anticholinergic side-effects possible
239	Phenergan	Promethazine	Gastrointestinal	Antihistamine - Nausea/Vomiting treatment	May cause anticholinergic side-effects.
240	Amitiza		Gastrointestinal	Chloride Channel Activator	Take with food to decrease nausea
241	Xenical	Orlistat	Gastrointestinal	Fat absorption inhibitor	Caution regarding uncontrollable oily bowel movements especially after high fat meal, patient should take supplemental fat soluble vitamins at least 2 hrs prior to orlistat dose

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
242	Pepcid	Famotidine	Gastrointestinal	H 2 Antihistamine	Do not exceed 14 days of OTC therapy unless directed by MD, report severe abdominal pain/discomfort to MD
243	Zantac	Ranitidine	Gastrointestinal	H 2 Antihistamine	Do not exceed 14 days of OTC therapy unless directed by MD, report severe abdominal pain/discomfort to MD
244	Miralax, Glycolax	Polyethylene Glycol	Gastrointestinal	Laxative	Safe for daily use, one heaping teaspoon dissolved in 8 oz of water once daily as needed
245	Reglan	Metoclopramide	Gastrointestinal	Promotility-Antiemetic	Take 30 minutes prior to meal, avoid use with alcohol, associated with extrapyramidal symptoms and depression, caution in elderly
246	Nexium	Esomeprazole	Gastrointestinal	Proton Pump Inhibitor	Take 30- 60 min prior to a significant meal. all of these meds are pro-drugs which need to be absorbed in that state and are activated within the parietal cell when the patient stimulates them to secrete acid by eating. They all also have a short half-life of 1-2 hours. Risks include C Diff diarrhea, pneumonia, fractures and low serum magnesium levels in addition to B12 deficiency
247	Prevacid	Lansoprazole	Gastrointestinal	Proton Pump Inhibitor	Take 30- 60 min prior to a significant meal. all of these meds are pro-drugs which need to be absorbed in that state and are activated within the parietal cell when the patient stimulates them to secrete acid by eating. They all also have a short half-life of 1-2 hours. Risks include C Diff diarrhea, pneumonia, fractures and low serum magnesium levels in addition to B12 deficiency
248	Prilosec	Omeprazole	Gastrointestinal	Proton Pump Inhibitor	Take 30- 60 min prior to a significant meal. all of these meds are pro-drugs which need to be absorbed in that state and are activated within the parietal cell when the patient stimulates them to secrete acid by eating. They all also have a short half-life of 1-2 hours. Risks include C Diff diarrhea, pneumonia, fractures and low serum magnesium levels in addition to B12 deficiency
249	Protonix	Pantoprazole	Gastrointestinal	Proton Pump Inhibitor	Take 30- 60 min prior to a significant meal. all of these meds are pro-drugs which need to be absorbed in that state and are activated within the parietal cell when the patient stimulates them to secrete acid by eating. They all also have a short half-life of 1-2 hours. Risks include C Diff diarrhea, pneumonia, fractures and low serum magnesium levels in addition to B12 deficiency

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
250	Aciphex	Rabeprazole	Gastrointestinal	Proton Pump Inhibitor	Take 30- 60 min prior to a significant meal. all of these meds are pro-drugs which need to be absorbed in that state and are activated within the parietal cell when the patient stimulates them to secrete acid by eating. They all also have a short half-life of 1-2 hours. Risks include C Diff diarrhea, pneumonia, fractures and low serum magnesium levels in addition to B12 deficiency
251	Zegerid	Omeprazole/sodium bicarbonate	Gastrointestinal	Proton Pump Inhibitor/Antacid combo	Take 30- 60 min prior to a significant meal. all of these meds are pro-drugs which need to be absorbed in that state and are activated within the parietal cell when the patient stimulates them to secrete acid by eating. They all also have a short half-life of 1-2 hours. Risks include C Diff diarrhea, pneumonia, fractures and low serum magnesium levels in addition to B12 deficiency
252	Avodart	Dutasteride	Genitourinary	BPH - 5 alpha reductase inhibitor	Capsules *should not be handled by women, takes time for shrinkage of prostate and symptom relief*
253	Flomax	Tamsulosin	Genitourinary	BPH - selective alpha blocker	Take 30min after the same meal every day. May cause dizziness.
254	Uroxatral	Alfuzosin	Genitourinary	BPH - selective alpha blocker	Take prior to bedtime to avoid orthostatic hypotensive effects
255	Levitra	Vardenafil	Genitourinary	Erectile dysfunction - vasodilator	Report erections lasting longer than 4 hours to ER, avoid nitroglycerin use
256	Viagra	Sildenafil	Genitourinary	Erectile dysfunction - Vasodilator	Report erections lasting longer than 4 hours to ER, avoid nitroglycerin use
257	Cialis	Tadalafil	Genitourinary	Erectile dysfunction - Vasodilator	Report erections lasting longer than 4 hours to ER, avoid nitroglycerin use
258	Ditropan (XL)	Oxybutynin	Genitourinary	Urinary Incontinence - Anticholinergic	May cause dry mouth, dizziness. Avoid alcohol use.
259	Detrol (LA)	Tolterodine	Genitourinary	Urinary Incontinence - Anticholinergic	May cause dry mouth, dizziness. Avoid alcohol use.
260	Enablex	Darifenacin	Genitourinary	Urinary Incontinence - Anticholinergic	May cause dry mouth, dizziness. Avoid alcohol use.
261	Pyridium	Phenazopyridine	Genitourinary	Urinary Tract Analgesic	Urine will change to orange-red color …not a cause for alarm, used only for symptom relief and not a cure
262	Calcitriol	cholecalciferol	Nutritional	Vitamin D supplement	Take with food to decrease GI problems
263	Alphagan P	Brimonidine	Ophthalmic	Agent for Glaucoma	Refer to eye-drop technique handout
264	Xalatan	Latanaprost	Ophthalmic	Agent for glaucoma	Refer to eye-drop technique handout. Stable at room temperature for 6 wks
265	Timoptic (XE)	Timolol	Ophthalmic	Agent for glaucoma	Refer to eye-drop technique handout
266	Travatan	Travoprost	Ophthalmic	Agent for glaucoma	Refer to eye-drop technique handout

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267	Combigan	Brimonidine/Timolol	Ophthalmic	Alpha II agonist/beta blocker/ antiglaucoma	Refer to eye-drop technique handout
268	Pataday or Patanol	Olopatadine	Ophthalmic	Antiallergy	Refer to eye-drop technique handout
269	Tobradex	Tobramycin/Dexamethasone	Ophthalmic	Antibiotic/anti-inflammatory	Refer to eye-drop technique handout
270	Vigamox	Moxifloxacin	Ophthalmic	Antibiotic/Ophthalmic	Refer to eye-drop technique handout
271	Restasis	Cyclosporine	Ophthalmic	Calcineurin inhibitor	Invert vial several times prior to use to create uniform emulsion. Used every 12 hours.
272	Cosopt	Dorzolamide/Timolol	Ophthalmic	Carbonic anhydrase inhibitor/beta blocker/antiglaucoma	Refer to eye-drop technique handout
273	Zymar	Gatifloxacin	Ophthalmic	Fluoroquinolone	Refer to eye-drop technique handout
274	Lumigan	Bimatoprost	Ophthalmic	prostaglandin analog for glaucoma treatment	Refer to eye-drop technique handout
275	Cortisporin Otic	Neomycin/polymyxin/hydrocortisone	Otic	Otic Antibiotic	See ear drop instructions
276	Ciprodex, Cipro HC	Ciprofloxacin/Dexamethasone, Ciprofloxacin/Hydrocortisone	Otic	Otic Antibiotic/Corticosteroid	See ear drop instructions
277	Astelin	Azelastine	Respiratory	Allergic Rhinitis - Topical H1 antagonist	Prime 4x upon assembly, 2x if left unused for 3 days or more
278	Rhinocort Aqua	Budesonide Nasal Spray	Respiratory	Allergic rhinitis -Nasal Steroid	May cause taste distortion, effects seen after several days of therapy, May cause nasal irritation, bleeding
279	Flonase	Fluticasone	Respiratory	Allergic rhinitis -Nasal Steroid	May cause dysgeusia (taste distortion), effects seen after several days of therapy, May cause nasal irritation, bleeding
280	Nasonex,	Mometasone	Respiratory	Allergic rhinitis -Nasal Steroid	May cause dysgeusia (taste distortion), effects seen after several days of therapy, May cause nasal irritation, bleeding
281	Singulair	Montelukast	Respiratory	Anti -asthmatic - Leukotriene inhibitor	chewable tablet contains phenylalanine
282	Proair HFA or Ventolin HFA or Proventil HFA	Albuterol	Respiratory	Anti- asthmatic - short-acting beta-2 agonist	Available in both MDI and nebulizer soln. Counsel on appropriate device use and prn rescue dosing. May also be use for prophylaxis for exercise-induce asthma. May cause jitteriness, nervousness, tachycardia and decrease effectiveness of beta blockers.
283	Xopenex (HFA)	levalbuterol	Respiratory	Anti-asthmatic - short-acting beta-2 agonist	counsel on appropriate MDI use and prn rescue dosing

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
284	Pulmicort Respules, Flexhaler	Budesonide Inhalation Suspension	Respiratory	Anti-asthmatic - Steroid	Some effects seen after first 2 days of therapy, maximum effect seen within first 2 weeks of therapy, not to be used for rescue
285	Flovent	Fluticasone	Respiratory	Anti-asthmatic - Steroid	Some effects seen after first 2 days of therapy, maximum effect seen within first 2 weeks of therapy, not to be used for rescue
286	Advair	Fluticasone/Salmeterol	Respiratory	Antiasthmatic - Steroid /LA B2 agonist Antiasthmatic - Controller	Diskus: Do not shake after activating, counsel on device technique, not to be used for rescue
287	Respimat or Duoneb	Albuterol/Ipratropium	Respiratory	Antiasthmatic/COPD Combo Bronchodilator/Anticholinergic	see albuterol and ipratropium counseling points, Combivent will no longer be available. Respimat is a new device with a counter - pt counseling required.
288	Spiriva HandiHaler	Tiotropium	Respiratory	Anticholinergic bronchodilator for COPD	counsel on device technique and once-daily use
289	Atrovent	Ipratropium Bromide	Respiratory	Anticholinergic antibrochospasm and antisecretory	Shake well, hold breath for 10 sec after actuation, wait 1 minute for 2nd inhalation, usually very little systemic side-effects because of poor absorption
290	Zyrtec	Cetirizine	Respiratory	Antihistamine, 2nd generation H1	May cause drowsiness, dizziness or dry mouth. Available in syrup and tablets
291	Clarinex	Desloratadine	Respiratory	Antihistamine, 2nd generation H1	May cause drowsiness, dizziness or dry mouth
292	Claritin	Loratidine	Respiratory	Antihistamine, 2nd generation H1	May cause drowsiness, dizziness or dry mouth
293	Allegra (D)	Fexofenadine (PSE)	Respiratory	Antihistamine, 2nd generation H1 (+Decongestant)	May cause drowsiness, do not take with fruit juices. PSE may cause insomnia, take D products in AM
294	Mucinex (D, DM)	Guaifenesin	Respiratory	Expectorant (+/- decongestant, antitussive)	Take with large glass of water, BID dosing, PSE may cause insomnia, PSE contraindicated in patients with CV risk, hypertension, DM drug interactions
295	Cheratussin AC	Guaifenesin & Codeine	Respiratory	Expectorant/Antitussive combo - CV	Take with water, codeine side-effect possible
296	Zostavax	herpes zoster vaccine	Vaccine	Herpes Zoster (shingles virus) Vaccine	CDC 60 yrs and above, FDA approved for 50 and above. Decreases risk of shingles and complications, such as postherpetic neuralgia. Not a substitute for varicella vaccine. Separate from Pneumovaz by 4 weeks
297	Gardasil, Cervarix	Human papillomavirus vaccine	Vaccine	Human papillomavirus vaccine (HPV)	Potentially prevents cancer. Given in 3 doses over 6 months, Gardasil approved for males also
298	Afluria or Fluvirin or Fluzone	influenza virus vaccine	Vaccine	Influenza Virus Vaccine	Once yearly dosing generally recommended before Halloween. Now, a variety of dosage forms available.
299	Pneumovax	pneumococcal polysaccharide vaccine	Vaccine	*Streptococcus Pneumoniae* Bacterial Vaccine	Once (or twice) life-time dosing in high risk patients. Pneumovax can now also be given along with Prevnar 13 in older patients with significant risks as of 6-21-12 ACIP Meeting

	Trade Name	Generic Name	General Category	Therapeutic Category (+ DEA Schedule)	Counseling Points
300	Tdap	Tetanus, Diphtheria, Pertussis Vaccine	Vaccine	Tetanus, Diphtheria, Pertussis	booster dose after DTaP series in childhood, can replace a Td booster, preferred administration 11-12 years of age.

Dosage Form Abbreviations		**Abbreviation**	**Name**	Other Abbreviations
XR or XL or ER	Extended release	APAP	Acetaminophen	ACE-I Angiotensin Converting Enzyme Inhib.
XE	Extended effect	HCT or HCTZ	Hydrochlorothiazide	ARB - Angiotensin Receptor Blocker
LA	Long Acting	ASA	Acetylsalicylic acid	B2 - beta 2 receptors.
SR	sustained release	DEX	Dexamphetamine	COPD - Chronic Obstructive Disease
CR	Controlled release	DM	Dextromethorphan	H1 -Histamine 1 receptors
TTS	Transdermal Therapeutic System			H2 - Histamine 2 receptors
ODT	Orally disintegrating tab			5-HT - serotonin receptor
D	Decongestant			NSAID - Non steroidal anti-inflammatory
PM	evening			SSRI - Selective Serotonin Reuptake Inhib
HS	half-strength			SNRI - Serotonin Norepinephrine Reuptake Inhibitor
				LD: Low-Dose