PTCB PREP, LLC

Pharmacy Technician Certified Board Preparation:

Comprehensive Review Manual

Pharmacy Technician Certified Board Preparation: Comprehensive Review

Manual

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Purpose

The intention of this textbook is to assist students who wish to become pharmacy technicians with or without any experience. Careers in the pharmaceutical industry are consistently in high demand. Becoming a nationally certified pharmacy technician is not that difficult. One would need to pass the national board exam with a 70 percent in all the following areas:

1. Assisting the pharmacist in serving patients: 66 percent of exam
2. Maintaining medication and inventory control systems: 22 percent of exam
3. Participating in the administration and management of pharmacy practice: 12 percent of exam

This book is designed for any student wanting to advance or change their career to become a national board certified pharmacy technician. Students who intend to buy this textbook also need to attend the preparation classes (see our class schedule lists on our Web site at www.ptcbprep.com). It is vital to attend these weekend PTCBPrep classes. In these classes, the instructor(s) will go over everything in this textbook and answer any questions. Students who use the textbook and attend the preparation classes will have greater chances of passing the board exam. Passing the exam depends on the student's time spent in studying and the materials provided. This book has thirty-six short chapters, which cover all areas of pharmacy practice—retail, hospital, mail-order, and other pharmaceutical areas.

Many students, who have purchased our textbook and have taken the two-day course, have passed with a high score. This textbook is provided by the PTCB Preparation team to interested individuals pursuing a rewarding career as a Certified Pharmacy Technician.

About the Authors

Anne Nguyen, RPh, Pharm D, has over 19 years of experience as a pharmacy clinician. She has practiced in retail, institutional, home-health care, and mail orders. She was a co-salutorian in Miami High School, Oklahoma and decided to go into pharmacy profession after working in a local pharmacy. She graduated Cum Laude with a Bachelor of Science in Pharmacy from Southwestern Oklahoma University in 1992 and a Doctor of Pharmacy from Idaho State University in 2010.

Mrs. Nguyen has practiced in retail as Pharmacist-in-charge and pharmacy manager. Her pharmacy served as a training store in the district for newly hired pharmacists. She also worked an OBRA Counselor for Medicare Part D for Blue Cross/Blue Shield at a mail-order pharmacy.

Mrs. Nguyen received a distinguished Service Award for Pharmacist of the First Quarter in the North Texas Region of Eckerd Pharmacy, 1999. She is certified as an immunizer from APhA, and ACLS, BLS and Pharmacist Preceptor for state of Texas since 1993. She is a Member of American Society of Health System Pharmacists, American Society of Parenteral & Enteral Nutrition. She is a certified instructor for IV certification classes through University of Houston College of Pharmacy.

Co-author Anne Nguyen notes that her husband, Chi-Man D Lau, with help of his critiques of ideas, providing guidance and support throughout the project.

Thanh Nguyen, RPh, Pharm D has more than 14 years of experience as a clinically oriented pharmacy leader. She has practiced in retail, institutional, home-health care, and mail order. She graduated with a Bachelor of Science in Pharmacy from Southwestern Oklahoma University of Oklahoma and a Pharm.D. from Idaho State University. She earned Honors (Cum Laude) at both Southwestern Oklahoma University of Oklahoma and Idaho State University.

She has authored the following articles: *Fact or Fallacy: A Nutrition Course Should Be Required in Pharmacy Curricula* and *Results of a nutritional questionnaire administered to registered pharmacists* , Fisher E, Nguyen T.P, Mossa S, Fourth Annual Student Research/Scholarly Activity Fair, March

19, 1997, Weatherford, Oklahoma.

Thanh is a member of ASHP and APhA. She was a Rho Chi member during her Pharmacy years. During her pharmacy school years, she received several scholarships and awards, such as Facts and Comparisons Excellence in Clinical Communication Award and Joseph Schwimen Scholarship.

Ms. Nguyen has held position as Pharmacist-In-Charge and clinical pharmacist. She has been actively training and teaching pharmacists and pharmacy interns for the APhA Pharmacy-based Immunization Delivery program and IV Aseptic Technique Training for Pharmacists and Technicians. She is actively involved in pharmacy wellness programs such as cholesterol management, diabetic management, and travel vaccines and consultations.

Christina Pham , CPht has been practicing as pharmacy technician in Texas for more than 4 years. She has practiced in retail and on-call customer service at PharMerica After Hours. She is a certified instructor for IV certification classes for pharmacy technicians.

We acknowledge **Caitlin Nguyen, Bachelor of Science, CPht**, for her assistance in reviewing and researching materials for the book.

Accordingly, Ms. Pham and Ms. Nguyen were pleased to have the opportunity to co-author this book for the use in the pharmacy profession.

Acknowledgment

To our families for the time that they have sacrificed so that this first edition would become a reality.

To our mentors and advisors, whose vision provided education and motivation that encouraged our professional growth and challenged us to be innovators in our educational endeavors.

Contents

Chapter 1

Introduction to Pharmacy

Pharmacy technicians today play a vital role in the pharmacy business and at other pharmacy practice sites. Technicians interact with patients, physicians, nurses, and health insurance providers. They work under the pharmacist's supervision and are allowed to assist in pharmacy activities that do not require the professional judgment of a pharmacist. Technicians are becoming more involved in the production and technical aspects of pharmacy, while pharmacists have become more involved with patient-care activities and have become the "dispensers of medicine."

There are many different specialized areas of pharmacy today. If you have excellent customer service skills, ambulatory care is for you. This work is challenging, but provides you with great knowledge and benefits as well as the possibilities of furthering your education in the future. Outpatient clinical pharmacies and retail pharmacies (e.g., your neighborhood CVS, Walgreens, Walmart, etc.) are a part of community pharmacy (also known as ambulatory care). If you prefer a more relaxed, yet professional atmosphere with less consumer interaction, mail order and nuclear pharmacies should be your choices. Nuclear pharmacy technicians require extra training since it is a specialty. The institutional pharmacy technician works closely with clinical pharmacists to supply orders to hospitals. There are many different roles of the pharmacy technician. Some areas of pharmacy practice require similar roles.

Certified Pharmacy Technician (CPhT) is a title given to technicians who have passed the national PTCB exam and have currently valid PTCB certificate. This implies that you have had additional training, which will make you more marketable and valuable in the pharmaceutical industry.

Pharmacists are among the most trusted professionals. *Preserving patient confidentiality is important in maintaining this trust*. It is important to keep

personal or health information about patients strictly confidential at *all times*. Discussing a patient's health information with anyone other than the patient, the patient's caregiver (person who takes care of the patient, who is a child, elderly, or disabled), or other pharmacists is a serious violation of ethics and could result in a lawsuit filed against the pharmacy or hospital.

Chapter 2

Pharmacy Technician Duties

Focus on Patient

4. Enter medication order into computer.
    - Obtain medication order from patient's chart or receive prescriptions via fax,
    telephone, electronic prescribing, or obtained directly from the patient
5. Collect data from patient (name, date of birth, address, insurance)
6. Maintain patient medication profile (drug allergies or other medications/herbals)
7. Help pharmacists with education programs about diseases, devices, and durable medical equipment (DME)
8. Call physicians' offices for refill requests (done in retail pharmacy)
    - This is a courteous procedure for patients
9. Document authorization for refill approvals (by fax, phone, or electronic)
10. Help patients find over-the-counter (OTC) products

Dispensing Functions

1. Prepare IV (intravenous) admixture solutions with approved training
    - Done in hospitals
2. Make bulk supplies (bulk compounding)
    - Independent pharmacies and hospitals
3. Compound prescriptions with training

- *Compounding*: The preparation of sterile, non-sterile, cytotoxic, and hazardous products for a specific patient

4. Perform calculations for medication order or compound
5. Reconstitute solid preparations into liquids or suspensions
    - *Example*: Amoxil® 250 mg/5 mL reconstituted with distilled water
6. Count and pour medications into prescription vials or bottles
7. Include labels and auxiliary labels on vials or bottles
8. Handle hazardous wastes properly
9. Bill third party (health insurances) for services and medications
10. File prescriptions according to laws and regulations
    - Controlled and noncontrolled files are usually kept separately
    - Keep files for several years, depending on the state board of pharmacy
11. Help keep accurate records for the pharmacy department

Inventory Control

1. Assist in inventory control
2. Purchase drugs, OTCs, and accessories
3. Check in order and file invoices
    - Controlled separate from noncontrolled
4. Maintain inventory on shelf
5. Maintain controlled substance inventory (narcotics, etc.)
6. Process returns for credit into inventory
    - Send back expired drugs, overstocked drugs, or recalled drugs to

manufacturers

7. Keep pharmacy department supplies well-stocked

To answer questions about technician duties, use *common sense*. The pharmacy technician can handle questions and answer phone calls that do not require pharmacists' judgment. Being part of a pharmacy team, it's important for technicians to follow the pharmacy's policies and procedures, and the pharmacist's instructions precisely. Everything the technician and staff do shapes the image of the pharmacy.

Tasks which Pharmacy Technicians may *not* perform include the following:

1. Providing drug information to patient or patient's caregiver (patient counseling)
2. Transferring prescriptions between pharmacies
3. Interpreting patient profiles and performing drug use reviews (OBRA counseling)
4. Receiving oral prescription orders by phone
5. Interpreting and evaluating prescription drug orders
6. Selecting drug products (brand vs. generic); must ask pharmacist for state law restrictions
7. Performing the final check of dispensed product before delivery to the patient

These tasks are only performed by a licensed pharmacist. Remember, the pharmacist is liable for anything that technicians do. Thus, mistakes can seriously affect patients.

Chapter 3

Different Classes of Practice Sites

There are different classes of pharmacies for practicing. Their classification is based on patient-oriented practices. Each of these sites requires certain skills and involves different types of tasks and functions. However, many pharmacists and technicians can work from one site to another without difficulties. It is all based on one's knowledge and skills.

Some states may have different pharmacy classification. Be sure to know your state's classification of pharmacies and its requirement. However, for the state of **Texas**, these are the following classifications:

1. Class A: a. Ambulatory care (community: retail and outpatient clinic pharmacies)

   b. Managed care (working for health insurance companies)

2. Class B Nuclear pharmacy only

3. Class C Institutional (hospital) pharmacies

4. Class D: a. Clinic (similar to hospital)

   b. Specialty services (e.g., pharmaceutical industry, government)

   c. Hospice/long-term care facilities (e.g., nursing homes)

   d. Home health care or home infusion facilities

5. Class E: Mail order pharmacies in other states; Internet pharmacies in other states

6. Class F: Free standing emergency center clinic pharmacies

Chapter 4

Health Insurance Review

There are many health insurance providers such as public assistance and private insurers. Many pharmacy insurance providers are separate from patients' medical insurance providers. Patients with insurance will select either an *HMO* (Health Maintenance Organization) or a *PPO* (Preferred Providers Organizations). Patients usually pay a *co-payment* (an amount set by the health insurance for services or medications provided) for their medications. Some patients have to pay a *deductible* amount before their co-payment is applied. Deductibles are usually effective at the beginning of the year. *Premiums* (an amount set by the health insurance company paid monthly by the patient for coverage) usually cover medical expenses and/or dental services, drugs, and vision care.

There are two types of government insurances—federal and state.

Federal insurance is provided by MEDICARE. This medical insurance covers patients sixty-five years of age and older and disabled patients under sixty-five years of age. There are currently several parts to Medicare.

Part A: Medical insurance, physician office visits, and hospital fees

Part B: Medications and injectables for outpatients

Part D: Medication (drug) coverage with $310 as deductible; patients sign up for different plans according to their region

They pay a premium (just like regular private insurance policies) and pay a deductible or percentage depending on the plans after their $310 deductible (that can be waived in special situations). After $2530 in coverage, they pay

the full amounts on medications until they reach $6137.50 total. Then, Medicare will pay 95 percent of their medications.

State insurance is provided by MEDICAID administered by the Department of Health and Human Services (DHHS). Each state differs in their requirements for qualification in this welfare system. Qualifications usually are medically indigent patients—including adults and children, elderly with low income, blind, and disabled adults who are eligible for Social Security assistance. *This covers prescription coverage*, usually free of charge to patients. There may be limitations, such as three per month for adults (anyone over 18 years of age) in Texas.

The private sector is called Managed Health Care. This includes HMO, PPO (*Preferred Providers Organization*), and fee for service (bill insurance plans for each prescription or services processed) plans. HMO plans limit patients' options in choosing a provider. They require the patient to choose a primary care physician, who will refer the patient to any specialist (*e.g.,* cardiologists, gastroenterologists).

Capitation is a fee paid per patient to a provider (such as physicians) for management of patients' health care even if the patient does not seek care; usually paid as per patient per month.

Example: Cigna will pay Dr. Smith (as a *PCP*: *P*rimary *C*are *P*hysician) $30 per month per patient even if the patient does not visit the doctor that month. PPOs are less strict, but require a higher premium from patient per month.

PPOs usually allow patients to go to any physician and do not require a PCP referral. The NCQA (*N*ational *C*ommittee for *Q*uality *A*ssurance) evaluates how well a health plan manages their physicians, hospitals, and other providers,

and their administrative services.

Chapter 5

Drug Definitions

Drug: By definition is used for *diagnosis, cure, mitigation, treatment,* or *prevention of disease* in man or animal.

- Intended to affect the structure or any function of the body (in man or animal)

-

Drug Naming: Three parts:

1. Brand name (also called *trade* or *proprietary name*)
2. Generic name (also called *nonproprietary name*)
3. Chemical name

Examples:

1. Brand name is Tylenol®
2. Generic name is Acetaminophen
3. Chemical name is 4'-hydroxyacetanilide

Generic Equivalent: To be able to substitute generic for brand drug, both drugs must have:

1. The same active ingredients in exactly the same concentration.
2. Affect the body in exactly the same way.

The *Orange Book* approves drug products with therapeutic equivalence evaluations. *This book is the standard.*

Generic Substitution: Drugs with the same ingredients and are chemically identical in strength, concentration, dosage form (capsule, tablet, suppository, etc.), and route of administration (oral, rectal, vaginal, etc.) to the drug prescribed.

Examples: Vasotec® and Enalapril (*Remember the Orange Book!)*

Therapeutic Substitution: Drugs chemically different, but have the same therapeutic outcome (affect the body the same way) and similar toxicities.

Examples: Enalapril (Vasotec®) and Captopril (Capoten®)

Therapeutic Equivalent: Enalapril is a therapeutic equivalent of Captopril; both have different chemical structures.

Chapter 6

Determine National Drug Code (NDC)

The *NDC* is the *National Drug Code*. This identifies different drugs and provides a different identity. For example, the generic drug, Acetaminophen from one manufacturer has a different NDC than another. Most NDCs have eleven digits in a 5-4-2 digit format.

Example: 55555-4444-22

1. 55555—Designates manufacturer
2. 4444—Designates *product* in name, strength, and dosage form
3. 22—Designates package size

Some manufacturers use a 5-3-2 digit format so we would have to convert it into a 5-4-2 digit format. Add a leading 0 in the set of numbers missing a digit.

*Example 1: 55555-333-22 => becomes 55555-**0**333-22*

*Example 2: 5555-3333-22 => becomes **0**5555-3333-22*

*Example 3: 55555-3333-2 => becomes 55555-3333-**0**2*

This NDC ensures the *right drug* is being used in filling prescriptions.

Chapter 7

Different Types of Dosage Forms

1. *Tablets*: Solid dosage form of medicine available in all colors, shapes, and sizes.

    a. Enteric—Coated tablets: designed to bypass first pass effect and not affect stomach

    b. Buccal tablets (also called troches): Like lozenges (cough drops)

    —Usually large tablets tend be left in mouth to dissolve and suck on similar like candy

    c. Sublingual tablets: Dissolve under the tongue

    —Usually for faster relief than oral tablets

    d. Coated tablets: Film-coated tablets

    e. Chewable tablets: Sugared and flavored tablets to mask unpleasant taste of a drug

    f. Effervescent tablets: Not made for direct swallowing; tablets made to dissolve in a diluent to dissolve and drink mixture

    g. Oral disintegrating tablet (ODT): Tablets that dissolve on tongue without any water

2. *Capsules:* Solid dosage form of medicine enclosed in a gelatin shell

    Example: Spansules

3. *Suspensions*: Medication in powder form when adding water becomes a liquid

4. *Solutions:* Medicine mixed with water

5. *Elixirs*: *Alcohol*-based solutions

6. *Syrups:* Medicine mixed with water and *sugar*

7. *Creams*: Dosage form applied on skin mixed with aqueous (watery) base or *non-greasy*

8. *Ointments*: Dosage form applied on skin mixed with a *greasy* base (oily)

9. *Suppositories*: A solid mass of medicine that melts upon insertion into vagina or rectum

10. *Sprays and inhalers*: Medication inhaled by mouth or nose

11. *Single and multi-dose vials*: For injection

12. *Patch*: Dosage form designed to support the passage of a drug from the surface of the skin into the bloodstream

Chapter 8

Different Routes of Administration and Storage Requirements

Routes of Administration: Different ways a drug gets into the body

1. Oral: By mouth

    - *First pass effect/metabolism:* When a medication gets broken down extensively by liver before it reaches its target site (where it should work)
    - Given by tablets, capsules, solutions/suspensions, inhalers
    - *Example*: Albuterol inhaler for asthma

2. Rectal: By rectum

    - Usually by suppositories or enemas
    - *Example*: Phenergan® rectal suppositories for nausea and vomiting

3. Vaginal: By vagina

    - Usually by creams, suppositories
    - *Example*: Premarin® vaginal cream

4. Sublingual: Under the tongue

    - Dissolve special tablets under the tongue for faster effect
    - *Example*: Nitroglycerin sublingual tablets for chest pain

5. Buccal: Drug dissolves inside the mouth, on the side wall of cheek

    - *Example*: Mycelex® Troche (large pill as lozenge)

6. Nasal: By nostrils (of nose)

    - *Example*: Flonase® nasal sprays for allergies

7. Transdermal: By applying a patch on skin

8. External: Apply on skin for absorption

9. Ear and eye drops: Apply into ear canal or eyes; eye ointment applied inside lower eyelids

10. Parenteral (injection): Inject in different areas to get into bloodstream, skin, and muscles for effect

- IV: Intravenous: Into bloodstream

  Example: Heparin IV

- SQ: Subcutaneous: Under the skin

  Example: Insulin given SQ

- IM: Intramuscular: Into muscles

  Example: Toradol® given IM

Fastest routes for effects: IV, IM, SQ, rectally/vaginally, and oral (PO)

The oral route of administration gets the *first pass effect*. All the other routes bypass this.

Storage:

1. Refrigeration: 2-8 degrees Celsius (36-46 degrees Fahrenheit)
2. Room temperature: 8-25 degrees Celsius; most drugs are stored

this way

Examples:

Fridge:

a. *Vaccines:* (influenza: flu) pneumonia

Shingles and varicella vaccines kept in *freezer*

b . *Rectal suppositories*: Promethazine (Phenergan®) and Acephen® (Acetaminophen)

c . *Tablets*: Thyrolar®, Volmax ER (Albuterol), and Nystatin tablets

d . *Injectables*: Insulin, Avonex®, Epogen®/Procrit® (Epopoeitin), Neupogen® (Filgrastim), Enbrel® (Epanercept)

e . *Nasal sprays*: Miacalcin® (Calcitonin) for osteoporosis (bone loss)

f . *Patch*: Combipatch® (estradiol) for hormone replacement therapy

g . *Eye drops*: Xalatan® (Latanoprost) for glaucoma, Viroptic® (Trifluridine) for viral infection in eyes

h . *Antibiotic suspensions*: Once mixed with distilled water, some suspensions must be kept refrigerated; maximum stability time is 14 days for most suspensions

Here are examples of antibiotics after reconstituted with water that need to keep in the fridge:

Amoxicillin, Cephalexin, Ampicillin, Cefaclor (Ceclor®), Cefprozil (Cefzil), Cedax®, Erythromycin, Augmentin® (only good for ten days), Cefpodoxime (Vantin®), Ceftin® (Cefuroxime)

Examples of Antibiotics that do not require refrigeration:

Biaxin® (Clarithromycin), Zithromax® (Azithromycin), Cipro® (Ciprofloxacin), Suprax®, Omnicef®

Examples of antibiotics in prefilled syringes that need to store in the fridge:

Bicillin® L-A (Penicillin G Benzathine inj)

Bicillin® C-R (Penicillin G Benzathine/Penicillin G Procaine)

Chapter 9

Different Types of Medications

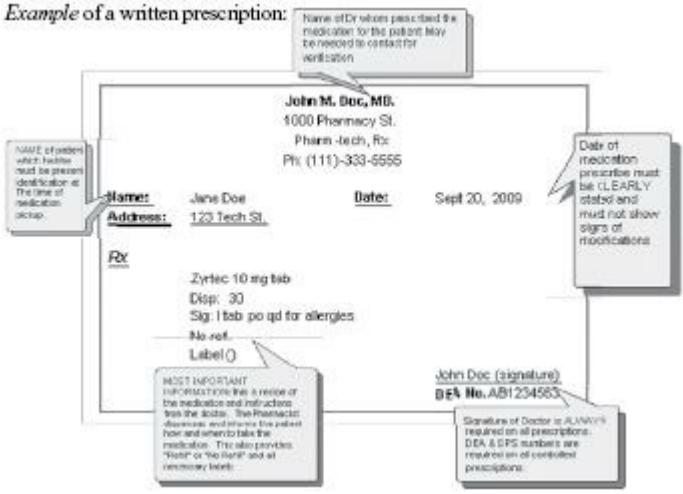
Types of Medications: Prescription vs. Over-the-counter (OTC)

1. Prescription medications: also called legend or dangerous drugs
    - Require a prescription
    - Require "Caution: Federal law prohibits dispensing without a prescription." or "Caution: Federal law restricts this device to sale by or on the order of a physician."
    - Who can write or order a prescription?

Doctor of Medicine (MD), Doctor of Osteopathy (DO), Dentist (DDS), Podiatrist (DPM), Veterinarian (DVM), Physician Assistant (PA)/Nurse Practitioner (RNCP) under doctor's supervision, Optometrist (OD)

2. Over-the-Counter medications:
    - Do not require a prescription
    - OTC labels have warnings, precautions, uses, and dosage for consumers
    - *Example*: Tylenol® (acetaminophen) tablets

Example of a written prescription:



Chapter 10

Obtain New Prescriptions and Interpretation of Prescriptions

Receiving Prescriptions

1. Written prescriptions: review for completeness

    - Controlled-substance prescriptions require the doctor's address, Department of Public Safety (DPS) and Drug Enforcement Agency (DEA) number (federal license to prescribe controlled substances)
    - If no refills are specified on prescription (left blank), *assume zero*

2. Oral (verbal) prescription orders: Taken by pharmacist and reduced to writing
3. Faxed prescriptions: *Only* from the physician's office or clinic

    - Cannot be faxed from patients

4. Electronic prescribing (e-prescribing): From e-mails/computer to computer
5. Transferred prescriptions from another pharmacy

    - Differ from state to state
    - In most states, noncontrolled substances can be transferred as many times as the refills authorized on original prescription order
    - In most states, controlled substances can be transferred only *once*

Example: In state of Texas, all controlled substances can only transferred once from pharmacy A to pharmacy B and cannot be transferred back to pharmacy A.

- C-II (highly restricted controlled substance) *cannot* be refilled or transferred

Interpretation of Directions for Use:

1. Administration directions

   Example: Take (for oral meds), insert (suppository, vaginal creams), apply (creams and ointments)

2. Number of units in a dose and dosage form

   Example: 3 tablets or capsules

3. Frequency of dosage or time

   Example: 2 times daily (twice daily) or at bedtime

4. Route of administration

   Example: By mouth, on affected area, inject under the skin

Note: If the route of administration is not specified on the prescription, sometimes it is implied by the dosage form prescribed. *Example*: tablets and capsules are taken by mouth; creams and ointments are applied to the affected area; and suppositories are usually inserted rectally or vaginally.

Sometimes, the prescription includes the length of time for therapy (*e.g.,* for ten days) and reason for the medication (*e.g.,* for high blood pressure, for nausea, for infection, etc.). Make sure to include everything written by the physician for completeness. If you cannot read something on the prescription, *refer* to the pharmacist for verification. If the prescription is not complete, call *prescriber* (person legally allowed to prescribe medications) for verification.

Examples:

Medication	Use when typing	Example
Oral	Take (if adult)	Take 1 tablet
	Give (if child/pet)	Give 1 teaspoonful
External	Apply	Apply to affected area
Suppository	Insert	Insert 1 suppository
Drops (eye/ear)	Place or Instill	Instill 1 drop
Inhaler (oral)	Inhale	Inhale 1 puff
Nasal spray	Inhale	Inhale 1 spray
Transdermal patch	Apply	Apply 1 patch
Injectables	Inject	Inject 1 mL
Insulin	Inject (x) unit SQ	Inject 10 units under skin

Controlled-release or extended-release products: These are capsules or tablets that exert activity for a longer period of time than immediate release products. They are usually not given 3-4 times daily or every 4 hours.

Abbreviation	Meaning	Example
LA	long-acting	Inderal® LA
SA	sustained action	Propranolol SA
SR	sustained release	Wellbutrin® SR
ER, XR	extended release	Sinemet® ER, Dilacor® XR

CR	controlled release	Eskalith® CR
TR	timed release	Rescon® TR

Miscellaneous: XL (in Procardia® XL, Ditropan® XL, Toprol® XL, and Glucotrol® XL) is a controlled-release product.

Chapter 11

Most Commonly Used Abbreviations

Hints for Working with Abbreviations

1. Understand the uses of meds; it helps you read prescriptions more easily.

   Example: Ambien (helps patient sleep) is taken at bedtime *not* 2-3 times a day.

2. Know the controlled release abbreviations. These meds are not given regularly throughout the day (*e.g.,* 3-4 times daily) but usually given *once* or maybe *twice* daily.
3. Translate the directions of use for patients in easy to understand terms or the patients will not take their meds properly.
4. Some physicians do not state the quantity of med to dispense, but give the length of therapy. You can calculate the total quantity by multiply the total amount of doses per day times the duration of therapy.

   Example: Amoxicillin 500 mg given one, three times daily for 10 days = 30 pills to dispense.

Common Abbreviations used in Prescriptions

Dosage Form	**Meaning**
cap(s)	capsule(s)

cr	cream
EC	enteric coated
el, elix	elixir
lot	lotion
ophth	ophthalmic, eye
otic	eye
pulv	powder
sol	solution
supp	suppository
susp	suspension
syr	syrup
tab(s)	tablet(s)
tinc	tincture
ung, oint	ointment

System of Measurement	**Meaning**	**Example**
cc	cubic centimeter	1 cc Albuterol solution
fl oz	fluid ounce	1 fl oz bottle
g or gm	gram	30 g cream
gr	grain	1/4 gr thyroid

gtt(s)	drop(s)	2 drops Cortisporin®
mcg, µg	microgram	300 mcg Melatonin
kg	kilogram	20 kg patient
L	liter	4 L Nulytely®
mEq	milliequivalent	20 mEq K-Dur®
mL, ml	milliliter	5 mL = 1 teaspoonful
oz	ounce	2 ounces cough syrup
t, tsp	teaspoonful	1 teaspoon = 5 cc
T, tbsp	tablespoonful	1 tablespoon = 15 mL

Route of Administration	**Meaning**	**Example**
ad	right ear	1 drop into right ear
app	apply	Apply cream in affected area
as	left ear	1 drop into left ear
au	both ears	2 drops into both ears
IM	intramuscular	Inject intramuscularly
IV	intravenous	Inject intravenously
loc	locally	Apply locally in affected area

od	right eye	2 drops into right eye
os	left eye	2 drops into left eye
ou	both eyes	1 drop into both eyes
po	by mouth, orally	1 teaspoonful by mouth
pr	per rectum, rectally	1 suppository rectally
SC, SQ	subcutaneous (under skin)	Inject insulin under the skin
SL	sublingual	Dissolve tablet under tongue
vag	vaginal, vaginally	Insert 1 applicator vaginally

More abbreviations in Appendix D

Chapter 12

Pharmacology Review

Introduction to Pharmacology

1. **Pharmacology:** The study of substances (drugs) that interact with living systems through a chemical process to activate or inhibit (stop) the body process.

2. **Pharmacokinetics**: The study of drug affect to the human body via its action.

    a. Absorption of a drug into bloodstream from site of administration (known as the *route of administration*)

        • Most drugs hit the *first pass effect* as tablets

    b. Distribution (spread) of drug to the site of action; goes through various barriers (*e.g.,* tissues, central nervous system (CNS), brain)

    c. Metabolism (breakdown) of drug usually occurs in *liver*

    d. Excretion (elimination) of drug usually occurs in *kidneys*

    Remember "ADME" for actions of the body on the drug.

3. **Pharmacodynamics**: Action of the drug *on* the body

    a. Therapeutic response: Desired (wanted) effects of

drugs; what the medication is used for

b. Adverse effects: Unwanted side effects of drugs

c. Toxicities: Harmful effects of drug; usually seen when overdosed

d. Allergic reactions: Skin rash, fever, swelling, anaphylaxis (breathing difficulties); usually occur when the body does not "like" the medication

4. **Drug interactions**: Occur between two medications or a drug and food

a. Synergistic interactions: Occur when the combined responses of two drugs are greater than the added responses of each drug (1+1 > 2)

Example: Alcohol and sedatives: increase drowsiness and impairment of motor skills (can't drive)

b. Negative interactions:

1. 1 drug decreases effects of the other drug

2. 1 drug eliminates effects of the other drugs

5. **Drug Abuse**: Self-directed use for non-therapeutic purposes; used for fun or physical well-being.

a. Dependence: Take medication for physiological and psychological needs

b. Tolerance: Decreased response. Need more drugs to get same effects as when patient started the medication.

Chapter 13

Pharmacy Department References

1. **Package inserts**: Complete labeling and dispensing information that goes with all drugs from the manufacturer. This information is written for pharmacists and physicians, and is usually not intended to be given to patients.

Package inserts include the following information:

- Product description
- Indications for use of medication
- Contraindications: When the medication should *not* be given
- Warnings: Extreme side-effects and caution with certain conditions or medications
- Precautions: Information similar to warnings, but not as severe side-effects. *Example*: pregnancy, nursing women
- Side effects (Adverse effects)
- Dosage and administration of medication: This will indicate maximum dosage and possible overdosing

Some manufacturers include a *P*atient *P*ackage *I*nsert (PPI) on certain medications. These are in easy-to-understand terms for the patients. Federal laws
require a PPI for certain medications when dispensing these medications.

Example: PPIs must be included with the following:

Oral contraceptives, hormone replacement medication, oral inhalers, nasal sprays, and inhalers

2. **Facts and comparisons:** Contains facts about *all current medications* in the United States; updated monthly. It lists complete dispensing and prescribing information, warnings, indications for use, *investigational uses*, and side-effects. It also tells if they are OTC or Rx and their schedule, if they are controlled-substances.

3. **USPDI: United States Pharmacopeia Dispensing Information** has two versions:

   a. USPDI Advice for the Patient: Information is in easy to understand terms for patients

   b. USPDI or the Health Care Professional: A compilation of all the manufacturers' package inserts

4. **USP (United States Pharmacopeia) and NF (National Formulary)**

   a. Both set the standards for medications

   b. Both have official titles of medications and other information about the medication (e.g., storage, formula for preparation of drug)

5. **Orange Book**

   a. Regulated by the FDA

   b. Sets substitution standards for multi-source drug products (generic drugs)

   c. Bioequivalent: When a generic drug product's rate and extent of absorption are not significantly different from

that of the innovator or brand-name product when administered under similar experimental conditions.

6. **AHFS (American Hospital Formulary Service**) Drug Manual: Collection of monographs on parenteral drugs, usually in the hospital setting; similar to Facts and Comparisons

7. **MSDS: Material Safety and Data Sheet**: Provide information on proper protective measures for exposure to hazardous chemicals, like chemotherapy agents or corrosive agents.

8. **Trissel's Handbook on Injectable drugs:** provide health care professionals with the most comprehensive source of injectable drug information, such as compatibility and stability.

9. **Texas Pharmacy Laws and Regulation:** provide information about the laws and rules governing the practice of pharmacy in the State of Texas; includes newly information about OTC sales of ephedrine and pseudoephedrine; and is required by state Board of Pharmacy to display or maintain in the library of each pharmacies.

10. **Pediatric Drug Information Handbook:** provide comprehensive drug information in children or pediatric include: dosing, drug administration, contraindication, interactions, and treatment of intoxication

Chapter 14

Pharmacy Law Review, Drug Recall Review

Federal and State laws affect different aspects of pharmacy.

Federal agencies regulate manufacturing and marketing of drugs.

State agencies regulate pharmacy practice and dispensing functions.

Key: *Use the stricter of the two laws if they conflict.*

1. Pure Food and Drug Act
2. Drug Development
3. Food, Drug, and Cosmetic Act
4. Prescription Drug Amendment
5. Controlled Dangerous Substances Act of 1970
6. Occupational and Safety Act
7. Poison Prevention Packaging Act
8. Prescription Drug Marketing Act
9. OBRA of 1990
10. Federal Recalls

Pure Food and Drug Act

1.) Administered by Food and Drug Administration (FDA)

2.) Misbranding: Any wrong information on drug's strength, quality, or purity

3.) Established product package insert labeling requirements

4.) Established Good Manufacturing Practices (GMPs) in manufacturers

5.) Separated drugs into two categories: *Legend* or prescription and *OTC*

a. Legend: Requires medical supervision; has following on bulk bottle:

- "Rx only" or
- "Caution: Federal law prohibits dispensing without a prescription."

b. Non-legend (OTC): No medical supervision because *safe* and effective

- Warning/requirements on OTC label

6.) Manufacturers must submit mandatory New Drug Application for approval

Investigational Phases of Drug Development

Phase I: Clinical pharmacology studies of the drug on human volunteers or animals

Phase II: Controlled, clinical trials showing effectiveness and safety in a small amount of patients with condition being treated

Phase III: Controlled and uncontrolled clinical trials in larger number of patients to show adverse side-effects, warnings, and toxicities. If approved, drug goes to market

Phase IV: *Post-marketing surveillance*

Controlled Substances Act (CSA) of 1970

1. All controlled substances must have following:

   Patient's name and address, prescriber's address and DEA number.

   "Caution: Federal law prohibits the transfer of this drug to any person other than for whom it was prescribed."

2. DEA (Drug Enforcement Agency) created schedules of controlled drugs:

   a. C-I: Highest potential of abuse, no currently accepted medical use

   - *Examples*: PCP, LSD, heroin, marijuana

   b. C-II: High potential for abuse with accepted medical

use

- Requires DEA form 222 to order, distribute, or return to manufacturer
- Has many restrictions
    a. Twenty-one day filling
    b. Partials must be filled within three days
    c. No refills

Examples: Methylphenidate, Adderall®, Oxycodone, Morphine, Fentanyl, Meperidine

3. C-III: Has moderate to low abuse potential: Usually pain products (narcotics) and anabolic steroids

Examples: Tylenol® with codeine products, Hydrocodone products, anabolic steroids, Marinol®

4. C-IV: Has limited abuse potential:

- Usually sedatives and hypnotics

Examples: Benzodiazepines (Valium®, Xanax®, Ativan®), Ambien®, Lunesta®, Phentermine, Phenobarbital, Midrin® (for headache)

5. C-V: Has very low abuse potential

- Usually cough preparations with codeine

Examples: Lomotil®, Robitussin® with codeine, Phenergan® with codeine, Lyrica®

Many states differ on sales of C-V drugs (some states consider OTC with restrictions)

6. Prescription refills and expiration

- C-II: No refills; expiration depends on state's rules
- C-III, C-IV, and C-V: max of five refills in six months; expiry in six months

7. Record keeping of files and invoices

- Federal law allows three ways to file

a. 3 separate prescription files

b. 2 separate prescription files

1. C-II to C-V, and noncontrolled files

2. C-II and C-III, C-IV, C-V, and noncontrolled files

- State requirements are sometimes stricter; *use them*
- Invoices are filed just like prescription files

8. Security requirements for controlled and noncontrolled substances

- Dispersement of controlled and noncontrolled medications on shelves
- Some states require C-IIs under lock and key

Some states require perpetual (annual) C-II inventory

- *Federal* law requires an inventory of all controlled substances *every* two years after initial inventory (anniversary of initial inventory)
- Report theft to DEA and local police and fill DEA form 106

9. Verification of DEA number for prescribers to prescribe controlled substances (refer to Chapter 24)

- Has 2 letters and 7 digits
- First letter is A, B, F, or M
- Second letter corresponds to prescriber's last name
- 7 digits can be verified to prevent forgeries

Omnibus Reconciliation (OBRA) of 1990

1.) Counseling law enacted for Medicare or Medicaid patients

2.) Some states require counseling on all new medications

- *Example*: Texas

3.) States differ by who can offer to counsel

- Texas: Pharmacists and pharmacist-interns can counsel

4. Requires DUR (Drug Usage Review)

- Review for therapeutic drug duplication, drug-drug interactions, drug-disease contraindications, high or low dosage, length of therapy
- Review for clinical abuse/misuse of drugs

—Computer programs usually perform DUR

Poison Prevention Packaging Act

1.) All medications must be dispensed in child-resistant closures to patients (unless specified)

2.) All OTC medications must be dispensed in child-resistant closures

3.) All iron products must be dispensed in child-resistant closures

4.) Medications administered to inpatients are exempt

5.) Patients and physicians may request easy-open closures

6.) Drugs exempt from this act: (easy-open closures)

- SL Nitroglycerin

- Cholestyramine powder and packets
- Steroid dose packs for several days
- Potassium powder or liquid
- Oral contraceptives

Other Laws

1.) Occupational and Safety Act of 1970

- Regulated by Occupational Safety and Health Administration (OSHA)
- Sets job safety and health standards
- Sets guidelines for handling of cytotoxic drugs

2.) Prescription Drug Marketing Act

- Samples cannot be sold, traded, or purchased
- Samples can only be distributed to practitioners or hospital pharmacies
- Retail pharmacies cannot receive samples without physician's prescription

Federal Drug Recalls

1.) FDA cannot order a recall, but ask manufacturers to voluntarily recall or risk seizure of medications

2.) Three classes of recalls are done based on seriousness:

Class I: Product will cause *serious* adverse health consequences or death

Class II: Product may cause temporary or medically reversible adverse health consequences

Class III: Product *not* likely to cause adverse health consequences

Health Insurance Portability and Accountability Act (HIPAA) of 1996

1.) Establishes national standards for electronic health care transactions and national identifiers for providers, health plans, and employers

2.) Protects patients' and customers' privacy about health data

3.) Department of Health and Human Services in charge

4.) Restricts private health data interchange between covered entities only

5.) Covered entities are health insurance plans, health-care providers, or health care clearinghouse

Chapter 15

Different Categories of Drugs and Their Usage

■ **Common Anti-Drug Category**	■ **Their Usage**
■ Antibiotic	■ Treats bacterial infection
■ Anti-arrhythmic	■ Slows heart rate
■ Anti-cancer	■ Treats cancer
■ Anticonvulsant	■ Treats seizures
■ Antidepressant	■ Treats depression
■ Antihistamine	■ Treats allergies
■ Anti-hyperlipidemic	■ Reduces high cholesterol
■ Anti-inflammatory (NSAID)	■ Treats inflammation and pain
■ Antifungal	■ Treats fungus infection
■ Antihypertensive	■ Treats high blood pressure
■ Anti-hyperactive	■ Treats ADHD
■ Anti-nausea	■ Relieves nausea
■ Antineoplastic	■ Cancer chemotherapy

■ Antispasmodic	■ Relieves spasm
■ Antipruritic	■ Relieves itching or rash
■ Antipyretic	■ Relieves fever
■ Antipsychotic	■ Treats psychological disorders
■ Antitussive	■ Cough suppressant
■ Antiviral	■ Treats virus infection

Tips on Recognizing Drugs

1. Put similar drugs together.

2. Classify their uses.

- **Calcium Channel Blockers (end in -pine)**

  Nifedipine (Procardia®, Adalat®)
  Amlodipine (Norvasc®)
  Felodipine (Plendil®)
  Nicardipine (Cardene®)

- **ACE Inhibitors (end in -pril)**

  Enalapril (Vasotec®)

Lisinopril	(Zestril®, Prinivil®)
Benazepril	(Lotensin®)
Quinapril	(Accupril®)
Ramipril	(Altace®)

- **Beta-blockers (end in -olol)**

Atenolol	(Tenormin®)
Propranolol	(Inderal®)
Pindolol	(Visken®)
Timolol	(Timoptic®, Blocadren®)
Bisoprolol	(Zebeta®)

- **Antihyperlipidemics (end in -statin)**

Lovastatin	(Mevacor®)
Pravastati	(Pravachol®)
Simvastatin	(Zocor®)
Fluvastatin	(Lescol®)
Atorvastatin	(Lipitor®)
Rosuvastatin	(Crestor®)

- **Proton Pump Inhibitors (end in -prazole)**

Omeprazole (Prilosec®)
Lansoprazole (Prevacid®)
Esomeprazole (Nexium®)
Rabeprazole (Aciphex®)
Pantoprazole (Protonix®)

- **Anti-migraine medications (end in -triptan)**

Sumatriptan (Imitrex®)
Zolmitriptan (Zomig®)
Rizatriptan (Maxalt®)
Almotriptan (Amerge®)

- **Antifungal agents (end in -conazole)**

Fluconazole (Diflucan®)
Ketoconazole (Nizoral®)
Terconazole (Terazol®)
Itraconazole (Sporanox®)

- **Antiviral agents (end in -cyclovir)**

Acyclovir (Zovirax®)
Valacyclovir (Valtrex®)
Famciclovir (Famvir®)

Penciclovir (Denavir®)

- **H2-Antagonists (end in -tidine)**

Cimetidine (Tagamet®)
Ranitidine (Zantac®)
Famotidine (Pepcid®)
Nizatidine (Axid®)

Chapter 16

Top Two Hundred Drugs

Brand Name	Generic Name
Abilify®	Aripiprazole
Accupril®	Quinapril
Aciphex®	Rabeprazole
Actonel®	Risendronate
Adderall®, Adderall XR®	Mixed amphetamines
Adipex-P®	Phentermine
Advair®	Fluticasone/Salmeterol
Allegra®, Allegra-D®	Fexofenadine
Amaryl®	Glimepride
Ambien®, Ambien CR®	Zolpidem
Amoxil®, Trimox®	Amoxicillin
Anaprox®, Anaprox DS®	Naproxen
Ativan®	Lorazepam
Augmentin®	Amoxicillin and Clavulanate
Bactrim®, Septra® (DS)	Sulfamethoxazole/Trimethoprim
Benicar®	Olmesartan

Biaxin®, Biaxin XL®	Clarithromycin
Calan®, Calan SR®	Verapamil
Capoten®	Captopril
Cardizem®, Cardizem CD®, Tiazac®	Diltiazem
Catapres®	Clonidine
Ceftin®	Cefuroxime
Cefzil®	Cefprozil
Celebrex®	Celecoxib
Celexa®	Citalopram
Cipro®, Ciloxan®	Ciprofloxacin
Clarinex®	Desloratidine
Coreg®	Carvediol
Coumadin®	Warfarin
Cozaar®	Losartan
Crestor®	Rosuvastatin
Depakote®, Depakote ER®	Valproate
Desyrel®	Trazodone
Brand Name	**Generic Name**
Detrol®, Detrol LA®	Tolerodine
Diabeta®	Glyburide

Diflucan®	Fluconazole
Dilantin®	Phenytoin
Diovan	Valsartan
Ditropan®, Ditropan XL®	Oxybutynin
Doryx®, Adoxa®, Vibramycin®	Doxycycline
E-Mycin®, Ery-tab®	Erythromycin
Effexor®, Effexor XR®	Venlafaxine
Elavil®	Amitriptyline
Estrace®	Estradiol
Fioricet®	APAP, Butalbital, Caffeine
Fiorinal®	Aspirin, Butalbital, Caffeine
Flexeril®	Cyclobenzaprine
Flomax®	Tamsulosin
Floxin®, Floxin® otic	Ofloxacin
Glucotrol®, Glucotrol XL®	Glipizide
Glucophage®, Glucophage XR®	Metformin
Humalog®	Insulin Lispro
Hydrodiuril®	HCTZ, hydrochlorthiazide
Imdur®	Isosorbide mononitrate
Imitrex®	Sumatriptan

Indocin®	Indomethacin
Januvia®	Sitagliptin
K-Dur®, Klor-Con®, Micro-K®	Potassium chloride (KCl)
Keflex®	Cephalexin
Klonopin®	Clonazepam
Lanoxin®	Digoxin
Lantus®	Insulin Glargine
Lasix®	Furosemide
Levaquin®	Levofloxacin
Lipitor®	Atorvastatin
Lodine®, Lodine XL®	Etodolac
Lopressor®	Metoprolol
Lortab®, Norco®, Vicodin®	Hydrocodone/APAP
Lotensin®	Benazepril
Lotrel®	Benazepril/Amlodipine
Lunesta®	Eszopiclone (es-zop-i-clone)
Macrobid®, Macrodantin®	Nitrofurantoin
Mevacor®	Lovastatin
Brand Name	**Generic Name**
Medrol®(dose pak)	Methylprednisolone

Micronase®	Glyburide
Minocin®, Solodyn®	Minocycline
Motrin®, Advil®	Ibuprofen
Naprosyn®	Naproxen
Neurontin®	Gabapentin
Niaspan	Niacin extended release
Nitrostat®, Nitro-Dur®	Nitroglycerin (NTG)
Nizoral®	Ketoconazole
Norvasc®	Amlodipine
Oxycontin®	Oxycodone
Pamelor®	Nortriptyline
Paxil®	Paroxetine
Pepcid®	Famotidine
Percocet®/Percodan®	Oxycodone/APAP or ASA
Phenergan®	Promethazine
Plendil®	Felodipine
Pravachol®	Pravastatin
Premarin®	Conjugated Estrogens
Prevacid®	Lansoprazole
Prilosec®	Omeprazole

Prinivil®	Lisinopril
Procardia®, Procardia XL®	Nifedipine ER
Proventil®, Proventil HFA®	Albuterol
Provera®	Medroxyprogesterone
Prozac®	Fluoxetine
Pyridium®, Azo-standard®. Uristat®	Phenazopyridine
Reglan®	Metoclopramide
Relafen®	Nabumetone
Retin-A®, Retin-A Micro®	Tretinoin
Restoril®	Temazepam
Risperdal®	Risperdone
Ritalin®, Ritalin SR®, Concerta®, Metadate CD®	Methylphenidate
Robaxin®	Methocarbamol
Septra®, Septra-DS®	Sulfamethoxazole/TMP
Seroquel®	Quetiapine
Singulair®	Montelukast
Skelaxin®	Metaxolone
Soma®	Carisoprodol
Brand Name	**Generic Name**
Synthroid®, Levothroid®, Levoxyl®	Levothyroxine

Sumycin®	Tetracycline
Tagamet®	Cimetidine
Tamiflu®	Oseltamivir
Tegretol®, Tegretol XR®	Carbamazepine
Tenormin®	Atenolol
Theo-Dur®, Theo-24®	Theophylline
Timoptic®	Timolol
Tobradex®	Tobramycin/Dexamethasone
Toradol®	Ketoralac
Tricor®, Trilipix®	Fenofibrate
Tussionex®	Hydrocodone/chlorpheniramine
Tylenol® with codeine	APAP/codeine
Ultram®, Ultracet®	Tramadol (and w/APAP)
Valium®	Diazepam
Valtrex®	Valacyclovir
Ventolin®, Ventolin HFA®	Albuterol
Vasotec®	Enalapril
Viagra®	Sildenafil
Vicodin®, Vicodin ES®	Hydrocodone/APAP
Vistaril®	Hydroxyzine

Voltaren®	Diclofenac
Vytorin®	Simvastatin/Ezetimibe
Wellbutrin®, WellbutrinSR®, Wellbutrin XL®	Bupropion
Xanax®	Alprazolam
Xalatan®	Latanoprost
Xopenex®	Levalbuterol
Zestril®	Lisinopril
Zithromax®	Azithromycin
Zocor®	Simvastatin
Zoloft®	Sertraline
Zovirax®	Acyclovir
Zyloprim®	Allopurinol
Zyrtec®, Zyrtec-D®	Cetirizine
Zetia®	Ezetimibe
Zyzal®	Levocetirizine

Chapter 17

Generic Drugs with Many Brand Names

Some medications/chemicals were created when laws did not regulate having one chemical (generic medication) with only one brand name.

Generic Name	Brand Names
Diltiazem	Cardizem®, Dilacor®, Tiazac®
Estradiol	Estrace®, Gynodiol®, Alora®, Vivelle®, Esclim®, Climara®
Verapamil	Calan®, Isoptin®, Verelan®
Ibuprofen	Motrin®, Advil®
Isosorbide mononitrate	Ismo®, Imdur®
Levothyroxine	Synthroid®, Levothroid®, Levoxyl®, Unithroid®
Sulfamethazole (SMZ)/Trimethaprim (TMP)	Bactrim®, Septra®
Potassium	K-Dur®, Micro-K®, Slow-K®, Klor-con®
Medroxyprogesterone	Provera®, Cycrin®
Nitroglycerin	Nitro-Dur®, Nitrostat®, Nitroquick®, Transderm-Nitro®
Lisinopril	Zestril®, Prinivil®
Nifedipine	Procardia®, Procardia XL®, Adalat®, Adalat CC®

Transdermal Patches	Frequency
Nicotine	Every day (QD)
Nitroglycerin	Every day (QD)
Estradiol, all except Climara	Twice weekly (BIW) for postmenopause
Climara□	Once a week for postmenopause
Ortho-Evra□	Once a week for birth control
Fentanyl (Duragesic□)	Every three days (Q3D) or every seventy-two hours (Q72H)
Scopolamine (Transderm-Scop□)	Every three days (Q3D) or every seventy-two hours (Q72H)
Clonidine (Catapres-TTS□—1, 2, 3)	Every seven days (Q7D) or once a week (Qwk)

Chapter 18

Different Drug Classifications

- **Muscle Relaxers**

1. Carisoprodol (Soma®)
2. Methocarbamol (Robaxin®)
3. Cyclobenzaprine (Flexeril®)
4. Metaxalone (Skelaxin®)
5. Chlorzoxazone (Parafon®, Parafon Forte®)
6. Orphenadrine (Norflex®, Norgesic®, Norgesic Forte®)
7. Baclofen (Liorisal®)

- **Parkinson's Drugs**

1. Benztropine (Cogentin®)
2. Levodopa/Carbidopa (Sinemet®)
3. Selegiline (Eldepryl®)
4. Bromocriptine (Parlodel®)

- **Antiepileptic**

1. Phenytoin (Dilantin®)
2. Carbamezepine (Tegretol®, Tegretol XR®)
3. Phenobarbital C-IV

4. Valproic acid, Valproate (Depakene®, Depakote®)
5. Gabapentin (Neurontin®)
6. Lamotrigine (Lamictal®)
7. Topiramate (Topamax®)
8. Pregablin (Lyrica®)

- **Sedatives/Hypnotics (all C-IV)**

1. Diazepam (Valium®)
2. Clonazepam (Klonopin®)
3. Lorazepam (Ativan®)
4. Flurazepam (Dalmane®)
5. Temazepam (Restoril®)
6. Alprazolam (Xanax®)
7. Zolpidem (Ambien®)
8. Zaleplon (Sonata®)
9. Eszoplicone (Lunesta®)

- **Antidepressants**

1. Selective Serotonin Reuptake Inhibitors (SSRIs)

a. Fluoxetine (Prozac®)
b. Sertraline (Zoloft®)
c. Paroxetine (Paxil®)

d. Citalopram (Celexa®)

e. Escitalopram (Lexapro®)

2. Bupropion (Wellbutrin®, Wellbutrin SR®, Wellbutrin XL®, Zyban®)

3. Trazodone (Desyrel®)

4. Venlafaxine (Effexor®, Effexor XR®)

5. Nefazodone (Serzone®)

6. Lithium (Lithobid®, Eskalith CR®)

7. Duloxetine (Cymbalta®)

8. Tricyclic Antidepressants (TCAs)

a. Amitriptyline (Elavil®)

b. Doxepin (Sinequan®)

c. Nortriptyline (Pamelor®)

d. Desipramine (Norpramin®)

- **Antihyperactive medications**—all are C-II except Pemoline and Strattera®

1. Methylphenidate (Ritalin®, Ritalin SR®, Concerta®, Metadate CD®)

2. Dextroamphetamine (Dexedrine®, Dextrostat®)

3. Mixed Amphetamines (Adderall®, Adderall XR®)

4. Pemoline (Cylert®): C-IV

5. Atomoxetine (Strattera®): not controlled

- **Antipsychotics**

1. Haloperidol (Haldol®)
2. Phenothiazines:
   a. Thioridazine (Mellaril®)
   b. Chlorpromazine (Thorazine®)
3. Risperdone (Risperdal®)
4. Olanzapine (Zyprexa®)
5. Quetiapine (Seroquel®)
6. Ziprasodone (Geodon®)
7. Clozapine (Clozaril®): decrease WBCs

Cardiovascular Medications

- **Diuretics**

1. Hydrochlorthiazide (HCTZ, Hydrodiuril®)
2. Chlorthalidone (Hygroton®)
3. Furosemide (Lasix®)
4. Bumetanide (Bumex®)
5. Torsemide (Demadex®)
6. Spironolactone (Aldactone®, Aldactazide®)
7. Triamterene/HCTZ (Dyazide® caps, Maxzide® tabs)

- **Angiotension Receptor Blockers**

1. Losartan (Cozaar®, Hyzaar®)
2. Irbesartan (Avapro®, Avalide®)
3. Valsartan (Diovan®, Diovan HCT®)
4. Telmisartan (Micardis®, Micardis HCT®)
5. Olmesartan (Benicar®, Benicar HCT®)

- **ACE Inhibitors (ACEI)**

1. Enalapril (Vasotec®, Vaseretic®)
2. Captopril (Capoten®, Capozide®)
3. Lisinopril (Zestril®, Prinivil®, Zestoretic®, Prinzide®)
4. Fosinopril (Monopril®)
5. Quinapril (Accupril®)
6. Ramipril (Altace®)
7. Benazepril (Lotensin®, Lotensin HCT®, Lotrel®)

- **Nitrates**

1. Nitroglycerin patches (Nitro-Dur®, Transderm Nitro®)
2. Isosorbide Dinitrate (Isordil®)
3. Isosorbide Mononitrate (Ismo®, Imdur®)

4. Nitroglycerin capsules (NTG)

5. NTG SL tabs (Nitrostat®, Nitroquick®, Nitrotabs®): Do not require childproof caps

Heart Medications

- **Alpha Blockers**
  - Used for blood pressure (BP) or prostate hypertrophy

1. Terazosin (Hytrin®)
2. Doxazosin (Cardura®)
3. Prazosin (Minipres®)

- **Beta-Blockers**

1. Atenolol (Tenormin®, Tenoretic®)
2. Metoprolol (Lopressor®, Toprol®, Toprol XL®)
3. Nadolol (Corgard®)
4. Propranolol (Inderal®, Inderal LA®)
5. Timolol (Blocadren®)
6. Eye drops for Glaucoma:

a. Timolol (Timoptic®)

b. Betaxolol (Betoptic®)

- **Calcium Channel Blockers**

- Used for BP (blood pressure) or angina (chest pain)

1. Nifedipine (Adalat CC®, Procardia®, Procardia XL®)
2. Amlodipine (Norvasc®, Lotrel®—has benazepril)
3. Felodipine (Plendil®)
4. Nicardipine (Cardene®, Cardene SR®)
5. Diltiazem (Cardizem®, Cardizem CD®, Dilacor XR®, Tiazac®)
6. Verapamil (Verelan®, Calan®, Calan SR®, Isoptin SR®)

- **Miscellaneous:**

- Clonidine (Catapres®, Catapres-TTS® patch): Used for BP, ADHD

- **Antiarrythmics:**

1. Propafenone (Rythmol®)
2. Amiodarone (Cordarone®, Pacerone®)
3. Digoxin (Lanoxin®, Lanoxicaps®): also used for CHF

Diabetic Medications

- **Sulfonylureas**

1. Glipizide (Glucotrol®, Glucotrol XL®)
2. Glyburide (Diabeta®, Micronase®)
3. Glimepride (Amaryl®)

- **Miscellaneous**

1. Metformin (Glucophage®, Glucophage XR®)
2. Acarbose (Precose®)
3. Miglitol (Glyset®)
4. Pioglitazone (Actos®)
5. Rosiglitazone (Avandia®) (withdrawn from the market in 2010)

- **Diabetic Supplies**

1. Syringes vary by sizes of needle, lengths, and dosage
2. Blood glucose meters—many different types for different users

a. Lancets: Needles on lancing devices to get blood

sample

b. Lancet device: Device to get blood sample

c. Test strips: Vary with each meter; used for testing blood samples

3. Urine testing: Ketostix® (for ketones), Diastix® (for glucose)

Ketodiastix® (for both ketones and glucose)

4. Glucose tablets: For fast treatment of hypoglycemia

5. Glucagon: Injection for treatment of severe hypoglycemia

- **Insulins**

  - Rapid-acting and Fast-acting

    1. Insulin lispro (Humalog®); insulin aspart (Novolog®)

    2. Regular (Humulin® R, Novolin® R)

  - Intermediate-acting

    1. NPH (Humulin® N, Novolin® N)

  - Long-acting

    1. Ultra-lente (Humulin® U)

    2. Lantus®, Levemir® (given at hs)

- These insulin are available as U-100 or U-50. U-100 (100 units per mL) and is more common.

- They are available as vials, cartridges for pens, or as disposable

pens.

Ear Eye Nose Throat (EENT) Medications

Respiratory Products

- **Oral inhalers** (for asthma and allergies): Needs PPI

1. Beta-agonists:

   a. Albuterol (Proventil®, Proventil HFA®, Ventolin®, Ventolin HFA®, Combivent®)

   b. Salmeterol (Serevent®)

   c. Pirbuterol (Maxair® autohaler)

   d. Levalbuterol (Xopenex®)

2. Corticosteroids:

   a. Fluticasone (Flovent®, Advair®)

   b. Triamcinolone (Azmacort®)

   c. Budesonide (Pulmicort®)

3. Ipratropium (Atrovent®, Combivent®)

4. Cromolyn (Intal®)

- **Antileukotrienes** (for asthma)

    1. Montelukast (Singulair®)
    2. Zafirlukast (Accolate®)

- **Nasal inhalers/sprays:** needs PPI

    1. Corticosteroids:
        a. Mometasone (Nasonex®)
        b. Fluticasone (Flonase®)
        c. Triamcinolone (Nasacort AQ®)
        d. Budesonide (Rhinocort AQ®)
        e. Beclomethasone (Beconase AQ®)

    2. Cromolyn (Nasalcrom®: OTC)

- **Antitussives**

    1. Dextromethorphan (referred to as DM in many cough preparations)
    2. Codeine (in Robitussin AC and DAC)
    3. Hydrocodone—in many cough liquids
    4. Benzonatate (Tessalon®): numbs cough

- **Expectorant**

1. Guaifenesin (Mucinex®, Robitussin®, various congestion formulations)

- **Antihistamines** (H1 antagonist) (OTC and Rx)

- OTC: These are mostly sedating

1. Clemastine (Tavist®)
2. Diphenhydramine (Benadryl®)
3. Chlorphenaramine (Chlor-Trimeton®)
4. Loratidine (Claritin®, Claritin-D®, Alavert®)
5. Doxylamine (Unisom®)
6. Cetirizine (Zyrtec®, Zyrtec-D®)

- Rx: Non-sedating and combinations with decongestants

1. DesLoratidine (Clarinex®)
2. Fexofenadine (Allegra®, Allegra-D®)
3. Azatidine (in Rynatan®)

- **Miscellaneous antihistamines**

1. Meclizine (Antivert®, Bonine®)

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2. Carbinoxamine (in combination products) taken off market

3. Olopatadine (Patanol® eye drops)

4. Azelastine (Astelin® nasal spray, Optivar® eye drops)

- Decongestants: Most are OTCs

- Topical sprays—May cause rebound congestion

1. Phenylephrine (Neo-synephrine®)

2. Oxymetazoline (Afrin®)

3. Saline (sodium chloride) (Ocean®, Ayr®) no rebound

- Tablets

1. Pseudoephedrine (Sudafed®, in various combination products)

2. Phenylephrine (Sudafed PE®, in Rx combo products)

3. Phenylpropanolamine (Dexatrim®): All removed from market

because of heart problems.

Hormones

- **Thyroid**

1. Dessicated thyroid: Armour® thyroid
2. Levothyroxine (Synthroid®, Unithroid®, Levoxyl®, Levothroid®)
3. Liothyronine sodium (Cytomel®)
4. Liotrix (Thyrolar®): Keep refrigerated

- **Female hormones**

1. Estrogens: Need PPI
    a. Estradiol tabs (Estrace®)
    b. Estradiol patches (Estraderm®, Vivelle®, Alora®, Esclim®)
    c. Conjugated estrogen (Premarin®, Cenestin®)
2. Progestins: Need PPI
    a. Medroxyprogesterone (Cycrin®, Provera®)
    b. Norethindrone acetate (Aygestin® & birth controls)

- **Oral Contraceptives**

1. Monophasic: Tablets, all of same strength and concentration

    a. Progestins only (Micronor®)

    b. Estrogen/Progestin combo

Examples: Alesse®, Ortho-Novum® 1-35/1-50, Nordette®, Lo/Ovral®, Ovral®, Mircette®, Loestrin®, Yasmin®

2. Triphasic: Three different strengths per week

Examples: Triphasil®, Ortho-Tri-Cyclen®, Ortho-Novum® 7/7/7, Trivora®

- **Testosterone**

1. Gel (Androgel®): C-III
2. Patch (Testoderm®, Androderm®): C-III
3. Capsules (Testred®): C-III
4. Tablets (Estratest®, Estratest-HS®—for females)

Anti-infectives

Antibiotics

- **Penicillin**

1. Penicillin VK (Pen VK®, Veetids®)
2. Nafcillin (Nafcil®)
3. Cloxacillin (Tegopen®)
4. Dicloxacillin (Dynapen®)
5. Amoxicillin (Amoxil®, Trimox®, Augmentin®)
6. Ampicillin (Principen®)
7. Ticarcillin (Ticar®, Timentin®): hospital
8. Piperacillin (Piperacil®, Zosyn®): hospital

- **Cephalosporins**

1. Cefadroxil (Duricef®)
2. Cephalexin (Keflex®, Keftab®)
3. Cefazolin (Ancef®): hospital
4. Cefaclor (Ceclor®, Ceclor CD®)
5. Cefprozil (Cefzil®)
6. Cefuroxime (Ceftin®, Zinacef®: hospital)
7. Loracarbef (Lorabid®)
8. Cefixime (Suprax®)
9. Ceftriaxone (Rocephin®—injection)
10. Ceftazidime (Fortaz®—injection)

- **Sulfas**

1. Sulfamethoxazole (Septra®, Bactrim®)
2. Sulfisoxazole (Gantrisin®)

- **Aminoglycosides** **Tetracyclines**

Available as IVs or as eye drops 1. Tetracycline (Sumycin®)

1. Gentamicin (Garamycin®, Gentak®. 2. Minocycline(Minocin®, Dynacin®)
2. Tobramycin (Tobrex®, Tobradex®. 3. Doxycycline (Vibramycin®, Vibratabs®)

- **Macrolides**

1. Erythromycin (E-Mycin®, Ery-tab®, Erythrocin®, E.E.S.®, PCE®)
2. Azithromycin (Zithromax®)
3. Clarithromycin (Biaxin®, Biaxin XL®)

- **Fluoroquinolones**

1. Ofloxacin (Floxin®, Floxin® otic)
2. Levofloxacin (Levaquin®)
3. Ciprofloxacin (Cipro®)
4. Gatifloxacin (Tequin®)
5. Moxifloxacin (Avelox®)

- **Miscellaneous**

1. Nitrofurantoin (Macrobid®, Macrodantin®)
2. Vancomycin (Vancocin®)
3. Metronidazole (Flagyl®, Flagyl ER®): No alcohol products
4. Ethambutal: for TB

Antineoplastic Agents

1. Cisplatin (Platinol®-AQ)
2. Cyclophosphamide (Cytoxan®)
3. Methotrexate
4. Fluorouracil (Adrucil®, Efudex®)
5. Tamoxifen (Nolvadex®)
6. Paclitaxel (Taxol®)

Anti-infective

- **Antifungals**

1. "-azole"

a. Terconazole (Terazol®)
b. Fluconazole (Diflucan®)
c. Itraconazole (Sporanox®)
d. Ketoconazole (Nizoral®)

2. Nystatin cream, tabs, susp (Mycostatin®)

- **Antivirals**

1. Herpes treatment

   a. Acyclovir (Zovirax® caps, tabs, ung)

   b. Valacyclovir (Valtrex®)

   c. Famciclovir (Famvir®)

   d. Penciclovir (Denavir® cream)

2. HIV (Human Immunodeficiency Virus)

   a. Zidovudine (AZT, Retrovir®)

   b. Stavudine (Zerit®)

   c. Lamivudine (Epivir®)

   d. Saquinavir (Invirase®)

   e. Ritonavir (Norvir®: must be kept in fridge)

Gastrointestinal (GI) Agents

- **Antiemetics**

1. Emetrol (Concentrated sugar solution)
2. Promethazine (Phenergan®: tabs, supp, IV): Rx
3. Prochlorperazine (Compazine®: tabs, supp, IV): Rx
4. Ondansetron (Zofran®): Rx

- **Vertigo medications**
  1. Diphenhydramine (Benadryl®)
  2. Dimenhydrinate (Dramamine®)
  3. Meclizine (Antivert®-Rx, Bonine® & Dramamine® II
  4. Scopolamine (Transderm-scop® patch): Rx

- **Antacids**
  1. Aluminum and Magnesium (Maalox®, Mylanta®)
  2. Calcium Carbonate (Tums®, Rolaids®)

- **Antidiarrheals**
  1. Loperamide (Imodium®)
  2. Attapulgite (Kaopectate®, Donnagel®)
  3. Diphenoxylate (Lomotil®)—Rx only

- **Laxatives**
  1. Methylcellulose (Citrucel®)
  2. Psyllium (Metamucil®, Fiberall®)
  3. Docusate (Colace®, Surfak®)
  4. Glycerin suppositories or liquid
  5. Bisacodyl (Dulcolax®)
  6. Lactulose Rx (Chronulac®, Enulose®, Duphulac®, Kristalose®)

- **H2-Antagonists: OTC & Rx** **Proton-Pump Inhibitors: Rx**

1. Cimetidine (Tagamet®) 1. Omeprazole (Prilosec®)
2. Ranitidine (Zantac®) 2. Lansoprazole (Prevacid®)
3. Famotidine (Pepcid®) 3. Esomeprazole (Nexium®)
4. Nizatidine (Axid®) 4. Pantoprazole (Protonix®)
5. Rabeprazole (Aciphex®)
6. Omeprazole/sodiumbicarbonate (Zeger

- **Miscellaneous**

1. Simethicone (Gas-X®, Phazyme®): available OTC

Analgesics

1. Narcotics

- Scheduled dangerous medications for pain relief, mostly C-II, C-III, or C-IV
- Standard is Morphine to measure

a. Morphine (MS Contin®, Oramorph®): C-II

b. Oxycodone (OxyContin®, Oxy IR®, Tylox®, Percocet® has APAP, Percodan® has ASA)

c. Codeine:

- C-II as pure 100%
- C-III if APAP with Codeine (15 mg = #2, 30 mg = #3)
- C-V if Promethazine w/codeine

d. Hydrocodone—Various formulations: C-III (Lortab®, Vicodin®, Norco®, Lorcet®, Tussionex®)

e. Pentazocine—C-IV (Talwin NX®, Talacen®)

f. Fentanyl—C-II (Duragesic® patches)

g. Propoxyphene—C-IV (Darvocet-N-100®, Darvon®): Discontinued from market by FDA

2. Non-narcotics

1. Acetaminophen (Tylenol®)
    a. No antiplatelet activity
    b. No anti-inflammatory activity
    c. Use antipyretic and analgesic; for osteoarthritis

2. Anti-gout medications
    a. Colchicine
    b. Probenemid
    c. Allopurinol (Zyloprim®)

d. NSAIDs (ex: Indomethacin)

- Non-Steroidal Inflammatory Dugs (NSAIDs)
  - Use: antipyretic, analgesic, anti-inflammatory (for arthritis)
  - Diflunisal (Dolobid®)
  - Salsalate (Disalcid®)
  - Ibuprofen (Motrin®, Advil®)
  - Ketoprofen (Orudis®, Oruvail®)
  - Indomethacin (Indocin®)
  - Piroxicam (Feldene®)
  - Etodolac (Lodine®, Lodine XL®)
  - Diclofenac (Voltaren®, Cataflam®)
  - Naproxen (Naprosyn®, Anaprox®, Anaprox DS®)
  - Celecoxib (Celebrex®)

Vitamins Review and Blood Disorders

1 . Anemia: Condition that develops when the blood is deficient in healthy red blood cells, which is the main transporter of oxygen to organs.

- Iron deficiency

Iron supplements

Ferrous sulfate (Feosol®, Fer-in-Sol®, Slow-Fe®)

Ferrous gluconate (Fergon®)

Ferrous fumarate (Femiron®, Feostat®, Hemocyte®)

- **B Vitamin deficiency**

1. B12 deficiency
2. Folic acid deficiency

- **Vitamins Overview**

Vitamins are essential for growth and development

Two types: Fat and water-soluble vitamins

Fat-soluble vitamins: FAKED (vitamins A, K, E, D)

Water-soluble vitamins: all B vitamins and citamin C

Vitamin B1 = Thiamine

Vitamin B2 = Riboflavin

Vitamin B3 = Niacin

Vitamin B6 = Pyridoxine

Vitamin B7 = Biotin

Vitamin B9 = Folic Acid

Vitamin B12 = Cyanocabalamin

- **Anticoagulants** (blood thinners)

Warfarin (Coumadin

Heparin: (Injectibles used mainly in hospital settings)

Enoxaparin (Lovenox®)

Fondaparinux (Arixtra®)

Dalteparin (Fragmin®)

Dabigatran etexilate (Pradaxa®)

- **Antiplatelet drugs** (oral meds)

Aspirin (OTC): prototype; an NSAID

Clopidigrel (Plavix®)

Ticlodipine (Ticlid®)

Dipyridamole/ASA (Aggrenox®)

Antiplatelet drugs (injectible meds) used mainly in stroke prevention. Other antiplatelets given after procedure are GP IIb/IIIa antagonists:

Tirofiban Aggrastat®)

Eptifibatide Integrilin®)

Abciximab Reopro®)

Chapter 19

Common Antidotes

For every treatment there is usually always a reversal agent for that drug's overdose. However, there are a few cases when there are no treatment. The rule of thumb is always to make sure the patient is breathing and having a pulse—following basic life support (BLS). When using the reversing agent, it is best to find out the toxic agent(s), its amount, and length of ingestion or injection. Each antidote is very specific. The following chart lists the toxic agents and its reversal agent.

Drug being Overdosed	**Antidote for Medication**
Acetaminophen	*N*-acetylcysteine (Mucomyst)
Methyl alcohol, ethylene glycol	Fomepizole or ethyl alcohol
Anticholinergics	Physostigmine
Anticolinesterases, pesticides	Atropine and pralidoxime (2-PAM)
Beta-blockers	Glucagon
Benzodiazepines, tricylic antidepressants	Flumazenil (Romazicon®)
Calcium channel blockers	Calcium chloride, Glucagon
Carbon Monoxide	Oxygen
Copper	Penicillamine (Cuprimine□)
Cyanide	Sodium nitride, Sodium thiosulfate
Digoxin	Digoxin immune Fab (Digibind□)

Heparin	Protamine sulfate
Heavy metals (e.g., mercury, iron, lead)	Specific chelating agent
Insulin	Dextrose 50% water
Isoniazid	Vitamin B-6 (Pyridoxine)
Methotrexate	Leucovorin
Narcotic (opioids)	Naloxone
Potassium	Sodium Polystyrene Sulfonate (Kayexalate□)
Warfarin	Vitamin K (Phytonadione)

Lawrence M. Tierney Jr., et al. "Antidotes," *Current Medical Diagnosis & Treatment*, 35th Edition, (2009) 1920.

Chapter 20

Herbal Medicine

Herbal medications and dietary supplements are commonly known to the general public as self-selected nutraceuticals for common ailments. Not many pharmacists are familiar with herbal medications and/or alternative medicines. Some hold alternative medicines in disbelief due to no FDA regulations and few clinical trials. They strictly recommend conventional medications. Others are very supportive of its usage due to increased knowledge of its potential risks and benefits. Due to the increasingly popular usage of herbal medicines and alternative medicines, pharmacists play a greater role in educating the consumers on the safety use of herbals because some may interact with common drugs. Pharmacy technicians play a large role in helping pharmacists in this area.

Table I. *Examples of common herbal medicines useful in treating diseases*

Digestive System Disorders		
Ginger	Belladonna	Gentian
Eucalyptus	Blessed thistle	Barberry
Cascara sagrada	Senna	Fennel
Blueberries	Peppermint	Chamomile
Anise	Licorice	Milk thistle
Kidney, Urinary Tract, and Prostate Disorders		
Parsley	Saw palmetto	Cranberry

Respiratory Tract Disorders		
Ephedra	Thyme	Eucalyptus leaves
Ipecac	Fennel	
Cardiovascular Disorders		
Digitalis	Garlic	Ginkgo
Hawthorn (diuretic)	Elderberry (diuretic)	Spearmint (diuretic)
Nervous System Disorders		
Valerian	Guarana	Feverfew
Ma huang	Evening primrose (PMS)	Ginseng
Metabolic and Endocrine Disorders		
Chaste tree	Berry black	Black cohosh
Arthritic and Musculoskeletal Disorders		
Willow bark	Capsicum	Methyl salicylate
Menthol oil	Camphor	Turpentine oil
Disorders of the Skin, Mucous Membranes, and Gingiva		
Witch hazel leaves	Plaintain leaves	Aloe
Volatile chamomile	Sage (sanguinaria)	Arnica
Cancer, Performance, and Immune Deficiencies		
The ginsengs	Echinacea	Podophyllum

Pacific yew	White birch	

Chapter 21

Review Basic Mathematics Used in Pharmacy

I. Temperature Conversion

$$°F = \frac{(9 \times C)}{5} + 32 \qquad °C = \frac{5 \times (F - 32)}{9}$$

II. Roman Numerals

ss = ½

I = 1

V = 5

X = 10

L = 50

C = 100

D = 500

M = 1000

III. Calculate Drug Enforcement Agency (DEA)

1. Add odd number (1st, 3rd, and 5th) (1+3 + 5 = 9)

2. Add even number (2nd, 4th, and 6th) (2 + 4 + 6 = 12) × 2 = (24)

3. Add the sum of both steps together (9 + 24 = 33)

4. The second digit of the sum is the last digit of DEA#

Answer: AB1234563

IV. Metric System

mcg	mg	cg	dg	gm	dg	hg	kg	Mg
micro	milli	centi	deci	gram	deka	hecto	kilo	mega
.000001	.001	.01	.1	1	10	100	1000	1,000,000

V. Pharmacy Conversion (usually in sig part of prescription)

Volume: 1 milliliter (mL) = 16 minim (m) = 15 drops (gtts)

1 teaspoon (tsp) = 5 mL

1 tablespoon (tbsp) = 15 mL

1 ounce (oz.) = 30 mL

1 pint (pt) = 480 mL

1 quart (qt) = 2 pint = 960 mL

1 Liter (L) = 1000 mL or 34 fl oz. = 1.1 qt

1 Gallon (Gal.) = 4000 mL = 4 quarts = 8 pt

Weight: 1 grain (gr.) = 65 mg
1 ounce (oz.) = 30 g = 480 gr
1 pound (lb) = 454 g
1 kilogram (kg) = 2.2 lb

VI. Prescription Calculation

Formula 1 Total medication = Number of doses / Size of one dose

Formula 2 Total medication = Doses per day X # day / Size of one dose

VII. Children's Doses (Hint: 1 kg = 2.2 lb)

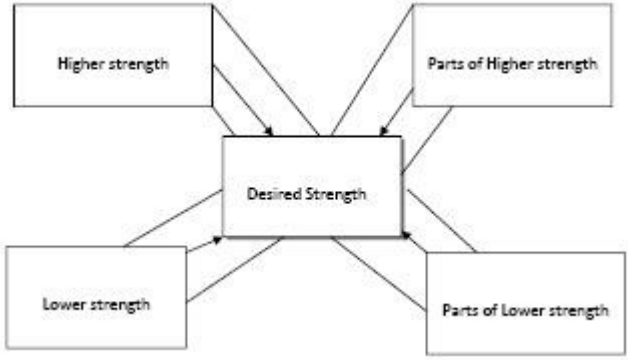
Clark's Rule: Weight of child / 150 lb X Adult dose = Dose for child

Young's Rule: Age of child / Age + 12 X Adult dose = Dose for child

VIII. Dilution

(Final volume × Final strength) = (Initial volume × Initial strength)

IX. Alligation



X. Calculate flow rate and drip rate (for tubing).

Always express in mL per min. (mL/min) or gtts per min (gtt/min).

macrodrip = 1 mL = 10 gtts

microdrip = 1 mL = 60 gtts

XI. Commercial Calculations

Selling price = Cost + Markup

$$\text{Markup} = \text{Percentage markup} \times \text{Cost}$$

$$\text{Percentage markup} = \text{Markup}/\text{Cost} \times 100$$

$$\text{Net profit} = \text{Selling price} - (\text{Cost} + \text{Overhead})$$

Pharmacy Conversion Systems

There are two types of pharmaceutical systems, apothecary and avoirdupois systems. Among these systems, the metric system is well-known because of its international use among the health-care professionals.

Here is the list of most common pharmaceutical conversions used in pharmacies.

Conversions (usually in sig part of prescription)

-

Volume:	1 milliliter (mL)	= 16 minim (m) = ~ 20 drops (gtts)
	1 fluid dram	= 5 mL
	1 teaspoon (tsp)	= 5 mL
	1 tablespoon (tbsp)	= 15 mL
	1 ounce (oz.)	= 30 mL
	1 pint (pt)	= 473 mL (~ 480 mL for calculations)
	1 quart (qt)	= 2 pint = 960 mL
	1 Liter (L)	= 1000 mL or 34 fl oz. = 1.1 qt
	1 Gallon (Gal.)	= 4000 mL = 4 quarts = 8 pt
	1 wine glass	= ~ 120 mL
	1 tea cup	= ~ 240 mL
Weight:	1 grain (gr.)	= 65 mg
	1 gram (g)	= 15 gr.
	1 ounce (oz.)	= 30 g = 480 gr
	1 pound (lb)	= 454 g

1 kilogram (kg) = 2.2 lb

1 inch = 2.54 cm

In order to pass the board exam, the above list needs to be memorized by the student(s). When solving conversion problems, proportion is the only type of method used. For every proportion problem, there are three known values and one unknown value. Then solve for that unknown value. It is very important to know how to set up the problem.

Example: How many mg is in a 5-grain aspirin tablet?

a. $\frac{1 \text{ gr}}{65 \text{ mg}} = \frac{}{}$ 1X= 5 x 65

b. Cross and multiply to solve for x alone

c. X = 325 mg

Chapter 22

Temperature Conversions

Fahrenheit and Celsius are the two most common temperatures used around the world. Most people are familiar with Fahrenheit than Celsius. Our body has a temperature of 98.6°F. Certain medications are required to be stored in the refrigerator, such as all insulin, Xalatan, Nuvaring, Humira, and liquid mixed antibiotics. Thus, it is very important to monitor the refrigerator daily and maintain appropriate fridge temperature between 2°C to 8°C.

Converting between temperatures is very simple. Students would need to plug the number to convert the variable (either F or C) into the formula.

Memorize: $°F = 1.8 \times C + 32$ $°C = 0.5556 (F - 32)$

1. Convert room temperature, 70°F to Celsius.

   a. 21
   b. 32
   c. 56
   d. 70

2. Convert 37° C to Fahrenheit.

   a. 90.6
   b. 95.6
   c. 98.6

d. 100.6

3. Xalatan eye drop is to be stored in temperature between 2°C and 8°C. What is the correct temperature in Fahrenheit?

a. 20.5°F to 36.4°F
b. 25°F to 45°F
c. 30.5°F to 40.5°F
d. 35.6°F to 46.4°F

Chapter 23

Roman Numeral Interpretation and Conversion

I. **Roman Numerals**

Roman numerals are often used in part of sig especially when entering data of prescription into the pharmacy computer system.

Rules for interpreting Roman Numerals

1. Always read from left to right.
2. Always write Roman numerals from a larger value to smaller value.
3. Never write more than three of the same symbol in a row.
4. Always *add* from right to left, if a 2nd roman numeral is a smaller value.
5. Always *subtract* from left to right, if a 2nd roman numeral is a larger value.

I. Convert the following Roman numerals into Arabic numbers.

1. XCIV
2. DCCLVIII
3. CDXCIII
4. MCMXCVIII

II. Translate the following Arabic numbers into Roman numerals.

1. 45
2. 98
3. 536

Chapter 24

Drug Enforcement Administration Number

Each subscriber has his/her own DEA number. This number is very important for prescribing controlled prescriptions (e.g., Narcotics, sedatives, hypnotics). It is issued to the physician from an organization, Drug Enforcement Administration. There is a method to validate whether this number is correct by determining the last digit of physician's DEA number. The last digit matches the DEA number written on controlled prescriptions.

Here is the following rule of determining the last digit of physician's DEA number:

1. Add the first, third, and fifth digits together.

2. Then add second, fourth, and sixth digits together. Then, multiply this sum by two.

3. Then add these two sums together and the number on the right of the sum would be the seventh digit.

1. What is the last digit of this DEA number: BD 987654?

a. 9

b. 8

c. 7

d. 6

2. Which of the following is correct DEA number?

a. AS 5352613

b. AE 5555557

c. AD 1111119

d. BC 2387156

3. Calculate the last digit of the following DEA number.

a. AB 535123_

b. BS 781245_

Chapter 25

Percentage, Proportion, Ratio Strength, and Dilution Method

I. Percentage

The term percent (%) means per hundred

Example: 50% means 50 per 100 or 50/100

1. Convert percent to decimal (move decimal two places to left and drop %)

50% = 0.5

12.5% = 0.125

2. Convert decimal to percent (move decimal two places to the right and add %)

0.5 = 50%

0.125 = 12.5%

3. Convert percent to proper fraction (divided by 100 and reduce to lowest term)

50% = 50/100 or ½

66.6% = 66.6/100 or 2/3

4. Convert proper fraction to percent (first convert to decimal and multiply by 100)

¼ = 0.25 = 25%

¾ = 0.75 = 75%

II. Proportion

Rules for solving proportion problems

1. Must convert to same units (mg, mcg, mL, etc.)
2. Same units on the same line, such as A = A1, B = B1
3. Always have three known values, and solve for 1 unknown (X).

$$\frac{A}{B} = \frac{A1}{B1}$$

Example: Sodium bicarbonate tablets are labeled 650 mg. How many grains of sodium bicarbonate are in each tablet? (*Note*: 1 gr = 65 mg)

$$\frac{1\text{ gr}}{65\text{ mg}} = \frac{X}{650\text{ mg}}$$

$$\frac{1\text{ gr (650 mg)}}{} = \frac{65\text{ mg } X}{}$$

65 65

10 gr = X

a. W/W (Weight/Weight): express in gram/gram

% W/W (solid in solid) are percent weight/weight

W/W Percent (%) gram of drug per 100 g of product

E.g.: Hydrocortisone 2.5% ointment is 2.5 g of hydrocortisone powder in 100 g of ointment

b. W/V (Weight/Volume): Express in gram/mL

Solids in liquids are percent weight in volume (%W/V)

E.g.: Dextrose 5% (W/V) in water is 5 g of Dextrose in 100 mL of solution

c. V/V (Volume/Volume): express in mL/mL

Liquids in liquids are percent volume in volume (%v/v)

E.g.: Isopropyl alcohol 70% (V/V) is 70 mL Isopropyl alcohol in 100 mL of solution

III. Ratio Strength: Express in *1: XXXX*

Some drugs in hospital are expressed in ratio strength, such as epinephrine and potassium permanganate.

E.g.:

Weight volume: Potassium Permanganate Solution *1:5000* is 1 g of Potassium Permanganate in 5000 mL of solution

Units per volume or per weight

Ex: Nystatin 100,000 units per 1 g ointment or Insulin 100 units per 1 mL

IV. Dilution Method

Formula: Final Volume × Final Strength = Initial Volume × Initial Strength

How many milliliters of 30% (v/v) solution is diluted, and can be prepared from 500 mL of 50% (w/v) solution?

X x 30% = 500 mL × 50%

30 X = 25000

<u>30X</u> = <u>25000</u> (divide both sides by 30 to solve for X)

$$\frac{30}{X} = \frac{30}{\sim 833 \text{ mL}}$$

Exercise

1. If 1000 mL of a 20 percent solution is diluted to 2000 mL. What is the percentage strength of the resulting solution?

2. Three tablespoons of 75 percent boric acid solution is diluted to 15 percent. How many one-ounce bottles will the technician be able to fill with the diluted solution?

3. How many milliliters of 10 percent (w/v) solution can be prepared from 300 mL of a 30 percent (w/v) solution?

4. If 100 mL of 70% (v/v) solution is diluted to 500 mL, what is the percent strength (v/v)?

5. Albuterol syrup is available in 2 mg/5 mL and the usual dose is 10 mg. How many mL is this dose?

6. Solve the following problems:

    a. 30% of 100 =
    b. 10 is what % of 60 =
    c. Change 2:3 to percent =

7. How many ounces is 1 quart?

8. If a pint of Lindane shampoo costs $20. What is the cost of 2 ounce?

9. A prescription calls for 30 capsules of 500 mg Cephalexin to be dispensed. The pharmacy stocks only 250 mg capsules. How many capsules should the technician count?

10. Zithromax suspension is available in 100 mg/5 mL. The sig: 2 tsp on day 1 then 1 tsp QD x4d. What is the total mL to be dispensed?

11. If a bottle of insulin contains 100 units per mL, how many units are in a 15 mL box of cartridges of Lantus Solostar?

    a. 100 U
    b. 1500 U
    c. 10,000 U

d. 15,000 U

12. How many mg of hydrocortisone is in 30 g of ointment taken from a 120 g ointment tube of 1% hydrocortisone?

a. 1.3 mg
b. 120 mg
c. 30 mg
d. 300 mg

13. Find the % W/W of a 50 g of drug *X* in a 0.1 kg preparation?

a. 10%
b. 25%
c. 50%
d. None of above

14. A pharmacy receives an order for 300 mL of 5% salicylic acid solution. How much salicylic acid powder is needed to make the solution?

a. 5 g
b. 15 g
c. 5 mg
d. 15 mg

15. If a prescription written for Cipro 125 mg po bid × 10 days, and only 0.5 g tablets are available, how many tablets will it take to fill the order?

a. 14 tablets

b. 10 tablets

c. 7 tablets

d. 5 tablets

Chapter 26

Calculate Day Supply, Dosage Regimen, and Children Dosages

1. The doctor prescribes Prednisone 5 mg with an instruction of taking 3 qd × 2 weeks, 2 qd × 2 weeks, and 1 qd × 1 week. How many tablets will be dispensed?

2. A physician calls in following prescription order for a ten-year old girl with an ear infection. Omnicef suspension 125 mg/5 mL. Sig: Take 1 tsp po q12h x10d. Given that Omnicef powder for oral suspension can be reconstituted in volumes of 100 mL or 200 mL, which size of bottle of Omnicef powder for oral suspension would be selected to fill this prescription order?

3. The recommended dose for treating otitis media in children 6 months to 12 years of age is 14 mg/kg/day. If the ten year old mentioned above weighs 20 kg, does the daily dose on the above prescription order match the recommended dose for this child?

4. The adult dose of Benadryl is 25 mg q4h prn, or 0.05 mg/kg/day q6h for a child under six years of age. The patient is four years old and 42 lbs. How

many mg per dose is recommended?

(a) Young Rule: $\frac{\text{Age of Child}}{12} \times \text{Adult Dose}$

(b) Clark's Rule: $\frac{\text{Weight of Child (lb)}}{150} \times \text{Adult Dose}$

5. A mother requests help in calculating the dose of children's Tylenol for her three-year old child weighing 22 lbs. The pharmacist recommends a dose of 15 mg/kg every 4 hours for a 24-hour period. Tylenol comes in 4 ounce bottles with a concentration of 120 mg/5 mL. How many mL will the child take after 24 hours' period?

6. The doctor writes a prescription for:

Estraderm 0.05 mg patch

#24

Sig: Apply 1 BIW

How many days' supplies will the prescription last?

7. A prescription is written for Medrol Dosepak (methylprednisolone) 4 mg tablet, containing 21 tablets. Sig: 6 tab po on first day, then decrease by 1

tablet until it is over (6-5-4-3-2-1). How many days supply will this dose pack last?

8. The doctor writes a prescription for:

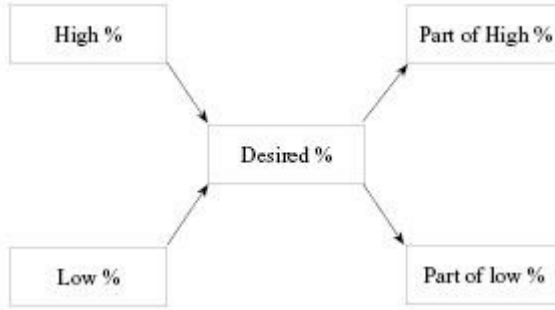
Xalatan eye drop #1 btl (2.5 mL)

Sig: i gtt ou QD

How many days would this last (assume 20 drops = 1 mL)?

Chapter 27

Pharmacy Alligations, Flow Rates, and Milliequivalent Calculations



I . **Pharmacy Alligations:** A calculation method that solves problems with three or more percentage solutions.

Exercise:

1. How much of 15% Dextrose solution and 75% Dextrose solution should be mixed to make 2 liters of 35% Dextrose solution?

2. The pharmacy has a 10% ointment and 1% ointment, and you are asked to make a 2.5% ointment of 45 g. What parts of each strength will be used? Give the final weight of each needed for the prescription.

II. **Flow Rates**

Learn to calculate the flow rate of an IV solution when given the total volume, total time of administration, and the drops delivered per mL.

When working with flow rate problems, always use the cancellation method. Similar units always cancel out each other. If the top unit is the same unit as the bottom unit, it can be cancelled out. It is very important to set the problem up properly.

Often expressed in these units: mL/h, mL/min, gtt/h, gtt/min

Note: 1 h = 60 min will be commonly used in this type of problem

a. *Example of flow rate.*

Flow rate = in mL/h or mL/min at which an IV is infused to the patient.

Formula:

$$\text{Rate (mL/h)} = \frac{\text{Total volume of fluid being infused (mL)}}{\text{Total time of infusion (h)}}$$

Example: 1 L of normal saline to be infused over eight hours. What is the flow rate in mL/h?

Step 1: Draw a straight line and set up by using cancelation method

Step 2: Place the unit by starting with what question is asked (*Note*: In this case, *mL/h*), so mL is to go on top and h is written below.

$$1\text{L} = \frac{1000\text{ mL}}{8\text{ h}} = \frac{125\text{ mL}}{\text{h}}$$

b. Example of flow rate in drops per time (gtt/min)

Formula = (Volume ÷ time) (drop factor) = drops per time

Example: Given 1 g vancomycin in D5W 250 mL infused over 3 h. The infusion set is labeled 10 gtts/mL. What is the flow rate in gtts/min?

Step 1: $\frac{250\text{ mL}}{3\text{ h}} = 83.33\text{ mL/h}$

Step 2: Change rate to gtts/min. What is the flow rate in gtts/min?

$$\frac{83.33\text{ mL}}{\text{h}} \times \frac{1\text{ h}}{60\text{ min}} = 1.39\text{ mL/min}$$

Step 3: Change mL to drops:

$$\frac{1.39\text{ mL} \times 10\text{ gtts}}{\text{min}\quad\text{mL}} = 13.8\text{ gtts/min} = 14\text{ gtts/1 min}$$

Cancelation method

Step 1: Draw a straight line and set up by using cancelation method

Step 2: Always pay attention to what the unit is asking for, gtts/min,

Step 3: Start with what has drops (gtts) and continue until all units cancel out and only unit gtts/min is left. Note: Feel free to insert 1 h = 60 min.

$$\frac{10 \text{ gtts}}{\text{mL}} \quad \frac{250 \text{ mL}}{3\text{h}} \quad \frac{1 \text{ h}}{60 \text{ min}} = \frac{14 \text{ gtt}}{\text{min}}$$

Exercise

1. Given the following IV order:

Patient name: James Doe

History number: 120579 Rm#307

Wt: 125 lbs Ht: 5'7"

Age: 60

Attending Dr: R. Goodbye, MD

Date Orders		Time Start @ 1300 04/01
	Na Heparin 10,000 units in 250 mL NS infuse over four hours	

Example:

a. What is the flow rate in mL/h?

b. What is the flow rate in gtt/min, given the administration set delivers 20 gtts/mL?

c. How many units of Heparin is this patient receiving per hour?

2. An order called for 20 mEq NaCl added to D5W 1000 mL bag infused

over 8 h. You have 50 mL bottle of NaCl with concentration 4.4 mEq/mL.

a. How many mL of NaCl is needed to make this IV admixture?

b. What is the flow rate in mL/h?

3. A solution is to be administered by IV infusion at a rate of 140 mL/h. How many gtt/min. should be infused if 1 mL = 25 drops (gtts)?

a. 58 gtt/min

b. 68 gtt/min

c. 78 gtt/min

d. None of the above

4. A patient is to receive 1000 mL of IV solution over ten hours. What is the rate of infusion (gtt/min) that should be utilized if 1 mL = 20 drops?

a. 30 gtt/min

b. 3.3 gtt/min

c. 33.3 gtt/min

d. 333 gtt/min

5. An IV drip provides 20 gtts/mL. The physician orders a 100 mL bag Dextrose to be administered at a flow rate of 10 gtts/min. How long will it take to administer the entire bag?

a. 0.3 hr

b. 2.3 hr

c. 3.3 hr

d. 4.3 hr

III. Milliequivalent (mEq)

Example: An order called for 30 mEq KCl added to normal saline 1000 mL bag. You have 2 mEq/mL. How many mL of KCl is needed?

Step 1: Use proportion formula:

$$\frac{X \text{ mL}}{30 \text{ mEq}} = \frac{1 \text{ mL}}{2 \text{ mEq}}$$

Step 2: Solve for x.

$$X = 15 \text{ mL}$$

Exercise

1. An order written for 60 mEq KCl po bid. What volume of KCl elixir containing 20 mEq/15 mL will be required to deliver a *single dose*?

a. 10 mL

b. 15 mL

c. 30 mL

d. 45 mL

2. A prescription order calls for Potassium Chloride (KCl) 30 mEq in 1000 mL normal saline. Calculate the number of mL which will give this amount from a 2 mEq/mL vial.

a. 5 mL
b. 7.5 mL
c. 10 mL
d. 15 mL

Chapter 28

Commercial Calculations and Terminology

Cost: The cost of a drug (acquisition cost)

Markup: The difference between the cost and its selling price

Selling Price: The total cost of a drug plus markup or gross profit

Gross Profit: The difference between the selling price and the cost of an item

Percent Markup: A percentage of the cost

Overhead: The expenses of the pharmacy in conducting business such as salaries, rent, utilities, freight cost, interest, taxes, and others

Inventory: An itemized statement of all the drugs or merchandise on hand

Turnover: The number of times a drug or merchandise is sold in a given length of time

Gross sales: The amount of money received for goods sold within a given length of time

AWP (Average Wholesale Price): Range of costs of a medication determined by a manufacturer to set prices at different pharmacies

Exercise

1. The cost of a Z-pak, an antibiotic is $34.50 and the selling price is $59.69. What is the percentage of the markup and its amount?

2. You have a prescription for Differin 0.3% gel, 45 g. The cost to you is

$90. You want to use a 50% markup on the cost. What is the retail price to the customer?

3. Mr. Smith has a written prescription for Lipitor 10 mg (brand drug that costs $110). He is on Aetna insurance. It requires a $50 deductible for each member of the family. Once the deductible has met, he will pay $20 for the brand and $10 for generic. However, Mr. Smith has not met his deductible yet for the new year. What is his total copayment?

Chapter 29

Introduction to Hospital Pharmacy

Institutional pharmacy differs from retail pharmacy. The pharmacy staff provides service to inpatients (patients staying at the hospital for medical care). Hospital pharmacists should able to provide information about medication and compatibility issues, intravenous drip calculations, renal dosing medications, and other clinical-related issues to other health-care members, including physicians, nurses, respiratory therapists, and dieticians. Retail pharmacists provide a more customer-oriented service. They directly counsel patients and interact with patients' insurances and physicians. They mostly provide medications for patients to ingest or administer while at home.

A hospital pharmacy's inventory includes more than oral or topical medications. They include many medications in injectable forms. Most of the medications are given parenterally by a nurse. Due to the serious condition of most patients in the hospital, they require intravenous medications for fast recovery and shorter length of stay.

A typical pharmacist in the hospital would enter orders written by a physician from the patient's chart or medical record. Once the order is entered into the computer system, the nurse can retrieve the medication(s) from the automated dispensing machine (*e.g.,* Pyxis, Accudose, or Omnicel). These machines are similar to vending machines, which document and store medications. Certain narcotic medications would require a co-signature of another nurse for verification or as witness. Before administering to a patient, the nurse would scan the medication barcode into the computer to make sure the correct medication is being given based on the medication administration record (MAR).

Most hospital pharmacies consist of clinical offices, a break room, medication shelves, a locked or security narcotic room with camera, and a clean room to

prepare all intravenous (IV) admixtures. All IV admixtures are performed in the laminar flow hood under the guidelines of United States Pharmacopeia (USP) Chapter 797. The main goal of USP 797 is reducing or eliminating the high risk of patient harm from unsterile compounding products. This is a safety measure for both patients and personnel who prepare these compounds. In the past, there were too many erroneously-prepared IV products causing harm to a number of patients. Recently, the improvement of aseptic techniques of personnel and better processes required by USP 797 has reduced the potential for error and patient harm tremendously. This USP 797 has created different risk levels. The requirements under each risk eliminate the chance of inconsistency and inaccurately prepared sterile compounding products. It also encourages each facility to use a checklist to evaluate sterile techniques of each employee annually. By now, all hospital pharmacies should be compliant with USP chapter 797.

Schneekluth, Gregory, USP Chapter 797 Clean Room Application, January 2009, pg. 1-5.

Hospital pharmacy

Important Terminology

Admixture:	Preparation of an IV fluid containing drugs or electrolytes which have been added to a larger volume of solution
Ampoule:	A glass, single dose container that is used to store sterile liquids
Aseptic techniques:	Techniques involving procedures designed to prevent contamination of drugs, packaging, equipment, or supplies by microorganisms during processing; they maintain the sterility of sterile products
Bolus:	One single relatively large substance administered rapidly
Cassette:	Medication carts have drawers with patients' names and room numbers, and patients, medications
Code cart:	A locked cart of medications designed for emergency use only
Clean rooms:	Areas designed for the preparation of sterile products
Centralized pharmacy system:	A system in which pharmacy activities in the hospital conducted at one location; the important pharmacy
Decentralized pharmacy system:	Pharmacy activities occur in multiple locations within a hospital. All decentralized locations are called satellite pharmacies
Diluent:	Fluid used to dissolve drug in solid form
Electrolytes:	Substances which conduct electrical current in the body's blood, tissues, fluids, and cells

Examples:

- NaCl
- KCl
- Na acetate
- K acetate
- K phosphate

Extravasation:	When inserting catheter, accidental leakage of medications onto the skin causing irritation, burning, and skin damage
Flow rate:	The rate (in mL/h or mL/min) at which an IV solution is administered to the patient
Formulary:	A list of medications approved for use in the hospital
Floor stock:	Oral medications, large volume IVs, and injectable medications kept on nursing units for easy access
HEPA filter:	High Efficiency Particulate Air filter that filters clean air
ID (intradermal):	Administration of drug by injections into the skin
IM (intramuscular):	Inject into muscles for drug administration
Infusion:	Slow injection of a solution into a vein
Intermittent infusion:	Infusion of small volume of fluid over a short time interval.
IVPB:	IV Piggy Back; the delivery of a secondary IV solution into an existing IV line containing large volume IV solution

Laminar flow:	Continuous movement at a stable rate in one direction
MAR:	Medication Administration Record; a form that tracks medications administered to patients. Contains all medications ordered for a patient, time when medication is administered, and the initials of the person who gives medications
MDV:	Multiple Dose Vial
MVI:	Multiple Vitamin for Infusion
MSDS:	Material Safety and Data Sheet
Parenteral:	Administration by injection (IM, ID, SQ, IV)
Particulate:	Any undissolved substances that are present in parenteral solutions
Pyxis, McKesson	An electronic equipment (like vending machines) that is used for storage of medications (especially controlled substances) for inventory control
PCA:	Patient Controlled Analgesic Pump: usually morphine or meperidine
Reconstitution:	The process of adding a liquid, the diluent, to the powdered solid to yield a solution
P and T Committee:	Pharmacy and Therapeutics Committee made up of pharmacists, physicians, nurses, and dietitians. This committee decides which drug is the best (efficacy of drug and ease of use) and most cost-effective; creates formulary; deals with investigational drugs
SDV:	Single dose vial; these vials have no preservatives
	Standard medication order for patient to receive medications

Standing order:	at scheduled intervals
Stat order:	An order for medication to be administered immediately
TPN:	Total Parenteral Nutrition intravenous infusion of high protein, carbohydrate solution, fat emulsion, electrolytes, MVI, sometimes insulin, to provide a patient's nutritional requirement
Unit dose:	A package containing the amount of drug required for one dose
Vial:	A small glass or plastic container with a rubber closure sealing the content in the container

Chapter 30

Regulatory Agencies in Institutional Pharmacy

- **JCAHO: Joint Committee on Accreditation of Healthcare Organization**

  - A private non-governmental, nonprofit organization that surveys and accredits health-care organizations every three years.
  - Its main function is to improve the quality of care for patients.
  - It requires pharmacies to screen for adverse events and do drug usage reviews.
  - It accredits Medicare and some insurance providers for reimbursement.

- **OSHA: Occupational Safety and Health Administration**

  This administration was designed to protect employees in the workplace.

  Safety guidelines:

  1. Floor must be clean and dry.
  2. Floor/aisle and counter must be free of clutter.
  3. Exits and fire door should be clearly marked and accessible.
  4. Sharp objects and hazardous material

must be properly stored and disposed.

5. All bodily fluids should be treated as if they are infected, if exposed.

6. Chemotherapy agents/equipment need to be disposed off in hazardous-labeled containers.

- **USP 797**

• Sets standards for each hospital to be uniform.

• Requires each employee to be better trained in aseptic techniques and procedures dealing with sterile compounding.

• Creates cleaner, better workplace with stricter standards.

See more details in Hospital Section.

- **State Boards of Pharmacy**

• Each state in the United States has its own regulations and laws concerning different pharmacy practice sites

• They usually have inspectors inspecting each practice site registered with them every few years

• They regulate what their registrants can and cannot do

Chapter 31

Pharmacy Supplies and Equipment

Sterile drugs are stored in vials and ampoules, and must be removed aseptically prior to use.

A typical *syringe:*

Tip: The part where the needle attaches; available in Luer Lock and Slip tip.

Barrel: The part of the syringe that is marked with calibrations to designate the quantity of liquid contained within.

Plunger: Part of the syringe that is used to force the liquid out from the barrel and also suck the drug back into the container. The inner core of the plunger must remain sterile.

A typical *needle* with five components that must remain sterile.

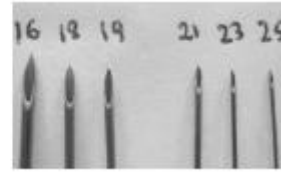
Bevel: A sharp-pointed tip of the needle that is angled to prevent coring when inserted into the vial or ampoule to withdraw the substance.

Gauge: Measure the size or the capacity of the needle.

Hub: Bottom part of the needle that is used to attach it to the syringe.

Heel: A flat rounded end of the needle opposite the bevel.

Length: Measures the needle from the tip to the hub.



Dispose used needles and syringes in red, Sharp's container.

Chapter 32

Medication Distribution Systems, Order Processing, and Hospital Automation

Medication Order

1 Written on physician order forms (not prescription blanks)

2. These physician forms usually come in duplicates so the original forms stay in the chart and copies are sent to appropriate areas

3. Different members of a health-care team have the ability to write on the same order form

4. Medication order includes the following:

- Patient's name and room number
- Patient's hospital number or ID number
- Patient's physician
- Date and time when the medication order is written
- Name of medication
- Dosage
- Frequency of administration
- Route of administration

- Signature of prescriber

5. Medication orders may be picked up hourly by technicians or nurses and orders are faxed to the pharmacy

Order Processing

1. It includes the following:

a. Order entry by pharmacist or technician

b. Verification of medication order by a pharmacist if it is entered by technicians

c. Dispensing of first-dose medication and other doses required to complete twenty-four-hour supply

d. Checking medications to make sure they are correctly prescribed or written by physician

e. Delivery of medication to the nursing unit

Order Entry:

1. Order entry generates MAR (Medication Administration Record)

2. Medication distribution systems: unit dose, floor stock

a. Unit dose: Medications prepacked in a single-unit package; send enough doses up to cart fill time

b. Cart fill will supply enough doses to complete twenty-four hours, if cart is exchanged daily

c. Large volume IVs and IVPBs are sent to complete twenty-four hours

d. Repacked medications from bulk bottle into unit doses must include the following on the label:

- Medication name
- Dosage form and strength
- Lot number
- Expiration date
- Manufacturer's name, if medication is generic

e. Unit dose exceptions: Cream, ointment, liquid medication difficult to measure correct dose

1. Label must contain the following:

- Patient's name
- Room number
- Date
- Name and strength of drug

f. Floor stock: After the medication order is written, a nurse may check to see if the medications ordered are available on his/her unit. She/he may administer the medication from floor stock instead of waiting for pharmacy to send them.

1. Nurses have to keep track of meds used
2. Floor stock meds are refilled daily by technicians
3. Expired medications must be check monthly by technicians

Medication carts: Usually done at nights and delivery is done early in the morning.

1. Oral meds and some injectable meds are commonly provided to the nursing unit in medication carts
2. Contain twenty-four-hour dosages for specific patients
3. Technicians play a big role in this type of dispensing
4. Meds are filled manually onto each patient's tray according to drug profiles prepared daily for each patient
5. Trays are labeled with patient's name and room number
6. Various times throughout the adjustments in patient trays (to account for changes in med orders)
7. Final step in the cart filling is delivery to nursing unit and retrieving used carts
8. Unused meds must be credited to the patient

Hospital Automation

Today, every hospital has an automation system, where medications are stored and retrieved readily. It helps eliminate clutter, provides efficiency and

security, and simplifies recordkeeping. It keeps track of inventories and expiration dates of each loaded medication. Due to touchscreen capabilities and mini pockets or drawers, workflow has been greatly improved.

There are about four different types of automation systems. They are the following: Pyxis Medstation 3000, McKesson, medDISPENSE, and Omnicell. These machines operate in a similar fashion. Only certain health-care personnel have access to these automated dispensing cabinets.

This automation system helps reduce tiresome paperwork, tracks inventories, verifies administration records, resolves narcotic discrepancies, and has a database of all dispensed medications. Thus, through the use of this automation, hospitals achieve cost reduction, optimized productivity and achieve better patient safety measures.

Pulling Meds Out of Mckesson

Laminar Airflow Hoods

Maintain Class 100 (aka ISO 5) conditioning

Must be checked every six months

Common devices are as follows:

1. Horizontal Laminar Airflow Hood
2. Biological Safety Cabinet (also called Vertical Airflow Hood)

Both devices have three main functions. They are as follows:

1. To provide clean air in the clean zone
2. To provide a constant air flow, which prevents unclean room air from entering into the clean zone
3. To remove and prevent any particulate matter 0.3 micron or larger from entering the clean zone

Horizontal Laminar Airflow Hood

1. Prefilter: Filter room air
2. HEPA filter (High Efficiency Particulate Air): A filter, capable of removing 99.97% of all particles 0.3 micron diameter
3. Work Surface: A place where all sterile compounds should be performed and should be clean

    a. Let it run at least thirty minutes before using

b. Always clean with 70% isopropyl alcohol

c. Begin at the top and work in a horizontal motion from back to front of the hood with long overlapping side-to-side strokes

d. No objects in work surface allowed

Vertical Laminar Airflow Hood (Biological Safety Cabinet)

1. Has five components

a. Glass shield: To protect from exposure to cytotoxic materials Open only about eight inches from the bottom

b. Air intake grills

c. Recirculation exhaust blower

d. HEPA filter: Remove particulates from air (not gaseous or vapors)

e. It has two filters:

1. Filtered air supply enters the cabinet zone

2. Filtered air comes out of the top of cabinet

2. **Work Surface**

a. Work at least three to six inches away from the ledge.

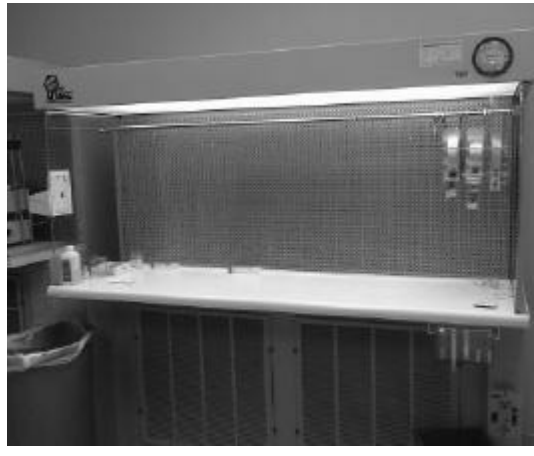
b. Blows from the top of the hood down to the bottom.

c. All objects are placed in a vertical manner to allow adequate air flow.

d. Do not move arms in and out, as it can contaminate the clean zone.

e. Let it run at least thirty minutes prior to use. It would be best to let it run continuously; if it is turned off, then it should be completely shut off, the window closed, and started again.

3. Cleaning is the same as in Horizontal Laminar Flow hood.



IV Batches

IV Admixture

Chapter 33

Touch Contamination, Sterilization Techniques, and Aseptic Techniques

I. Touch Contamination

"Touch contamination" is the main source of contamination during preparation of sterile products. Bacteria grow everywhere on skin and internal areas. After scrubbing hands and arms clean, if the mouth or nose is touched during the mixing process, the sterile product can be contaminated. Another common source of contamination is food, drinks, jewelry, and other nonsterile items (such as pens, markers, calculators).

Proper hand washing can prevent nosocomial infections according to Center for Disease Control and Prevention (CDC).

The next most important point to remember is the flow of sterile air inside the laminar flow hood. Blocking this laminar airflow essentially compromises the sterility of the prepared product.

Here are a few examples:

- Putting nonsterile products inside hood
- Mixing toward the outer edge of the Laminar Flow Hood (LFH)
- Cluttering the hood with too many things inside the hood.
- Mixing the IV solution that blocks air flow

It is very important to remember that anything inside the laminar flow hood can block air flow. It takes about three times the diameter of the object before sterile air flow is re-established. Therefore, points—such as the point of insertion for the needle, the needle itself, and the additive port—critical for sterility are considered. All work must be performed at least six inches inside the hood.

II. Sterilization Techniques

1. Thermal sterilization

    a. Moist heat: Performed in an autoclave, which uses steam under high pressures; usually for glassware and ampoules

    b. Dry heat: Performed in an oven at temperatures between 140°C to 260°C to kill spores and other microorganisms; usually for rubbers and plastics

2. Chemical sterilization: Uses chemical agents to kill microorganisms

    <u>Ethylene oxide:</u>

    a. It only requires a temperature of 54°C for four to sixteen hours

    b. It can be used for rubbers and plastics

    c. It cannot be used for IV solutions due to chemical reactions

    d. Disadvantage: Have to wait at least twenty-four to forty-eight hours after

sterilization before using

e. Highly toxic if inhaled; can cause irritation to skin, eyes, and mucus membranes

f. Available in liquid form of 10% or 20% mixed with carbon dioxide or as 12% mixed with CFCs

3. Sterilization by Filtration: Most commonly used in hospitals.

a. Filtration: Using filters to remove larger particles from a solution

b. Filters can be used for IV solutions and eye drops

c. For a filter to prevent the passage of all bacteria, it must be no more than 0.22 microns in size

d. Always use sterile syringe in a Class 100 environment to withdraw desired ingredients

III. **Aseptic Techniques**

1. **Before preparing IVs**:

a. Turn on flood hood for thirty minutes before use to prepare particle free environment

b. Clean flow hood:

1. Use 70% isopropyl alcohol with gauze
2. Start cleaning IV pole first
3. Next clean the sides of the hood; start with the end closest to the filter working outward, and wipe from top to bottom
4. Then clean the work bench. Wipe using side-to-side strokes from the filter to the outside edge

2. **Collect supplies**:

a. Gather all necessary supplies; check for expiration date; particulate matter and leakage

b. Use sterilized syringes, needles, and filters

c. Place supplies horizontally in horizontal laminar airflow hood and vertically in vertical laminar flow hoods

3. **Safe practices:**

a . *Never* sneeze, cough, talk directly into hood; do not chew gum

b. Close doors or windows

c. Perform work at least six inches inside hood

d. Maintain a direct, open path between the

filter and the area inside the hood

e . *Never* place nonsterile objects into the hood

4. **Hand washing**:

a. Remove all jewelry and scrub hands, arms to elbows with soap or suitable antibacterial agent

b. Do not use false fingernails and nail polish

c. Turn on water, adjust water temperature to lukewarm, wet hands, and apply soap or antibacterial agent to fingertips

d. Use brush to clean under fingernails

e. Wash from hand to elbows; do not rub hands up and down between the elbow and wrist.

f. Rinse hands in an upright, vertical manner

g. Do not touch sink or faucet during this process

h. Wipe dry with paper towel

i. Throw away used paper towel; use clean paper towel to shut off water

Chapter 34

Intravenous Preparations

Technicians play a large role in IV preparation.

Characteristics of IV Solutions

1. Free of particulate matter
2. Clear but not necessarily colorless
3. Maintain tonicity number of dissolved substances found in a solution)
4. Maintain particular pH (~7.4)
5. Sterile
6. Free of pyrogens

Common large volume IV solutions (most base solutions are for IV mixtures)

D5W: Dextrose 5% in water

D10W: Dextrose 10% in water

D70W: Dextrose 70% in water

NS: (0.9% NaCl): normal saline

½ NS: (0.45% NaCl)

D5 ½ NS: Dextrose 5% water 0.45% sodium chloride

LR: Lactated ringers

D5LR: Dextrose 5% lactated ringers

Labels for LV IV solutions, IVPB, TPN, hazardous drugs

Name of patient

Room number

Name of solution, drug

Amount of drug added

Rate, time of administration

Date, time prepared, date and time expired

Initials of preparer

Initials of pharmacist

Large volume (LV) IV and IVPB

1. Prepared similarly except that some IVPB are Add-vantage or ready-to-mix (have adaptor attached to bag and vial of drug)

Total Parenteral Nutrition Admixtures

1. Amino acid, lipids, and dextrose mixed together using a TPN compounder or using gravity method

2. Electrolytes, MVI (multivitamins), and insulin (only regular) are manually added to TPN bag

3. Calcium should be added first and phosphate last to prevent precipitation of *calcium phosphate*

4. Label and attach TPN tubings to bag and deliver to the nursing unit

Nutritional Requirements (BEE):

Males kcal/day = 66.5 + 13.8 (wt in kg) + 5.0 (ht in cm) − 6.8 (age in yrs)

Females kcal/day = 655.1 + 9.6 (wt in kg) + 1.8 (ht in cm) − 4.7 (age in yrs)

Preparation of Hazardous Drugs

1. Prepare in vertical flow hood (aka BSA) only
2. Wear protective garment, mask, and gloves
3. Use Luer-lock syringe only
4. Use venting devices 0.22 micron hydrophobic filter or 5 micron filter needles/straws
5. Use sterile plastic-backed absorbent drape
6. Draw drug from vial the same way as preparing other IV admixtures
7. Place label on final product
8. Place special label: "Caution: chemo waste. Dispose of properly" on final product
9. Put final product in zip-lock bag
10. Discard used syringes, vials, absorbent drape, gloves, gown, mask in hazard container (biohazard containers are for blood/bodily fluids)
11. Never rub areas around eyes, nose, and mouth—

drug will absorb through mucus membranes

Working with Vials

Prevent coring

1. Follow these steps:

a. Place vial on flat surface and position the needle point on the surface of the rubber closure. Place needle about 45 to 60 degree angle to closure surface.

b. Put pressure on needle while bringing needle to an upright position.

c. Before needle is withdrawn from vial, the drug solution in the needle and the tip of the syringe should be cleared by drawing additional air into the syringe.

Vial with solution

1. Draw into syringe a volume of air equal to the volume of drug to be withdrawn.

2. Push the air into the vial.

3. Turn vial upside down. Fill the syringe with medication.

4. Withdraw needle from the vial. With needle end up, tap syringe to allow air bubbles to come to the top of the syringe.

5. Transfer solution into the IV bag or bottle, minimizing coring.

Vial with powder

1. Determine correct volume of diluent and withdraw it from vial using similar steps above.
2. Inject diluent into vial.
3. Once diluent is added, withdraw a little air to create negative pressure.
4. Unless shaking is not recommended, shake the vial until the drug is dissolved.
5. Insert needle and remove proper volume of drug solution. Do not inject air.
6. Remove air bubbles from syringe and transfer reconstituted solution to the final container.

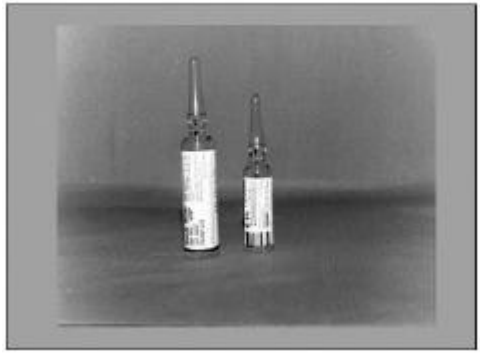
Working with Ampules

How to open ampules:

1. Hold ampule upright and tap the top to settle the solution in the ampule.
2. Swab neck of ampule with an alcohol swab.
3. Wrap gauze pad around neck of ampule. Grasp the ampoule on each side of neck with thumb and index finger of each hand.
4. Quickly snap ampule away from you, toward side of the flow hood.
5. Inspect opened ampule for glass particles that may have fallen inside.

Transfer solution from ampule:

1. Hold ampule at about a 20-degree angle.
2. Insert needle into ampule.
3. Position needle in the solution. Place its beveled edge against side of ampule to avoid glass.
4. Withdraw solution with needle inside ampule.
5. Withdraw needle from ampoule.
6. Switch out to filter needle before transferring solution.
7. Transfer solution to the final container.



Chapter 35

Drugs Commonly Used in Hospitals

Abciximab (Reopro®)	Antiplatelet agent injection, helps dissolve blood clots during percutaneous coronary intervention (PCI) procedure
Acyclovir (Zovirax®)	For viral infection (herpes)
Aminophylline	Relaxes the bronchial airway to help patients with asthma, bronchitis, and emphysema breathe easier
Amphotericin B	For fungal infection, use D5W to mix only, protect from light; usually gives test dose
Ampicillin	For bacterial infection; use NS to mix only
Cefazolin (Ancef®, Kefzol®)	For bacterial infection
Ceftriaxone (Rocephin®)	For bacterial infection
Cisplatin (Platinol-AQ®)	Chemotherapy agent used for treating cancer; protect from light
Dobutamine (Dobutrex®)	Helps heart pump more effectively
Dopamine	Helps heart pump more effectively; used in patients with

(Intropin®)	shock and heart failure
Enoxaparin (Lovenox®)	Prevents blood clots after surgery in knees, hip, abdomen; dissolve blood clots in the lung (PE) and in the veins (DVT)
Epoeitin (Epogen®)	Increases RBC production in chronic anemic patient; keep *refrigerated*
Eptifibatide (Integrilin®)	Antiplatelet agent injection helps dissolve blood clots during percutaneous coronary intervention (PCI) procedure
Fluconazole (Diflucan®)	For fungal infection
Fosphenytoin (Cerebyx®)	Treatment of seizures
Mannitol (Osmitrol®)	A diuretic. Diuretics increase urine passed, which causes body to lose salt and water; helps reduce pressure and swelling of brain and around eyes (cerebral edema)
Meperidine (Demerol®)	For pain; C-II; usually for PCA pumps
Morphine	For pain; C-II; usually for PCA pumps
Methotrexate (Rheumatrex®)	Treat various cancers and rheumatoid arthritis
Metronidazole (Flagyl®)	For bacterial infection; protect from light; do *not* refrigerate

Lidocaine	For irregular heart beat (Antiarrhythmic); or as a local anesthetic
Methylprednisolone (Solu-Medrol®)	Reduces swelling
Midazolam (Versed®)	Helps reduce anxiety during surgical procedures; sedative
Nitroglycerin	Dilates blood vessels for angina; decreases BP; dispense in glass bottles only
Nitroprusside (Nipride®)	Dilates blood vessels (vasodilator); to decrease BP; protect from light
Filgrastim (Neupogen®)	Increases WBC production; keep in refrigerator; mix in D5W only
Ondansetron (Zofran)	Antiemetic; usually for cancer patients on chemotherapy; for postsurgical patient (one dose only)
Penicillin G Procaine/Penicillin G Benzathine	For bacterial infection; give IM only
Penicillin G sodium/potassium	For bacterial infection; for IV infusion
Paclitaxel (Taxol®)	For breast and ovarian cancers; refrigerate; prepare in glass container only
Streptokinase (Streptase®)	Dissolves blood clots in heart, blood vessels, or lungs; do not *shake* vial when reconstituted

Chapter 36

Quiz for Hospital Review

1. What size filter is considered an air-retentive, sterilizing filter?

   A. 0.22 µm
   B. 0.3 µm
   C. 0.45 µm
   D. 5 µm

2. How often must a laminar flow hood be checked?

   A. Every 2 months
   B. Every 6 months
   C. Every 24 months
   D. When it is broken

3. What type of insulin may be added to an IV admixture?

   A. Lente
   B. Ultralente
   C. Isophane
   D. Regular

4. Who is responsible for developing a drug formulary?

A. The physician
B. The pharmacist
C. The Pharmacy and Therapeutics Committee
D. The nurse

5. When drawing drugs out of an ampule, it is best to use:

A. Regular needle
B. Filtered needle/straw
C. Luer-lock syringe
D. All of the above

6. When using laminar flow hood, one should work inside the hood at least:

A. 2 inches
B. 6 inches
C. 8 inches
D. 12 inches

7. Which of the following drugs must be protected from light, but should not be refrigerated:

A. Metronidazole
B. Acyclovir

C. Penicillin G Procaine and Benzathine

D. None of the above

8. Which of the following IV admixture must be dispensed in a glass bottle?

A. Nitroprusside

B. Nitroglycerin

C. Taxol

D. B and C

E. None of the above

Ans: 1. a, 2. b, 3. d, 4. c, 5. b, 6. b, 7. a, 8. d

Answer to pharmacy calculations (chapters 22 to 28)

Chapter 22: Temperature Conversion

1. a
2. c
3. d

Chapter 23: Roman Numeral Interpretation

I.

1. 94
2. 758

3. 493
4. 1998

II.

a. VL
b. XCVIII
c. DXXXVI

Chapter 24: DEA

1. c
2. c
3. a.6 b.2

Chapter 25: Percentage, Proportion, Ratio, and Dilution Method

1. a. 10%, b.1:10
2. 8
3. 900
4. 14
5. 25
6. a. 30 b.16.67% c.66.675
7. 32
8. $2.54

9. 60
10. 25
11. b
12. d
13. c
14. b
15. b

Chapter 26: Day Supply, Dosage Regimen

1. 77
2. 100
3. no
4. a. 8.3 b. 7
5. 62.5
6. 84
7. 6
8. 30

Chapter 27: Alligations, Flow Rate, Milliequivalent Alligation

1. 666.67 mL of 75%, 1333.33 mL of 15%
2. 7.5 g of 10%, 37.5 g of 1%

Flow Rate

1. a. 62.5 b. 20.8 c. 2500
2. a. 4.5 b. 125
3. a
4. c
5. c

Milliequivalent

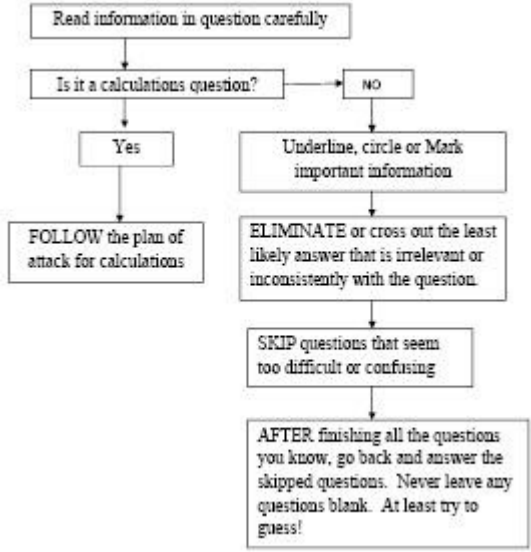
1. d
2. d

Chapter 28: Commercial Calculation

1. $25.19, 73%
2. $135
3. $110

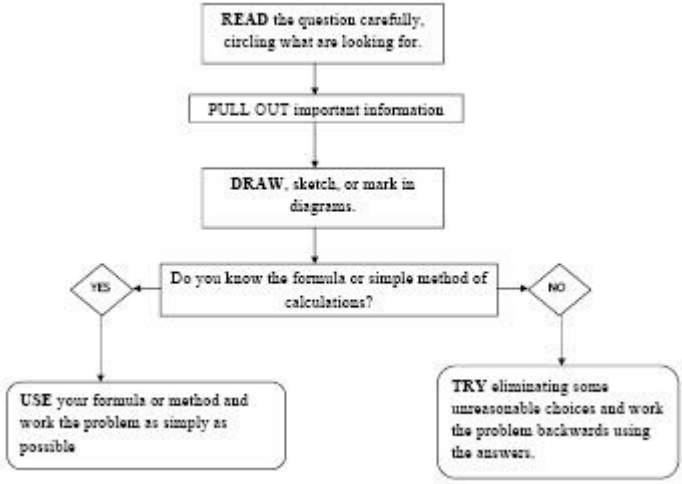
Appendix A

Patterned Plan of Attack for Questions



Appendix B

Patterned Plan of Attack for Calculations



Appendix C

Common Pharmacy Abbreviations

Application Time		**Application Areas**	
QD	every day	AD	right ear
BID	twice daily	AS	left ear
TID	three times daily	AU	both ears
QID	four times daily	Aff ear	affected ear(s)
5XD	five times daily	OD	right eye
QOD	every other day	OS	left eye
Q1H	every 1 hour	OU	both eyes
Q4H	every 1 hours	Aff eye	affected eye(s)
Q4-6H	every 4-6 hours	AA	affected area(s)
Q12H	every 12 hours	BSA	body surface area
Q24H	every 24 hours	SL	under the tongue, sublingual
Q Wk	every week	SC, SQ	subcutaneous, under the skin
BIW	twice a week	Sup, supp.	suppository
QMonth	every month	SR	suppository rectally
HS	at bedtime	SV	suppository vaginally
AC	before meals	Vag	vaginally

PC	after meals		

Appendix D

Common Medical Abbreviations

AA, aa	of each
Ad lib	at pleasure
ADR	adverse drug reaction
AM	morning
Amp	ampule
ANS	autonomic nervous system
APAP	acetaminophen
Aq, aqua	water
Aq dist	distilled water
ASA	aspirin
AWP	average wholesale price
BC	birth control
BE	barium enema
BM	bowel movement
BP	blood pressure
BUN	blood urea nitrogen
C	with
Carb	carbohydrate

Cath	catheter
CC	cubic centimeter
CCU	critical care unit
CHF	congestive heart failure
Cmp.	compound
Conc.	concentration
CVA	cerebral vascular accident
D5W	dextrose 5% in water
DAW	dispense as written
DC	discontinue
DEA	Drug Enforcement Administration
Diag, DX	diagnosis
Disp.	dispense
DS	double strength
DUR	drug utilization (usage) review
ECG	electrocardiogram
EEG	electroephalogram
El, elix	elixir
Ex aq.	in water
EtOH	ethanol, alcohol
Ext.	extract, external

FBS	fasting blood sugar
Fl., fld.	fluid
g., Gm, g	gram
Gl	gastrointestinal
Gr.	grain
Gtt.	drop(s)
GU	gastrourinary
H	hypodermic
Hr.	hour
HA	hyperalimentation, headache
HC	hydrocortisone
HDL	high density lipoprotein
Hgb	hemoglobin
HIV	human immunodeficiency virus
HMO	health maintenance organization
HR	heart rate
Hx	history
ICU	intensive care unit
IM	intramuscular
INH	isoniazid
INR	international normalized ratio

IV	intravenous
IVP	intravenous push, intravenous pyelogram
Kg	kilogram
Lb.	pound
LCD	coal tar solution (liquor carbonis detergens)
LDL	low density lipoprotein
LOC	laxative of choice
M	mix
MAC	maximum allowable cost
Mcg	microgram
MDI	metered dose inhaler
mEq	milliequivalent
m. ft.	mix and make
Mg	milligram
MI	myocardial infarction
Mixt	mixture
ML	milliliter
MM	millimeter
MOM	milk of magnesia
MR	may repeat
MS	morphine sulfate

MVI	multiple vitamin infusion
NandV	nausea and vomiting
NMT	no more than
Non rep, NR	do not repeat
Noc.	night (nocturnal)
NPO	nothing by mouth
NS	normal saline
NSAID	nonsteroidal anti-inflammatory drugs
NTG	nitroglycerin
Oint	ointment
OJ	orange juice
O	pint
OTC	over-the-counter drug, non-prescription
Oz.	ounce
PCN	penicillin
Ped	pediatric
PEFR	peak expiratory flow rate; peak flow
PM	afternoon; evening
PO	by mouth, orally
Post	after
Post op	after surgery

Post partum	after delivery
PPO	preferred provider organization
PPI	patient package insert
Pre op	before surgery
PRN	as needed
PT	prothrombin time
Pulv	powder
Q	each, every
R	right
RBC	red blood cell
R.L., R/L	ringer's lactate
Rx	prescription
S	without
Sat	saturated
Scr	serum creatinine
Sig	label, write on label
SOB	shortness of breath
Sol, soln	solution
SOS	may repeat if necessary
ss	½ (one-half)
SSKI	saturated solution of potassium iodide

STAT	now, immediately
Surg.	surgery
Susp.	suspension
SWI, SWFI	sterile water, sterile water for injection
Sx	symptoms
T	temperature
Tal.	such
Tal Dos.	such dose
Tbsp	tablespoon
TC	total serum cholesterol
TCN	tetracycline
TCT	total clotting time
TPA	tissue plasminogen activator
TPN	total parenteral nutrition
Tinct.	tincture
Top.	topically
Tsp	teaspoon
Ung.	ointment
Ud, ut dict.	as directed
URI	upper respiratory infection
UTI	urinary tract infection

w.; wk	weekly

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