Certification Study Guide and Practice Exams

FIRST EDITION

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PharmacyTechnicianCertification.com
About the Author

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Disclaimer

This book is intended to be used as a study guide and does not guarantee successful completion of any pharmacy technician certification examination. This guide is designed to assist with exam preparation and is not intended to replace other study materials or academic texts. The practice tests are the opinions of the author and have not been tested, reviewed or endorsed by any organization.

While every attempt has been made to include accurate and up-to-date information, it is possible changes and amendments have been made since publication.

This book is not to be used as a reference for patient care.

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Chapter One
The Pharmacy Technician Certification Examination

Pharmacy technician certification helps create a standard by which pharmacy technicians can be held accountable, as well as common ground for continuing education. When a pharmacy hires a certified pharmacy technician, it knows the employee has an established skill set to effectively work in the pharmacy.

There are two recognized national pharmacy technician certification examinations: the Pharmacy Technician Certification Exam (PTCE), which is offered by the Pharmacy Technician Certification Board (PTCB) and the Exam for the Certification of Pharmacy Technicians (ExCPT), offered by the Institute for the Certification of Pharmacy Technicians (ICPT).

These examinations will test your knowledge and skills sets in three primary areas:

- Helping the pharmacist serve patients
- Maintaining inventory and medication control systems
- Pharmacy practices, management and administration

As of 2010, the PTCE test has 100 multiple-choice questions, each of which has four choices with only one accurate answer. It’s a good idea to answer every question, even if you’re not certain of the answer, because final results are based upon the number of correct answers. You are given two hours to finish the PTCE.

The ExCPT test has 90 multiple-choice questions. Like the PTCE test, there are four possible answers, but only one correct answer. Both tests offer questions in a random order.
Studying for the Exam

Use this book as a guideline to develop a topical study plan. Remember this book should be used in conjunction with your pharmacy technician education and on-the-job-training; it is not designed to act as a stand-alone guide for the pharmacy technician certification exam.

Potential study outline topics may include:

- Aseptic technique
- Antibiotic reconstitution
- Calculations
  - Weight
  - Volume
  - Temperature
  - Time
  - Additives
  - Ratios and percentages
  - Dose changes
  - Prescription pricing
- Compounding
  - Terminology
  - Equipment
  - Types of compounding solutions
  - IV setting
- Customer service skills
• Drugs
  – Interactions and incompatibilities
  – Disposal and storage requirements
  – Trade names
  – Generic names
  – Commonly used drugs
  – Formulations

• Duties a pharmacy technician may or may not perform

• Formularies

• Monitoring and systems of medication distribution
  – Purchasing procedures, practices and policies
  – Dosage forms
  – Packaging
  – Quality assurance

• Pharmacy administration
  – Written prescription requirements
  – Prescription label requirements
  – Internal polices, regulations and procedures

• Pharmacy law
  – Controlled substances
  – Federal regulations
  – State regulations
The practice tests in this book will help you study for the exam and provide examples of potential questions. Make note of questions and topics that you don’t understand or about which you need more information.

**Pharmacy Technician Certification Testing Services**

Most states require or will require pharmacy technician certification. Even if your state does not currently require certification, it can demonstrate to your employer that you are a competent professional. As of January 2011, there are two national organizations that offer pharmacy technician certification; you only need to successfully pass one of these tests as recognized by the state in which you plan to practice.

The Pharmacy Technician Certification Board (PTCB) offers the Pharmacy Technician Certification Exam (PTCE). It is currently recognized by 45 state boards of pharmacy.

**Requirements:**

- Applicants must be at least 18 years old
- High school degree or G.E.D.
- No denial by any state board of pharmacy
- No drug- or pharmacy-related convictions
- No felony convictions
- Application fee of $129.00

The Institute for the Certification of Pharmacy Technicians (ICPT) offers the Exam for the Certification of Pharmacy Technicians (ExCPT). It is recognized by 32 state boards of pharmacy.
Requirements:

- Applicants must be at least 18 years old
- High school degree or G.E.D.
- No felony convictions
- Registration fee of $105.00

The following table can be used to identify if certification is required yet in your state and also which testing service (or both) are approved. States marked with (*) enforce a minimum certified to non-certified technician ratio.

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Scheduling the Test

The Institute for the Certification of Pharmacy Technicians (ICPT) and The Pharmacy Technician Certification Board (PTCB) use electronic testing services to administer their certification processes.

The PTCB uses Pearson Vue as its test administration service. It has over 5,000 test centers in 165 countries. More information about Pearson Vue test centers, locations and test scheduling can be found on their website.

The ICPT offers the ExPCT and uses Lasergrade as its test administration service. Lasergrade has over 800 testing centers in North America. More information about Lasergrade test locations and scheduling can be found on their website.

Taking the Test

While everyone's testing experience is different, there are some common experiences most exam takers share. It's a good idea to arrive 30 minutes before your test is scheduled to start so you have enough time to check in. You will be asked for at least one form of current photo identification, such as a driver's license or passport and you may be asked to provide a digital fingerprint. If you are taking the PTCB exam, you must bring your Authorization to Test letter to your examination. Personal items such as cellphones, purses or bags are not allowed in the testing area; test takers are typically given a locker in which to secure their belongings.

You will be given laminated paper and a dry erase marker or paper and pencil to help you with calculations during the test, as well as access to a calculator; you must submit these materials to the proctor at the end of your exam.

Both the PTCB and ExPCT test last two hours; questions are not permitted during either exam.

People with disabilities who need special accommodations can make arrangements with either testing company; supporting documentation may be required.
Chapter Two
Role of the Pharmacy Technician

Pharmacy technicians assist pharmacists in many areas, including customer service, prescription medication preparation and pharmacy administration. Job duties may include taking prescription requests, filling prescriptions, counting tablets and labeling bottles as well as clerical duties like stocking and inventory and operating cash registers.

Pharmacy technician responsibilities may further include:

- Familiarity with pharmacy policies and procedures
- Assist the pharmacist and customer as needed
- Taking a customer's prescription order and verifying it is accurate and complete
- Taking customer prescription refill requests and checking refill availability
- Computer data entry
- Price prescriptions and verify insurance and co-pays
- Maintain files for prescription hard copies
- Manage and maintain current patient profile information
- Gather, pour, weight, count, mix and measure medications
- Compound and/or reconstitute drugs
• Pick the correct size container for prescriptions
• Attach appropriate prescription labels and auxiliary labels to packaging
• Review pharmacy inventory to ensure stock is at appropriate levels

**Prescription Orders**

Prescriptions are orders for medications in a specified dose and amount to be given in a specific time frame. Prescriptions are typically written by physicians but may also come from physician assistants (PA), dentists (DDS, DMD), podiatrists (DPM), ophthalmologists (OD) and veterinarians (DVM). In some states, pharmacists may also write prescriptions. Prescriptions may come to the pharmacy in person, over the phone, via fax or electronically. Faxed and personally delivered prescriptions require a physician’s signature. Electronic prescribing (when prescriptions are sent from a provider’s software directly to the pharmacy dispensing software) is on the rise; it helps reduce medication errors and offers potential cost savings. Prescriptions received over the telephone may come from the doctor himself or his proxy, such as a nurse. State laws vary on who can receive new telephone prescription orders, however in the majority of cases only the pharmacist can take such orders.

**Parts of a Prescription**

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<tr>
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<td><strong>Medication name</strong></td>
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<tr>
<td><strong>Directions/Sig</strong></td>
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<tr>
<td><strong>Prescriber signature</strong></td>
<td><strong>Refills</strong></td>
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<tr>
<td><strong>DEA #</strong></td>
<td><strong>DAW</strong></td>
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</table>
• Prescriber’s name and contact information

• Patient name

• Date

• Medication, strength, dosage form and amount
  – Prescription orders must be interpreted accurately. If there are any questions about missing information or interpreting a prescription order that require professional judgment, the pharmacy technician must consult with a pharmacist.

• Directions
  – Directions may be provided in shorthand or abbreviated form so they can be written more easily and more precisely. Prescription directions include how a prescription should be administered, i.e. orally or topically, the dosage form, such as capsule or tablet and how often the prescription should be taken, such as daily, twice daily and so on. Prescription orders also contain the length of time of a dose, such as seven days or 30 days, and the reason for the medication, i.e. for pain.
  – Pharmacy technicians need an understanding of the abbreviations and shorthand used in prescription orders. Please refer to Chapter 7 for a list of common abbreviations.
  – While pharmacists check prescription orders before they are administered, pharmacy technicians must make every effort to correctly interpret a prescription order. If there is any doubt or question about a prescription or its directions, professional judgment must be left up to the pharmacist.

• Number of refills, if any

• Substitution allowances, if any

• Prescriber's Drug Enforcement Agency (DEA) number, if required
  – Pharmacy technicians are often responsible for verifying the validity of a prescription. If a prescription is written for a controlled substance, it will contain a verifiable DEA number. This book’s Pharmacy Law chapter contains a review on verifying DEA numbers.

• Physician’s signature
Prescription Transfers and Refills

States have different laws about prescription transfers between pharmacies; in some states the original prescription is cancelled after a transfer. Pharmacists will transcribe a hard copy of a transferred prescription along with the transfer information when they receive a prescription previously filled by another pharmacy. Some national or regional retail pharmacies have large computer databases to eliminate the need for prescription transfers between different locations.

Pharmacy technicians may take refill requests over the phone; it is essential to read back and confirm the prescription order with the customer while taking such a request. Typically, only pharmacists are allowed to take new prescription orders over the telephone; however this is not Federal law so some states may allow a pharmacy technician to perform this function under the supervision of a pharmacist.

Prescription and Medication Order Computer Entry

Patient profiles typically contain the patient's name, address, telephone number and other contact information. It will also contain information such as allergies and prescription history. Pharmacy technicians must enter prescription information into the computer, including medication information, directions and all other details included in a prescription. After the information is entered, the pharmacy technician should verify all data. The pharmacy computer will typically check the data and review for potential issues such as refill status, i.e. if the date is too early for a refill, drug-drug interactions, potential allergies, potential harm and dosing discrepancies. If there is an alert, the pharmacy technician needs to inform the pharmacist immediately.

Filling Prescriptions

Pharmacy technicians are often responsible for dispensing medications. The first step to accurately dispensing medication is to compare the original prescription to the medication, dosage form and strength of the product taken from inventory. Prior to counting the medication or filling the order the pharmacy technician should conduct a second review for accuracy. During the third step the pharmacy technician attaches the label to the prescription container.
and once again verifies the order contains the proper medication, dosage form and quantity. The prescription is then ready for a final review by the pharmacist.

**Hard Copies**

Pharmacies file the original hard copies of each prescription based on their prescription number or serial number, though Schedule II drugs are filed separately. State laws vary on how long hard copies must be maintained, though it's typically anywhere from five to seven years.

**National Drug Code Numbers**

Every prescription bottle and Rx Only label is required to carry a National Drug Code (NDC) number, which labels the product. NDC numbers are made up of three sets of digits. The first set of numbers identifies the drug manufacturer, the second set identifies the product, and the third set of numbers identifies the size of the package.

For example: 12345 – 1234 – 12

- **Drug manufacturer**
- **Drug product**
- **Package size**

**Working with Medications**

To avoid contaminating prescriptions, pharmacists and pharmacy technicians do not use their hands while working with medications. For example, tablets and capsules are typically counted using a spatula and counting tray.

Pharmacy technicians may need to reconstitute or compound prescriptions. Reconstitutions involve combining a powdered
medication with liquid; reconstitution may happen in hospital or retail pharmacies. Compounding is used to create creams, ointments, suspensions and solutions and should be done under the supervision of a pharmacist. Chapter 4 provides more information about compounding.

**Prescription Containers**

Common sense dictates pharmacy technicians put prescriptions in a container that best fits the quantity to be supplied – avoid using too large containers. Vials are used for liquids and are measured in drams. The lower the number of drams, the smaller the container should be. Bottles are measured in ounces, and the lower the number of ounces, the smaller the bottle should be.

**Prescription Labels**

Auxiliary labels provide supplemental instructions to a patient, such as “take at mealtimes,” or “may cause drowsiness.” Rx Only labels were introduced with the FDA Modernization Act of 1997 and are used in place of the former “Federal law prohibits dispensing without a prescription” label.

**Prescription Pricing**

Most pharmacy computer systems will price medication, including figuring the amount of third-party payments or money owed by the patient. Pharmacy technicians may need to re-enter patient information when there are insurance plan or policy changes.

**Third-party insurance terminology:**

- **Capitation** – typically used by HMOs, this insurance provides a pre-set amount of money for a membership group no matter the cost of services;

- **Co-payments, or co-pays** – require patients to make a partial payment at the time of service. There are percentage co-pays as well as flat-rate co-pays.
• **Fee-for-service** – the pharmacy may bill the insurance provider when service is rendered;

• **Out-of-pocket expense or indemnity** – patients must pay the pharmacy in full for services, and then use proof of payment to request reimbursement from their insurance companies.

• **Spend-downs** – require patients to pay the full cost for a service up to a specified amount of money before offering supplemental payments.

**Formulary**

Insurance plans have different requirements and permissions. For example, different plans have varying formulary restrictions and allowed number of refills. There are certain drugs insurance companies will and won’t accept, and these permissions are typically based on cost. Sometimes name brand drugs are excluded when a suitable generic is available; cosmetic drugs or weight control prescriptions may also be excluded.

**Inventory**

Pharmacy technicians oversee the inventory levels of their pharmacies; it is important to keep the proper amount of each drug in stock to avoid both product shortages as well as wasted, unused product. Some pharmacy technicians are also responsible for ordering drugs directly from manufacturers and wholesalers; orders are typically conducted over the phone or via the Internet. In emergencies, a pharmacy may purchase or borrow drugs from another pharmacy to meet patient needs.

When drugs are received at the pharmacy, the technician needs to compare the shipment with the invoice to make sure all information is correct. When stocking new drugs, technicians should move older drugs to the front of the supply shelves so they are used first, and take down any expired product. Expired drugs may be returned to either the manufacturer, the wholesaler or a licensed medication return company, depending upon company policies and procedures.
Hospitals

Retail and hospital pharmacy settings vary because in hospitals prescription orders are viewed as medication orders or doctor’s orders. In hospitals, pharmacists are more likely to input prescription information into the computer to insure both correct dosage as well as patient safety. Pharmacy technicians who work in hospitals are less likely to interact with customers. Instead, they will typically prepare prescriptions as well as IV admixtures. (Please see the Compounding chapter of this book to review IV admixtures.)

Because hospital patients often need around-the-clock medication, pharmacy technicians will prepare 24-hour supplies for each patient. These are typically stored in cassette drawers and feature unit-doses or prepackaged units of drugs, as well as injectable medication, if needed. Pharmacists will check these cassettes to ensure accuracy. Alternately, a pharmacy technician employed in a hospital may help restock decentralized dispensing cabinets such as Pyxis® or Omnicell®.

Pharmacy Technician Conduct

Pharmacy technicians must remember at all times that only a pharmacist can provide professional advice or exercise professional judgment. It is important pharmacy technicians know and understand the rules and regulations of their employer and follow them at all times.

As with other health care providers, pharmacy technicians must uphold patient confidentiality. It is also important to provide good customer service in a courteous, calm and efficient manner and to perpetuate a professional atmosphere in the workplace. Because you are working with the public, it is also important to maintain a polished appearance.
Pharmacy Resources

Most pharmacies have books and other resources you can reference if you have questions or want to learn more about a specific medication.

**Drug Facts and Comparisons** from Wolters Kluwer Health:

- Drugs are sorted into pharmacological or therapeutic groups for comparison
- More than 22,000 prescription and 6,000 over-the-counter products listed
- Includes manufacturer and distributor list

**American Drug Index** from Wolters Kluwer Health:

- A comprehensive drug list in a dictionary format
- Provides identification, explanation and correlation of drugs
- Information includes strength, dose forms, composition, packaging, schedule and usage

**Physician’s Desk Reference** from PDR Network:

- Color picture pill identification catalog
- Includes drug mechanism of action, indications and contraindications, side effects, warnings and precautions

**USP Pharmacists' Pharmacopeia** from The United States Pharmacopeial Convention:

- Detailed reference about pharmacy and healthcare practices
- Offers best practice information
- Provides details about regulatory standards and procedures as outlined by federal and state laws
## Chapter Three
### Pharmacy Law

### Major Pharmacy Law Timeline

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<td>1911</td>
<td>Shirley Amendment</td>
<td>Forbade false claims about drug effects</td>
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<td>1914</td>
<td>Harrison Narcotic Act</td>
<td>Introduced control of the distribution and use of narcotics</td>
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<tr>
<td>1938</td>
<td>Food, Drug and Cosmetic Act</td>
<td>Drug manufacturers must demonstrate drug safety prior to marketing</td>
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<tr>
<td>1950</td>
<td>Alberty Food Products vs. United States</td>
<td>Drug purpose must be on label</td>
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<tr>
<td>1951</td>
<td>Durham-Humphrey Amendment</td>
<td>Introduced the “Caution: Federal law prohibits dispensing without a prescription” label</td>
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<tr>
<td>1960</td>
<td>Federal Hazardous Substances Act</td>
<td>All hazardous materials should be handled with care and disposed of in a specifically marked container</td>
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<tr>
<td>1962</td>
<td>Kefauver-Harris Amendments</td>
<td>Drug effectiveness and safety must be proved prior to marketing</td>
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<tr>
<td>1966</td>
<td>Fair Packaging and Labeling Act</td>
<td>All products sold interstate must be labeled correctly</td>
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<tr>
<td>1970</td>
<td>Poison Prevention Packaging Act</td>
<td>Child-proof packaging is required for all prescription drugs</td>
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<tr>
<td>1970</td>
<td>Controlled Substances Act</td>
<td>Regulates the manufacture, distribution and sales of drugs that carry a risk of dependence or abuse</td>
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<tr>
<td>1976</td>
<td>Medical Device Act</td>
<td>Amendment to the FD&amp;C Act; requires assurance of the</td>
</tr>
<tr>
<td>Date</td>
<td>Law</td>
<td>Description</td>
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<td>------------------------------------------------------------------------------</td>
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<tr>
<td>1983</td>
<td>Federal Anti-Tampering Act</td>
<td>It is a Federal offense to tamper or change consumer products</td>
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<tr>
<td>1983</td>
<td>Orphan Drug Act</td>
<td>Gives incentives to increase research and manufacture of drugs used to treat rare diseases</td>
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<tr>
<td>1984</td>
<td>Drug Price Competition and Patent Term Restoration Act</td>
<td>Extended the patent life for all drugs</td>
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<tr>
<td>1987</td>
<td>Prescription Drug Marketing Act</td>
<td>Amendment to the FD&amp;C Act; designed to lower the health risks that may result from the diversion of prescriptions from legitimate commercial avenues.</td>
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<tr>
<td>1990</td>
<td>Omnibus Budget Reconciliation Act</td>
<td>Pharmacists must counsel Medicaid patients</td>
</tr>
<tr>
<td>1997</td>
<td>FDA Modernization Act</td>
<td>Updated the Durham-Humphrey Amendment so label need read “Rx only”</td>
</tr>
<tr>
<td>2006</td>
<td>Dietary Supplement and Nonprescription Drug Consumer Protection Act</td>
<td>Requires manufacturers to report adverse drug reactions</td>
</tr>
<tr>
<td>2006</td>
<td>Combat Methamphetamine Act</td>
<td>Limits the sale of Pseudoephedrine</td>
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**Federal Food, Drug, and Cosmetic Act (FD&C Act)**

Until the Food and Drugs Act of 1906, there was no comprehensive legislation protecting consumers and public health. The Federal Food, Drug and Cosmetic Act of 1938 (FD&C Act) further expanded this protection and added new provisions such as the right of the Food and Drug Administration (FDA) to require proof of drug safety, create food safety standards and inspect factories. The FD&C Act also allowed the FDA to define legal definitions for drugs. For example, section 201(g) of the FD&C Act defines drugs as articles intended for use in the diagnosis, cure, mitigation, treatment, or prevention of disease in man or other animals" and "articles (aside from food) intended to affect the structure or any function of the body of man or other animals."
Amendments to FD&C Act helped expand and improve drug safety laws. The Durham-Humphrey Amendment of 1951 brought about the distinction between over-the-counter and prescription drugs; it mandated prescription drugs could only be dispensed with the authorization of a doctor or other qualified health professional. Prior to the amendment, consumers could buy any pharmaceutical over-the-counter.

After it was discovered the drug thalidomide was the cause of countless birth defects in babies born in Europe, the FDA worked to keep the drug from being marketed in the United States. The Kefauver-Harris Amendments of 1962 was a response to the tragedy and forced drug manufacturers to prove the effectiveness of their products, detail any adverse reactions or responses and required the companies to inform physicians of both the health benefits and risks of their products. This amendment also gave the FDA control over the advertising of prescription drugs, approval of new drug applications prior to the manufacturer marketing of a drug and required an inspection of drug manufacturers every two years.

Poison Prevention Packaging Act

The Poison Prevention Packaging Act of 1970, also known as the PPPA, instituted “special packaging” for prescription drugs and other household products which may be harmful. Oversight is conducted by the United States Consumer Product Safety Commission (CPSC).

According to the PPPA, special packaging is “packaging that is designed or constructed to be significantly difficult for children under five years of age to open or obtain a toxic or harmful amount of the substance contained therein within a reasonable time and not difficult for normal adults to use properly, but does not mean packaging which all such children cannot open or obtain a toxic or harmful amount within a reasonable time.”

Federal Anti-Tampering Act

The Federal Anti-Tampering Act of 1983 requires over-the-counter drugs, contact lens solutions, cosmetic liquid oral hygiene products and vaginal products to be contained in tamper-resistant packaging that is also “distinctive by design”; consumers must be given
details about the products' tamper-resistant features. Persons who are convicted of tampering with a consumer product may face felony charges and imprisonment of up to ten years.

Examples of tamper-resistant packaging include blister packs, which are capsules, pills or tablets individually wrapped in plastic compartments with a paper or foil backing, film wrap around the whole container, tape seals, break-away packs and aerosol containers.

**OBRA 90**

OBRA 90 is the common name for the Omnibus Budget Reconciliation Act of 1990, which required states to assist Medicaid recipients’ understanding of medications; states could also elect to expand this provision to other types of patients, as well. The pharmacy practice requirements were enacted in 1993.

Different jurisdictions only required the application of OBRA 90 to new prescriptions, while others covered new and refilled prescriptions. Additionally, states vary as to whether the information should be presented in person by the pharmacist or via some other method.

*Major provisions brought about by OBRA 90 include:*

**Prospective Drug Utilization Review:**

- Before administering a drug, there are many factors to review, including:
  - Drug to drug interactions
  - Drug and allergy interactions
  - Drug and disease interactions
  - Duplications
  - Dosage and duration
  - Abuse and/or misuse
Patient Counseling Standards:

- Patients must have the opportunity to speak with a pharmacist about their prescription, including:
  - Drug name
  - Possible side effects, how to minimize them and what to do if they occur
  - Possible interactions
  - Dosage and form, as well as administration schedule
  - Refill information and requirements
  - What to do in the event of a missed dose

Patient Record Maintenance:

- Pharmacies must create and maintain up-to-date patient files. Records should include:
  - Full name
  - Date of birth and/or current age
  - Gender
  - Mailing address and phone number(s)
  - Drug allergies and reactions
  - Pharmacist comments and notes
  - Drug profile
Controlled Substance Act

Federal and state laws regulate controlled substances; production, possession, importation and distribution of controlled substances is highly regulated in the United States. There are five schedules, or categories for controlled substances based on the characteristics of the drug and the regulation the substance requires.

These laws were created to help minimize and control the abuse and misuse of drugs, as well as any associated criminal activity. The Controlled Substances Act (CSA) Title II of the Comprehensive Drug Abuse Prevention and Control Act of 1970 features multiple laws that regulate the creation and distribution of depressants, hallucinogens, anabolic steroids, stimulants, narcotics and chemicals used in the illegal creation of controlled substances. The Drug Enforcement Administration (DEA) oversees and enforces the laws.

Drug Schedules

Controlled substances are organized based on their characteristics and the regulation they require. The following table provides some examples of controlled substances; however the list is not comprehensive. Salts, isomers and salts of isomers, esters, ethers and derivatives are not included.

| Schedule I (CI)          | Drugs that are not allowed for medical use in the United States; they typically have a high risk for abuse. These substances may not be prescribed. | Heroin  
|                         |                                                                            | LSD  
|                         |                                                                            | Peyote  
|                         |                                                                            | Crack  
| Schedule II (CII)       | Drugs that may have a high risk for abuse and physical or mental dependence, however they are used for medical purposes. These substances are non-refillable. | Cocaine  
|                         |                                                                            | Morphine  
|                         |                                                                            | Oxycodone  
|                         |                                                                            | Amphetamines  
|                         |                                                                            | Opium  
<p>|                         |                                                                            | Ritalin® |</p>
<table>
<thead>
<tr>
<th>Schedule III (CIII)</th>
<th>Drugs used for medical purposes with a lower likelihood for abuse than Schedule I and Schedule II drugs.</th>
<th>Tylenol® with Codeine No 3 Anabolic steroids Fiorinal® Vicodin®</th>
</tr>
</thead>
</table>
| Schedule IV (CIV)   | Drugs used for medical purposes with a lower likelihood for abuse than Schedule III drugs.      | Benzodiazepines  
-Clonazepam  
-Diazepam  
-Lorazepam  
Phenobarbital |
| Schedule V (CV)     | Drugs used for medical purposes with a lower likelihood for abuse than Schedule IV drugs. Typically antitussives and antidiarrheals. | Lomotil®  
Robitussin AC®  
Phenergan® with codeine |

**Controlled Substance Prescriptions**

Schedule II prescriptions can be handwritten or printed, but they must be hand-signed by a doctor and no refills are allowed; partial fillings are acceptable if the remaining quantity is available to the recipient within 72 hours. New prescriptions must be written by the prescriber after 72 hours. Pharmacists must contact the physician if the balance of the prescription cannot be given to the patient. Physicians may file oral prescriptions of schedule II drugs as long as they complete a written prescription for the quantity and the pharmacy receives it within seven days. Pharmacies can also accept faxed schedule II prescriptions for patients in long-term care facilities. Pharmacies must note “long-term care facility patient” and/or “terminally ill patient” on the prescription as a condition of federal law.

Schedule III, IV and V prescriptions can be handwritten or printed, but they must be signed by the doctor with ink. A doctor’s office may also telephone or fax a schedule III, IV or V
prescription to a pharmacy, though individual state laws may vary. Up to six months of refills are permissible.

As of June 2010, the DEA allows for prescribers with the appropriate credentials to prescribe controlled substances electronically. Pharmacies can receive, dispense and archive these prescriptions, however it should be noted these regulations are in addition to, and not a replacement of, existing state laws.

**DEA Form 222**

A DEA license is required to order Schedule I or II controlled substances. Pharmacies do so with the Controlled Substance Ordering Form, more commonly known as DEA Form 222. The form comes directly from the DEA and must be completed in triplicate. Pharmacies can order Schedule III, IV and V drugs directly from the wholesaler or manufacturer, though a copy of the pharmacy’s DEA Registration may be required prior to order fulfillment. The DEA allows for the electronic ordering of CIIs from wholesalers, with the proper software and credentials.

**Schedule V Record Book of Sales**

In some states, prescriptions are not required for the sale of schedule V substances (New York and Colorado are two exceptions to this rule.) However, because these drugs do contain small amounts of controlled substances, it is required pharmacies record sales of these drugs. Other regulations state the drug must be sold by a licensed pharmacist and the customer has to be at least 18 years old and must provide valid identification. No more than eight ounces or 48 doses of any medication containing opium can be sold to an individual in a 48 hour timeframe. Additionally, no more than four ounces or 24 doses of any other controlled substance can be dispensed to an individual in a 48 hour timeframe.

Pharmacies must keep a record of these nonprescription transactions in a bound book. The book must include the name and address of the customer, the name and amount of the controlled substance, the date of purchase and the name or the initials of the dispensing pharmacist.
**Prescription Drug Monitoring Programs**

Prescription Drug Monitoring Programs, or PDMPs, are electronic databases that collect and store information about substances dispensed in individual states. The DEA does not oversee state PDMPs, but the information is shared with prescribers, pharmacies and law enforcement agencies. The intent is to help curb substance abuse as well as “doctor shopping.” As of March 2010, 33 states had active PDMPs.

**Prescription Filing Methods**

The Controlled Substance Act states pharmacy registrants conduct a complete inventory of all controlled substances every two years, within six months of May 1. The inventory must be kept on site for two full years.

There are three acceptable methods for filing prescriptions, according to Federal regulations.

- **Three types of prescription files:**
  - Schedule II
  - Schedule III, IV & V
  - All other prescriptions

- **Two types of prescription files:**
  - Schedule II, III, IV & V. All schedule III, IV and IV prescriptions must have a red “C” that is at least one inch in height stamped on the lower right hand corner of the prescription
  - All other prescriptions

- **Two types of prescription files:**
  - Schedule II
  - All other prescriptions. All schedule III, IV and IV prescriptions must have a red “C” that is at least one inch in height stamped on the lower right hand corner of the prescription
How to Verify a Prescriber’s DEA Number

Any prescriber who writes prescriptions for controlled substances must have a DEA number. Prescribers are assigned DEA numbers made up of two letters and seven numbers. The first letter of a DEA number is always A, B, F or M. The second letter is the first letter of the prescriber’s last name at the time of the DEA number application. To verify the number, add the first, third and fifth numbers together. Then add the second, fourth and sixth numbers together. Multiply the total by two. Add the first total and the second sum. The number in the last column farthest from the right and the seventh digit of the DEA number should be identical.

Example: AB 1234563

a)  1 + 3 + 5 = 9
b)  (2 + 4 + 6) x 2 = 24
c)  9 + 24 = 33
d)  The last digit of the sum must match the last digit of the DEA number. In this case, it is 3.

Drug Recalls

Pharmaceutical companies recall drugs in order to remove them from the market. Recalls are due to FDA order, FDA request or a manufacturer initiative. Class I recalls are issued when a product can cause severe harm, illness or death. Class II recalls are issued when a product can inflict illness or harm that is most likely reversible. Class III recalls occur when a product is volatile but unlikely to inflict severe health issues.
Limitations of Pharmacy Technician Duties

Each state has individual restrictions and regulations for pharmacy technicians. It is vital pharmacy technicians are familiar with and understand the rules for their state.

Federal regulations state pharmacy technicians can perform the functions of pharmacy practice under the supervision and direction of a licensed pharmacist. Examples include:

- Entering prescription or medication orders into the computer
- Pricing prescriptions
- Creating and maintaining patient profiles
- Count, pour, measure, mix and weigh medications
- Compound and/or reconstitute drugs
- Take prescription refill authorization orders
- Prepackage and label prescription orders
- Choose prescription containers and affix prescription and auxiliary label(s) on containers
- Stock and inventory medications
- Clerical duties

Pharmacy technicians may not receive oral prescriptions nor may a pharmacy technician exercise professional judgment in any pharmacy practice matter. Pharmacy technicians may not counsel patients or make the final interpretation of a medication or prescription order.

**Liability**

While pharmacists are typically held liable for products and medication that leave the pharmacy, there are cases in which a pharmacy technician is liable. For example, if a pharmacy technician is negligent or causes intentional harm, he is liable for both civil action and/or criminal charges. If a pharmacy technician steals drugs, she is criminally liable for theft. To avoid increased liability, pharmacy technicians must take care not to act outside the bounds of permissible duties.
Chapter Four
Compounding Principles

Non-Sterile Compounding

While many dosage forms of prescription drugs are pre-packaged, there are times when a drug must be prepared according to a formula, recipe or prescription. This involves combining precise, calculated amounts of ingredients into a uniform mixture.

A pharmacy may need to compound drugs if the proper dosage is unavailable or an adult dose needs to be diluted to meet the needs of pediatric or geriatric patients. Sometimes a solid dosage form must be converted to a solution or suspension, such as when a particular combination of topical medications is not available from a drug manufacturer. Drugs also need to be compounded if a product contains inactive ingredients to which the patient is allergic.

To properly compound drugs, a pharmacy technician must understand the proper formulas and processes for weighing, measuring and mixing pharmaceuticals such as powders, ointments and solutions. Pharmacy technicians need to be familiar with weights and balances, graduates, mortar and pestles and other measuring devices and familiar with the colors, smells and textures of frequently used ingredients. Additionally, it is essential a pharmacy technician be proficient in the mathematical requirements for such measurements.

It is important to be familiar with the following compounding concepts:

- A solute is a substance to be dissolved or diluted. It is usually a solid but it can be a liquid.
- Reconstitution means to add a diluent like purified water or another liquid to powder to create a suspension or solution.
- A diluent is a fluid that creates a less concentrated or viscous mixture; the fluid dilutes the mixture. Diluents are also used to turn dry substances into liquids. *Dilution* is the extent to
which the concentration of a mixture is reduced. The dilution ratio identifies the number of parts of an active ingredient to the number of parts of an inactive ingredient. For example, a 1:2 ratio means that of 3 total parts, 1 part is active and two parts are inactive.

- Displacement is the process that increases the volume of fluid when liquid is added to a solid (like powder) or another liquid.
- Solution concentration is the ratio (100 mg/100 ml, or 1:1) of a drug in quantity of solution or a fraction of percentage (1/4 strength, 25% solution.)
- Suspension is a liquid in which fine particles are dispersed throughout. These particles are supported by the buoyancy of stirring or shaking; when a suspension is still, the particles settle.
- Blending is the process of combining two substances.
- Flocculating agents are electrolytes used when preparing suspensions.
- Levigation is the breaking down of a powder drug using a solvent with which the drug is insoluble.
- Trituration is the act of pulverizing, rubbing or grinding a powder to make fine particles.

Balances and Compounding Equipment

“Class A” Prescription Balance

The National Bureau of Standards (NBS) requires pharmacies to have a “Class A” Prescription Balance on-site. This balance uses internal and external weights and has two-pan; it is a torsion-type balance. A “Class A” balance can measure between 120 milligrams (mg) and 120 grams (g); the balance has a sensitivity of 6 mg, which means it only takes 6 mg of a substance to upset the balance’s equilibrium by one degree or shift the pointer one division.

Proper Weighing Technique with a “Class A” Prescription Balance

1. Lock the balance and put a weighing paper on each pan.
2. Place the substance to be weighed on the left pan and the desired total weight on the right pan.
3. Unlock the balance the check the position of the indicator.

4. Lock the beam and change the amount of substance as needed.

5. You have an accurate measurement when the pointer swings an equal number of divisions to each side of the central position.

6. Put the cover down to conduct your final measurement.

7. It’s a good idea to measure your weights three times for accuracy:
   a. When they are first on the pan
   b. From their vacant positions in the weight box
   c. When they rest on the pan.

Care must be taken with “Class A” Prescription Balances to make sure they continue to offer accurate measurements. Keep unused balances in the locked position and do not add weight or materials to the balance unless it is locked. Keep the cover down on the balance when it is not in use, and take care to keep it clean of dust, corrosive vapors and moisture.

**Bulk Balance**

A Bulk Balance, which is also known as a Counter Balance, is considered to be less accurate than a “Class A” Prescription Balance. The balance can weigh substances up to 5 kilograms (kg) and has a sensitivity of 100 mg.

**Analytical Balance**

Analytical Balances are newer technology and offer the convenience of a digital readout. The sensitivity of this balance is 0.1 mg.

**Weights**

Most pharmacy weights, including those used with the “Class A” Prescription Balance are made of polished metal or brass. Weights must be cared for and handled properly in order to maintain their integrity. Do not touch weights with your bare hands, because body oil can
increase the weight and/or hurry corrosion of the weight. Use plastic or plastic-tipped tweezers when working with weights to avoid oxidation of the metal. Weights must be clean when they are stored and kept in a rigid, compartmentalized and covered box. Weights that are dropped or dented must be replaced.

Weight sets typically include cylindrical weights between 1 and 50 gms and fractional weights between 10 and 500 mg. It’s a good idea to calibrate weights once a year to ensure their accuracy.

**Mortar and Pestle**

Mortar and pestles are used to grind powders together. These powders may be used in topical creams, ointments, capsules or oral liquids, among other things. Mortars are bowls, which may be made from marble, glass, stone, clay or hard wood. You place the substance you want to grind in the mortar and crush, grind and mix it with the pestle, which is a cylindrical tool with a rounded end that is typically made from the same material as the mortar. You may also mix liquids or semi-soft dosage forms with a mortar and pestle; it is recommended you use glass for such mixtures.

**Graduate**

Graduates are used to measure liquids. Cylindrical graduates are uniform from top to bottom and are the most accurate type of graduate. Conical graduates have wide mouths and wide bases so you can stir liquids with glass rods. The accuracy of a conical graduate decreases as the diameter increases. Conical graduates range in size from 10ml to 4000ml.

Graduates are typically marked “TD,” which stands for “to deliver.” This means the measurement of the graduate will compensate for any excess liquid that sticks to the graduate after the liquid is poured out.
Technique for Measuring Liquids

1. **Pick the appropriate size graduate** – make sure the liquid you are measuring is not less than 20 percent of the total volume of the graduate

2. **Pour the substance down the middle of the graduate at a slow pace** until the level of the liquid rises to the appropriate volume

3. **Make sure all of the liquid has settled in the graduate** prior to taking your measurement

4. **Measure the level of the liquid at your eye level**, then check the bottom of the meniscus (the surface of the liquid that bulges downward)

5. **Pour the substance into its container** – make sure the liquid is fully drained from the graduate

**Spatula**

Spatulas may be made of hard rubber, plastic or stainless steel – the type of spatula you use will depend on the substance you are transferring or mixing. You may use a spatula to mix or transfer solid ingredients like creams, powders or ointments.

**Ointment Slab**

Ointment slabs offer hard, clean surfaces on which to mix compounds. They are typically made of ground glass plates, which provide a non-absorbable surface area. Pharmacies often use disposable parchment papers over an ointment slab because they allow for multiple compounding without cleaning between substances.
Principles of Compounding Liquids

Solutions and suspensions are common forms of compounded medications. Solutions are clear liquids in which a drug is completely dissolved. Suspensions are liquids with fine drug particles distributed consistently throughout the solution; suspensions must be shaken before they are used. Suspending agents are thickening agents that provide structure to a suspension – this allows for an easy dispersion of particles. Examples include Tragacanth and Carboxymethylcellulose.

To incorporate a solid into a liquid, you must first break down the particle size of the solid with a mortar and pestle – this is called trituation. You may also need to use other agents to make particles even smaller and finer and/or to make sure the particles are distributed evenly, as with a suspension. Dilute solutions have a very small amount of solute, or particles in solution. Concentrated solutions have large amounts of solute in solution. Saturated solutions have the greatest amount of solute that can be dissolved in a solvent or at a given pressure or temperature.

Creams and ointments are semisolid dosage forms used for topical application. They are typically created when a physician requests a mixture of two or more creams or ointments in a specific ratio, or the addition of a drug into a cream or ointment base. Creams are usually water based and ointments are typically oil based.

There are times when you cannot directly mix ingredients, so other ingredients like levigating or wetting agents must be added to achieve a finer particle size. Wetting agents displace air from particles so they can mix better – alcohol is an example of a wetting agent. Levigating agents reduce the size of particles. Examples include glycerin and mineral oil.

Geometric Dilution

Geometric Dilution is used to create an even distribution or homogenous mixture of two or more substances. To use this method, mix the smallest amount of active ingredient with an equal volume of the diluent or base on an ointment slab. Continue to add diluent in amounts equal to the volume of the mixture on the slab. Continue this process until all of the diluent is
incorporated into the mixture. Failure to compound ingredients properly may result in an ineffective cream or ointment, which can cause skin reactions or create an ineffective product.

**Calculations**

Proper calculations are an essential aspect of pharmacy. Pharmacy technicians must fully understand percentages, the metric system and ratio and proportion so they can consistently provide accurate calculations.

Many solutions and/or suspensions are marked as a specific concentration or strength of active ingredient per volume of liquid. Sometimes solutions are marked as a percentage of strength; creams and ointments are typically marked as a percentage of active ingredient.

Percents are fractions with a specific denominator, which is always 100. For example, with liquids, a percentage is mls per 100 mls. With creams or ointments, the percentage is grms per 100 gms.

**Reconstituting Oral Powders**

Drugs such as antibiotics weaken quickly when they are prepared in liquid form. For this reason, pharmaceutical manufacturers provide pharmacies with products in powder (solute) form so they may be reconstituted with a diluent or purified water when prescribed. Such powders are packaged in self-contained bottles large enough to allow for the reconstituted volume.

Powders will have instructions from the manufacturer explaining how they must be reconstituted (note some manufacturers may use the term constitute instead of reconstitute.)

**Sterile Compounding**

When compounding and packaging sterile drugs, you must ensure a sterile preparation. This means the drugs are free from living organisms such as bacteria. When formulating and compounding sterile preparations, pharmacy technicians need to follow FDA regulations and state laws.
Pharmacies typically use equipment such as syringes and needles, ampules or vials, alcohol pads, laminar airflow hoods, refrigerators and freezers for sterile compounding, as well as sharp containers, disposable gloves, masks, caps and gowns. Disposable towels and wipes are also used.

**Definitions of Parenteral Products**

Parenteral products are those that enter the body via a means other than the gastrointestinal tract, typically via injection. Drugs are administered this way for a variety of reasons. These include a need for quick onset of action or an inability to administer the drug orally, such as with unconscious patients. Some drugs may only be effective intravenously. Disadvantages include a lack of control over the medicine once it is injected, potential pain at the site of the injection and a need for strict sterility.

**Routes of Administration:**

**Subcutaneous (SC; SQ; Sub Q):** injection of up to 2ml is given under the skin using a ½ to 1 inch 23 gauge or smaller needle. Common subcutaneous injections include vaccines and insulin.

**Intramuscular (IM):** injection is typically between 0.5 and 2ml, though it can be up to 4ml. The injection is delivered to the muscle fiber using 1 to 1.5 inch and a 19 to 22 gauge needle. Intramuscular injections are usually given in the buttocks (gluteal muscle), upper arms (deltoid muscle) or the lateral thigh area.

**Intravenous (IV):** injections between 1 to 1000 ml are delivered into the vein using a 1 inch, 19 to 20 gauge needle. Drugs administered via intravenous injections include aqueous solutions and TPN. Advantages to IV drugs include maximum bioavailability and the dilution with blood – this allows solutions of irritating drugs to be administered to patients. Large volume parenteral (LVP) fluids (100 to 1000ml) are used to restore and maintain blood volume, prevent dehydration and supply patients with nutrients and electrolytes. LVPs also dilute toxic materials.
Intravenous therapy is the riskiest type of administration because it circumvents the body's natural barriers. Additionally, patients who receive IV therapy are typically the most vulnerable. It is essential IV admixtures are free of contamination; improper solutions can cause occlusions, infections and even death. The combination of parenteral dosage forms for administration via a unit product is called an IV admixture.

**Inter-arterial (IA):** injections are between 2 and 20 ml and administered directly into an artery using a 20 to 22 gauge needle. Examples of drugs given via IA injection include antibiotics, antineoplastic and radio opaque media.

**Interarticular:** injections of 2 to 20ml are given directly into the joints using a 5 inch, 22 gauge needle. They must be isotonic. Drugs given via inerarticular injection include NSAIDs, antibiotics and steroids.

**Intrapleural:** injections are administered directly into the pleural cavity (lung) and are also used for fluid withdrawal. Needles are 2 to 5 inch, 16 to 22 gauges, and between 2 and 30ml of fluid is given. It’s often used for chemotherapeutic agents.

**Intracardial:** injections between 0.2 and 1ml are administered directly into the patient’s heart using a 5 inch, 22 gauge needle. Typical drugs injected via this method are calcium shots and cardiotonics.

**Intradermal:** also referred to as diagnostic testing. Using a ½, 25 to 26 gauge needle, 0.05ml of fluid is injected. An intradermal injection must be isotonic.

**Syringes**

Syringes typically include four main components: a cap, a needle, a barrel and a plunger. The cap covers the needle, and the barrel of the syringe holds the fluid; the plunger forces the fluid out of the syringe. Some needles are permanently attached to the syringe, while others are detachable.
**Insulin syringe:** usually has a smaller barrel and a shorter needle. Used for subcutaneous injections. Insulin syringes are the only syringes in which the medication is measured in units instead of ml.

**Mouth syringe:** used to administer liquid medications, either to adults who are unable to take solid dosages or children. Barrel sizes include 1ml and 5ml.

**Allergy syringe:** used for subcutaneous and intramuscular injections.

**Safety syringe:** offer additional protection against accidental injuries and exposure to bloodborne pathogens. Safety syringes may come equipped with a needle sleeve that locks in place over the needle or a retractable needle.

Needles are made up of two parts known as the shaft and the hub. The shaft is the stem of the needle that is cut diagonally (beveled) at the end to create a point. The lumen is the hollow bore of a needle shaft. At the opposite end of the needle is the hub, where syringes may be attached.

The size of a needle is determined by its gauge and length. Length is measured in inches from where the hub and shaft meet to the tip of the point. Needles may be from 3/8 of an inch to 3 ½ inches, or longer. Needle gauges indicate the size of the lumen. The finest needle gauge is 27 and 13 is the largest.

Filter needles are like other needles, but they have a filter located in the hub to contain any particles from a vial or ampule and are used to vent small-volume vials.

Needles are sterile as long as their individual wrappings are intact. To ensure sterility, do not touch the hub of a needle when removing its overwrap.

Vials are glass or plastic containers with rubber closures held on by a metal ring. They contain injectable medications and may come in single use or multidose containers. Vials should be swabbed with a 70 percent isopropyl alcohol and left to dry prior to use.
Because air or fluid cannot pass freely in or out of vials, they are closed-system containers. This means when fluid is removed from a vial it should be replaced with an equal amount of air so a vacuum is not created. Exceptions to this rule include drugs like ceftazidime, which produce gas when they are reconstituted.

Ampules are made from glass; once they are broken they are single-use, open system containers. Prior to opening an ampule, move any solution visible in the head (top portion) to the body (bottom) of the ampule. You can do this by tapping the head of the ampule, quickly inverting, then righting the ampule or swirling the ampul while it is in an upright position.

Prior to opening an ampule, clean the neck with an alcohol swab and leave the swab in place. Hold the head between your thumb and index finger and the body between the same fingers of the opposite hand. Placing pressure on both thumbs, snap the ampule open at the neck. Take care not to open the ampule in the direction of a Laminar airflow HEPA filter. Once it's open, you may use a syringe to withdraw the solution from the ampule.

**IVPB**

Intravenous piggyback (IVPB) is used when an intermittent infusion will require more than five minutes to complete.

**IV Solutions**

**Clarity:** free of foreign particles, usually achieved through filtration.

**Sterility:** substances may be made sterile via filtration, gas, radiation or by autoclave.

**pH:** pH refers to the degree of acidity of a solution; pH can range from 0 to 14. A pH value less than 7 indicates a larger acidity, and
values above 7 mean less acidity or increased alkalinity. A solution with a pH of 7 is neutral – it is neither acid, nor alkaline. Normal human serum pH is 7.4.

When compounding a solution, pharmacy technicians use buffering agents (which stabilize a solution) at their lowest concentration so a person’s pH is not disturbed. Common buffers include phosphates, acetates and citrates.

Isotonicity: Isotonic solutions have the same concentration as red blood cells; isotonic IV solutions help keep patient discomfort and the damage to red blood cells at a minimum. The larger the volume of solution intended for injection, the closer the parenteral preparation needs to be to isotonicity.

0.9 percent sodium chloride injection (NS or normal saline) and 5 percent dextrose (D5W) injection are approximately isotonic.

**Common IV Solutions**

**Hypotonic**
- ½ NS
- ¼ NS

**Isotonic**
- D5W
- NS

**Hypertonic**
- LR (Lactated Ringers)
- D5 ¼ NS
Laminar Flow Hoods

Class 100 environments (in which no more than 100 particles are present) are required for the preparation of sterile products. To achieve this environment, pharmacies use Laminar Flow Hoods, which reduce the risk of airborne contamination while IV admixtures are prepared. Laminar Flow Hoods have high-efficiency particulate air (HEPA) filters that clean and purify the air over the work surface. The airflow also keeps air from the room out of the work area, and removes contaminants brought into the work area by people or objects such as syringes, packaging or IV bags. This air flow may be horizontal or vertical; vertical Laminar Airflow Hoods are used for chemotherapy drug preparation.

Laminar Flow Hoods are also used for filing unit dose syringes, reconstituting powdered drugs, preparing ophthalmic solutions and preparing IV admixtures.

Aseptic Technique

Procedures performed under sterile conditions are called aseptic techniques. Long hair should be secured away from the face, and any jewelry should be removed. You must wash your hands prior to entering the IV area and again before entering the laminar flow hood – this means your hands, wrists and arms (up to the elbow) should be washed with an antimicrobial soap and hot water between 30 and 90
seconds. If you wear gloves, they must be rinsed with 70 percent isopropyl alcohol after you put them on.

The surface of the hood needs to be cleaned with 70 percent isopropyl alcohol and the hood needs to be run for at least 30 minutes before you put medications inside. Any vials or ports need to be wiped down with alcohol (not sprayed). Make sure nothing blocks the airflow of the hood – no talking, coughing or sneezing may be directed toward the hood's airflow, and work a minimum of six inches into the hood. Be sure to dispose of all needles, syringes, vials and other by-products in their proper receptacles.

**Total Parenteral Nutrition (TPN) Solutions**

TPNs typically consist of 50 percent dextrose, 20 percent fat and 10 percent amino acids. TPN is infused into the right atrium of the heart with the use of a central line, so aseptic technique is required when compounding. Peripheral parental nutrition (PPN) is infused through a peripheral iv access line and usually consists of 10 percent amino acids, 10 percent fat and 25 percent dextrose, ie less concentrated.

Both TPN and PPN base solutions are available premixed by manufacturers, but pharmacies may add the vitamins, medications and electrolytes as ordered by the prescriber.

**Antineoplastics**

Also known as chemotherapeutics, antineoplastics are drugs that prevent and fight the development of cancer. Pharmacy technicians may need to prepare intravenous admixtures of these drugs. When doing so, you must use both a vertical Laminar Flow Hood and a gown, gloves and mask for both the sterility of the admixture and your own protection. All materials used when creating such admixtures must be disposed in hazardous waste containers.

**Radiopharmaceuticals**

Radiopharmaceuticals must be prepared in a vertical flow hood with a glass shield, and people working with such drugs must wear a meter indicating the levels of radioactivity to which they are exposed. When you prepare a radiopharmaceutical, you use a syringe equipped with a syringe shield, which helps lower radiation exposure.
**797 Guidelines**

Each chapter of the Federal Food, Drug and Cosmetic Act has a number; these numbers may be used in shorthand to refer to the requirements outlined in that particular chapter. Chapter 797 contains contamination and control requirements, as well as proper compounding procedures. These are required in all healthcare settings.
Chapter Five
Medication Classes

As a pharmacy technician, you may come into contact with thousands of different types of drugs during your career. It is important to be familiar with drugs and their uses to provide the best possible service to your customers. When you take a pharmacy technician certification examination, you will be asked about the main groups of drugs used in both hospital and retail settings.

There are a variety of drug classifications. Drugs may be classified based on their primary therapeutic action or indication. Drugs can also be arranged based on the specific classification on how the drug works. Drugs classified in this manner typically share characteristics such as similar chemical structure, similar mechanism of action and similar effects (including side effects.) The following represents a breakdown of the more common medication classes and is not meant to be all inclusive.

ANGIOTENSIN-CONVERTING ENZYME (ACE) inhibitors

- **Actions**: dilatation of the arterial and venous systems occur through the suppression of renin-angiotensin I to angiotensin II conversion
- **Uses**: Hypertension, suffix = “-pril”
- **Examples**:
  - Captopril
  - Lisinopril
  - Enalapril
ANGIOTENSIN RECEPTOR BLOCKERS (ARBs)

- **Actions:** dilatation of the arterial and venous systems occur through the blocking of the angiotensin II receptors
- **Uses:** Hypertension, suffix = “-sartan”
- **Examples:**
  - Losartan
  - Valsartan
  - Irbesartan

ANTACIDS

- **Actions:** They contain magnesium, aluminum, calcium and a combination of these compounds. They slow down the rate of gastric emptying and neutralize gastric acidity.
- **Uses:** Gastritis, peptic ulcer, hiatal hernia and reflux esophagitis.
- **Examples:**
  - Aluminum Carbonate
  - Calcium Carbonate
  - Maalox®
  - Mylanta®

ANTICOAGULANTS

- **Actions:** Prevent clot formation.
- **Uses:** MI, pulmonary embolus, deep vein thrombosis, disseminated intravascular clotting syndrome (DIC), and atrial fibrillation. It is also used with dialysis.
- **Examples:**
  - Warfarin Sodium
- Heparin
- Enoxaparin
- Dabigatran

**ANTICONVULSANTS**

- **Actions:** Act to prevent seizures.
- **Uses:** Depending on the specific drug, they prevent tonic-clonic seizures, psychomotor seizures, status epilepticus, petit mal seizures and cortical focal seizures.
- **Examples:**
  - Phenytoin
  - Diazepam
  - Gabapentin
  - Valproic acid

**ANTIDEPRESSANTS**

- **Actions:** Blocking the breakdown or inhibiting the reuptake of epinephrine, norepinephrine, serotonin, and dopamine which increases their actions in the nerve cells
- **Uses:** Depression. Nocturnal enuresis in children.
- **Examples:**
  - Sertraline
  - Amitriptylyline
  - Bupropion
  - Fluoxetine
ANTIDIABETIC MEDICATIONS

Antidiabetics are also subdivided into the following groups:

1. insulins of varying kinds
2. oral hypoglycemic agents
   - **Actions:**
     - Insulin- lowers blood sugar, potassium and phosphate
     - Oral hypoglycemic agents- stimulate the β -cells of the pancreas to release insulin.
   - **Uses:** Diabetes and ketoacidosis
   - **Examples:**
     - Insulin- Lantus®, Humalog®, Regular, NPH
     - Oral- Glyburide, Metformin, Actos®

ANTIDIARRHEALS

- **Actions:** Some decrease water content of stool, some slow down GI peristalsis.
- **Uses:** Diarrhea
- **Examples:**
  - Bismuth Subgallate
  - Kaolin And Pectin Mixtures
  - Lomotil®

ANTIDYSRHYTHMICS

- **Actions:** Are subdivided into classes which differ in how they affect the electrical conduction of the heart
• **Uses:** Atrial and ventricular arrhythmias (atrial fibrillation, PVCs, and tachycardia), hypertension, and angina

• **Examples:**
  - Digoxin
  - Procainamide
  - Quinidine
  - Acebutolol
  - Bretylium
  - Verapamil

**ANTIFUNGALS**

• **Actions:** Decreases sodium, potassium and nutrients in the cell and increases cell permeability.

• **Uses:** Fungal infections such as cryptococcosis, aspergillosis, histoplasmosis, blastomycosis, coccidiomycosis, phycomycosis, and candidiasis

• **Examples:**
  - Nystatin
  - Amphotericin B

**ANTIHISTAMINES**

• **Actions:** Block histamine.

• **Uses:** Allergies, pruritus and rhinitis.

• **Examples:**
  - Diphenhydramine Hydrochloride
  - Chlorpheniramine Maleate
- Loratadine
- Fexofenadine

ANTIINFECTIVES

- **Actions:** are divided further into penicillins, cephalosporins, aminoglycosides, sulfonamides, tetracyclines, monobactam, erythromycins, quinolones and all act to inhibit the growth and/or replication of susceptible bacteria
- **Uses:** Infection
- **Examples:**
  - Penicillin
  - Cephalexin
  - Gentamicin
  - Azithromycin
  - Erthromycin
  - Ciprofloxacin
  - Tetracycline

ANTINEOPLASTICS

- **Actions:** interfere with DNA, RNA synthesis or by affecting the hormones associated with tumor growth
- **Uses:** Tumors, lymphoma, leukemia and Hodgkin's disease
- **Examples:**
  - Fluorouracil
  - Cisplatin
  - Taxol®
− Doxorubicin
− Mitomycin

ANTIPARKINSON AGENTS

• *Actions*: block acetylcholine or activate dopamine receptors
• *Uses*: Parkinson's disease
• *Examples*:
  − Levodopa
  − Entacapone
  − Selegiline
  − Ropinirole

ANTIPSYCHOTIC AND NEUROLEPTIC AGENTS

• *Actions*: Multiple pharmacological agents that block the dopamine receptors in the brain, the area that involves psychotic behavior
• *Uses*: Schizophrenia, mania, paranoia, and anxiety. They are also sometimes used for unrelieved hiccups, nausea, vomiting, and pediatric behavioral problems as well as pre-operative relaxation.
• *Examples*:
  − Haloperidol
  − Chlorpromazine
  − Olanzapine
  − Risperidone
  − Aripiprazole
  − Quetiapine
ANTITUBERCULARS

- **Actions:** Decreases the replication of the offending bacillus through the inhibition of RNA or DNA
- **Uses:** Pulmonary tuberculosis
- **Examples:**
  - Isoniazid
  - Rifabutin
  - Rifampin

ANTITUSSIVES and EXPECTORANTS

- **Actions:** suppression of the cough reflex or decrease the viscosity of thick, tenacious secretions
- **Uses:** The expectorants are used with a cough associated with bronchitis, TB, pneumonia, cystic fibrosis and COPD. Antitussives are used for nonproductive coughs.
- **Examples:**
  - Guaifenesin
  - Codeine
  - Dextromethorphan

ANTIVIRALS

- **Actions:** Interferes with the DNA needed for viral replication
- **Uses:** HIV infections, herpes (herpes simplex virus and herpes genitalis), encephalitis (herpes simplex) and varicella zoster encephomyelitis
- **Examples:**
− Acyclovir Sodium
− Cidofovir
− Lamivudine

BARBITURATES

- **Actions:** Decreases impulse transmission to the cerebral cortex
- **Uses:** Epilepsy, sedation, insomnia, anesthesia, cholestasis with some medications in this classification.
- **Examples:**
  - Phenobarbital
  - Secobarbital

BENZODIAZEPINES

- **Actions:** Decreases anxiety by potentiating g-aminobutyric acid and other CNS inhibitory transmitters
- **Uses:** Anxiety secondary to phobic disorders and other conditions, acute alcohol withdrawal and pre-operative relaxation.  
  
  *Suffix = “-pam”*
- **Examples:**
  - Diazepam
  - Clonazepam
  - Lorazepam
  - Oxazepam
BETA-ADRENERGIC BLOCKERS

β-Blockers are divided into two categories:

1. Selective blockers
2. Nonselective blockers

- **Actions**: block the stimulation of beta-receptors in the cardiac smooth muscle which lowers blood pressure and may reduce heart rate.
- **Uses**: Hypertension, angina prophylaxis and ventricular dysrhythmias, suffix = “-olol”
- **Examples of Medications in This Classification**:
  - Metoprolol
  - Propranolol
  - Bisoprolol

BRONCHODILATORS

- **Actions**: Work by differing mechanisms to relax the bronchial smooth muscle
- **Uses**: Asthma, bronchospasm, COPD, emphysema, Cheyne-Stokes respirations
- **Examples**:
  - Albuterol
  - Aminophylline
  - Levalbuterol

CALCIUM CHANNEL BLOCKERS

- **Actions**: Inhibits the flow of calcium ions across the cell membrane of cardiac and vascular smooth muscle, thus relaxing the coronary vascular smooth muscle, dilating the coronary arteries, slowing SA/AV node conduction, and dilating peripheral arteries.
• **Uses:** Angina, hypertension, and dysrhythmias.

• **Examples:**
  - Verapamil
  - Felodipine
  - Diltiazem

**CARDIAC GLYCOSIDES**

• **Actions:** Cardiac output and cardiac contractility are enhanced by making more calcium available

• **Uses:** CHF and tachycardia

• **Examples:**
  - Digitoxin
  - Digoxin

**CHOLINERGIC BLOCKERS**

• **Actions:** Blocks the autonomic nervous system's acetylcholine

• **Uses:** Prevention of surgical secretions, to decrease the motility of the urinary, biliary and GI tracts, reverses neuromuscular blockade. Some are used for parkinsonian symptoms secondary to the use of neuroleptic medications

• **Examples:**
  - Atropine
  - Scopolamine
  - Belladonna
CORTICOSTEROIDS

This classification is also subdivided. These groups are:

1. Glucocorticoids
2. Mineralcorticoids

- **Actions:**
  - Glucocorticoids: increase capillary permeability and decrease inflammation.
  - Mineralcorticoids: increase potassium and hydrogen excretion in the distal tubule by increasing the resorption of sodium

- **Uses:**
  - Glucocorticoids: decrease inflammation. Some are used for adrenal insufficiency, allergies and cerebral edema.
  - Mineralcorticoids: adrenal insufficiency

- **Examples:**
  - Cortisone
  - Dexamethasone
  - Hydrocortisone

DIURETICS

- **Actions:** Work in the kidney by altering electrolyte balance and increase the excretion of water as a result

- **Uses:** Hypertension and edema with CHF

- **Examples:**
  - Furosemide
  - Hydrochlorothiazide
  - Spironolactone
HISTAMINE H2 ANTAGONISTS

- **Actions:** Inhibits histamine in the stomach, thereby inhibiting the secretion of gastric acid secretion
- **Uses:** Gastric and duodenal ulcers, gastroesophageal reflux disease (GERD)
- **Examples:**
  - Cimetidine
  - Ranitidine

IMMUNOSUPPRESSANTS

- **Action:** Inhibits lymphocytes
- **Uses:** Prevention of organ transplant rejection
- **Examples:**
  - Cyclosporine
  - Azathioprine

LAXATIVES

- **Actions:** Work by increasing water retention, speeding up intestinal contractions, or reducing the surface tension
- **Uses:** Constipation, as a bowel prep and a stool softener
- **Examples:**
  - Psyllium
  - Docusate Sodium
  - Magnesium Hydroxide
− Mineral Oil
− Bisacodyl

NITRATES

• **Actions:** dilate coronary arteries, decrease preload and afterload

• **Uses:** Angina. Calcium channel blockers and β-blockers can also be used for hypertension and dysrhythmias

• **Examples:**
  − Nitroglycerin
  − Isosorbide Dinitrate
  − Isosorbide Mononitrate

NONSTERoidal ANTIINFLAMMATORIES (NSAIDs)

• **Actions:** Decreases prostaglandin synthesis

• **Uses:** Mild to moderate pain, arthritis and dysmenorrhea

• **Examples:**
  − Ibuprofen
  − Naproxen
  − Diclofenac

OPIOID ANALGESICS

• **Actions:** Depression of the pain impulse transmission at the level of the spinal cord

• **Uses:** Moderate to severe pain

• **Examples:**
- Codeine
- Fentanyl
- Morphine
- Oxycodone
- Hydrocodone
- Hydromorphone

**SALICYLATES**

- **Actions:** Antipyretic (inhibits the heat regulation center in the hypothalamus), anti-inflammatory (inhibits prostaglandin), analgesic (inhibits prostaglandin)
- **Uses:** Mild to moderate pain, inflammation (arthritis), fever, and thromboembolic disorders
- **Examples:**
  - Aspirin
  - Salsalate

**THROMBOLYTICS**

- **Actions:** Break down blood clots
- **Uses:** Pulmonary emboli, deep vein and arterial thrombosis, with or after MI, arteriovenous cannula occlusion
- **Examples:**
  - Streptokinase
  - Urokinase
THYROID MEDICATIONS

- **Actions:** Increase metabolism cardiac output, blood volume, oxygen consumption, and respiratory rate
- **Uses:** Thyroid replacement
- **Examples:**
  - Thyroid
  - Levothyroxine
# Chapter Six

## Top 100 Drugs

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<th>Generic Name</th>
<th>Trade Name</th>
<th>Classification</th>
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<tbody>
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<td>1</td>
<td>Hydrocodone w/ Acetaminophen</td>
<td>Vicodin®, Lorcet®</td>
<td>Opiate Agonist</td>
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<tr>
<td>2</td>
<td>Lisinopril</td>
<td>Zestoretic®, Prinzide®</td>
<td>ACE Inhibitor</td>
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<td>Simvastatin</td>
<td>Zocor®</td>
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<td>Amoxicillin</td>
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<td>Macrolide</td>
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<td>Hydrochlorothiazide</td>
<td>Microzide®, Esidrix®</td>
<td>Thiazide Diuretic</td>
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<td>Amlodipine</td>
<td>Norvasc®</td>
<td>Calcium Channel Blocker</td>
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<td>Alprazolam</td>
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<td>Metformin</td>
<td>Glucophage®</td>
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<td>Atorvastatin</td>
<td>Lipitor®</td>
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<td>Omeprazole</td>
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<td>Atenolol</td>
<td>Tenormin®</td>
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<td>Furosemide oral</td>
<td>Lasix®</td>
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<td>Metoprolol tartrate</td>
<td>Lopressor®, Toprol®</td>
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<td>Zolpidem tartrate</td>
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<td>Metoprolol succinate</td>
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<td>Oxycodone w/ Acetaminophen</td>
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<td>Esomeprazole</td>
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<td>22 Ibuprofen</td>
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<td>Conjugated Estrogen</td>
<td>Premarin® tabs</td>
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<td>95</td>
<td>Isosorbide mononitrate</td>
<td>Imdur®, Ismo®, Monoket®</td>
<td>Vasodilator</td>
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<td>Cefdinir</td>
<td>Omnicef®</td>
<td>Cephalosporin</td>
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<td>100</td>
<td>Metformin ER</td>
<td>Fortamet®</td>
<td>Biguanide</td>
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* Source: SDI/Verispan, VONA, full year 2009.
Chapter Seven
Common Pharmaceutical Terms and Abbreviations

There are many pharmacy and medical words and abbreviations medical professionals use when writing prescriptions. It is essential pharmacy technicians understand the meaning of these vocabulary terms and abbreviations to ensure both accuracy and patient safety. This chapter provides examples of some of the most common terms and abbreviations used in the pharmacy setting, though it is not intended to be all-inclusive.

Terms

<table>
<thead>
<tr>
<th>Terms</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Blending</td>
<td>The process of combining two substances.</td>
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<tr>
<td>Cardiovascular system</td>
<td>Carries blood through the body using arteries, capillaries and veins.</td>
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<tr>
<td>Clarity</td>
<td>Free of foreign particles, usually achieved through filtration.</td>
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<tr>
<td>Controlled substances</td>
<td>Drugs which may have the potential to be misused or abused and for which distribution is controlled by one of five schedules.</td>
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<tr>
<td>Diluent</td>
<td>A fluid that creates a less concentrated or viscous mixture; the fluid dilutes the mixture. Diluents are also used to turn dry substances into liquids.</td>
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<tr>
<td>Dilution</td>
<td>The extent to which the concentration of a mixture is reduced.</td>
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<tr>
<td>Dilution ratio</td>
<td>The number of parts of an active ingredient to the number of parts of an inactive ingredient. For example, a 1:2 ratio means that of 3 total parts, 1 part is active and two parts are inactive.</td>
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<tr>
<td><strong>Displacement:</strong></td>
<td>The process that increases the volume of fluid when liquid is added to a solid (like powder) or another liquid.</td>
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<tr>
<td><strong>Drug classifications:</strong></td>
<td>The organization of drugs that have common properties.</td>
</tr>
<tr>
<td><strong>Emulsion:</strong></td>
<td>Unstable systems made up of two or more unmixable (immiscible) liquids.</td>
</tr>
<tr>
<td><strong>Endocrine system:</strong></td>
<td>The system of glands that secret hormones.</td>
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<tr>
<td><strong>Extemporaneous compounding:</strong></td>
<td>Preparation of a drug using a prescription, formula or recipe.</td>
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<tr>
<td><strong>Female reproductive system:</strong></td>
<td>Creates hormones such as progesterone and estrogen, controls menstruation and childbirth.</td>
</tr>
<tr>
<td><strong>Flocculating agents:</strong></td>
<td>Electrolytes used when preparing suspensions.</td>
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<tr>
<td><strong>Formulations:</strong></td>
<td>The products that contain drugs. There are multiple drug formulations as well as routes to administer them.</td>
</tr>
<tr>
<td><strong>Gastrointestinal (GI) tract:</strong></td>
<td>The organs used to absorb nutrients and digest food.</td>
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<tr>
<td><strong>Generics:</strong></td>
<td>After a brand-name drug’s patent expires, any manufacturer can copy the drug formula and sell it under its pharmaceutical or generic name.</td>
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<tr>
<td><strong>Geometric dilution:</strong></td>
<td>Mixing two powders of different sizes during which the smaller portion of powder is diluted by additions of the larger portion.</td>
</tr>
<tr>
<td><strong>Intravenous formulations:</strong></td>
<td>Drugs that are administered directly into the blood supply via a vein. They are typically water based (aqueous) but they can also contain non-aqueous solvents such as glycols or alcohols.</td>
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<tr>
<td><strong>Isotonicity:</strong></td>
<td>Isotonic solutions have the same concentration as red blood cells; isotonic IV solutions help keep patient discomfort and the damage to red blood cells at a minimum. The larger the volume of solution intended for injection, the closer the parenteral preparation needs to be to isotonicity.</td>
</tr>
<tr>
<td><strong>Levigation:</strong></td>
<td>Grinding a powdered drug with a solvent with which the drug is insoluble in order to reduce the drug’s particle size.</td>
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<tr>
<td>Local and systemic effects:</td>
<td>Local effects happen when the drug activity occurs at the site of administration, such as the skin, ears, eyes, etc.</td>
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<tr>
<td>Lymphatic system:</td>
<td>The core of the immune system. The white blood cells that defend the body against disease and bacteria are called lymphocytes.</td>
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<tr>
<td>Male reproductive system:</td>
<td>Releases the hormone testosterone and creates sperm.</td>
</tr>
<tr>
<td>Medication orders:</td>
<td>Used in place of prescription forms in institutional settings.</td>
</tr>
<tr>
<td>Meniscus:</td>
<td>Curved surface of a volume of liquid.</td>
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<tr>
<td>Muscular system:</td>
<td>The more than 600 muscles in the human body.</td>
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<tr>
<td>Pharmacology:</td>
<td>The study of drugs, their uses, application, properties and effects.</td>
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<tr>
<td>Placebos:</td>
<td>Fake medications, or inactive substances, that are used when testing the effectiveness of drugs.</td>
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<tr>
<td>Reconstitution:</td>
<td>To add a diluent like purified water or another liquid to powder to create a suspension or solution.</td>
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<td>Respiratory system:</td>
<td>Controls the intake of oxygen and the release of carbon dioxide.</td>
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<td>Route of Administration:</td>
<td>Enteral routes are oral, sublingual and rectal. Oral is the most common route of administration. Any other administration route is considered parenteral.</td>
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<tr>
<td>Signa:</td>
<td>A prescription’s directions for use.</td>
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<tr>
<td>Solute:</td>
<td>A substance to be dissolved or diluted. It is usually a solid but it can be a liquid.</td>
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<tr>
<td>Solution concentration:</td>
<td>The ratio (100 mg/100 ml, or 1:1) of a drug in quantity of solution or a fraction of percentage (1/4 strength, 25% solution.)</td>
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<tr>
<td>Sterility:</td>
<td>Substances may be made sterile via filtration, gas, radiation or by autoclave.</td>
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</table>
| pH:                        | Refers to the degree of acidity of a solution; pH can range from 0 to 14. A pH value less than 7 indicates a larger acidity, and values above 7 mean less acidity or increased alkalinity. A solution with a pH of 7 is neutral –
it is neither acid, nor alkaline. Normal human serum pH is 7.4.

**Sublingual administration:** Drugs administered by placing them under the tongue.

**Suspension:** A liquid in which fine particles are dispersed throughout. These particles are supported by the buoyancy of stirring or shaking; when a suspension is still, the particles settle.

**Synthetic drugs:** Drugs derived from new chemicals created by the reformulation of simpler chemicals.

**Trituration:** Grinding a powder into fine particles.

**Urinary tract:** Creates urine by filtering blood through the kidneys.

### Abbreviations

<table>
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<tr>
<th>Abbreviation</th>
<th>Description</th>
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<td>ac</td>
<td>Before meals</td>
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<tr>
<td>AD</td>
<td>Right ear</td>
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<td>ADR</td>
<td>Adverse drug reaction</td>
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<td>AM</td>
<td>Morning</td>
</tr>
<tr>
<td>AMP</td>
<td>Ampule</td>
</tr>
<tr>
<td>APAP</td>
<td>Acetaminophen</td>
</tr>
<tr>
<td>AS</td>
<td>Left ear</td>
</tr>
<tr>
<td>ASAP</td>
<td>As soon as possible</td>
</tr>
<tr>
<td>AU</td>
<td>Both ears</td>
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<td>AWP</td>
<td>Average wholesale price</td>
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<td>BID</td>
<td>Twice a day</td>
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<td>BM</td>
<td>Bowel movement</td>
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<td>Bolus</td>
<td>Intravenous push, one time injection</td>
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<td>BP</td>
<td>Blood pressure</td>
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<td>BS</td>
<td>Blood sugar</td>
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<td>100</td>
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<tr>
<td>CC</td>
<td>Cubic centimeter</td>
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<td>CHF</td>
<td>Congestive heart failure</td>
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<td>Comp</td>
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<td>Cr</td>
<td>Cream</td>
</tr>
<tr>
<td>d</td>
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<tr>
<td>DAW</td>
<td>Dispense as written</td>
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<td>Diagnosis</td>
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<td>Elixir</td>
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<td>Gr</td>
<td>Grain</td>
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<td>Gtt (s)</td>
<td>Drop(s)</td>
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<td>Heart pain</td>
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<td>ID</td>
<td>Intradermal</td>
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<td>Liter</td>
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<td>Liq</td>
<td>Liquid</td>
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<td>LVPB</td>
<td>Large volume piggyback</td>
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<tr>
<td>Mcg</td>
<td>Microgram</td>
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<td>MDI</td>
<td>Metered dose inhaler</td>
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<td>mEq</td>
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<td>Mg</td>
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<td>ml</td>
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<td>MOM</td>
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<td>MRx1</td>
<td>May repeat once</td>
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<td>Multivitamin</td>
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<tr>
<td>NG</td>
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<td>NKA</td>
<td>No known allergies</td>
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<tr>
<td>NPO</td>
<td>Nothing by mouth</td>
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<td>No refills</td>
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<td>Nonsteroidal Anti-Inflammatory Drug</td>
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<td>Nitroglycerin</td>
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<td>N/V</td>
<td>Nausea and vomiting</td>
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<td>O</td>
<td>Orally</td>
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<td>Right eye</td>
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<td>Left eye</td>
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<td>Every morning</td>
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<td>Every day</td>
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<td>Four times daily</td>
</tr>
<tr>
<td>Q ____ H</td>
<td>Every ____ hour</td>
</tr>
<tr>
<td>QNOC</td>
<td>Every night</td>
</tr>
<tr>
<td>Qs</td>
<td>Sufficient quantity</td>
</tr>
<tr>
<td>QOD</td>
<td>Every other day</td>
</tr>
<tr>
<td>Sc</td>
<td>Subcutaneous</td>
</tr>
<tr>
<td>SI</td>
<td>Sublingual</td>
</tr>
<tr>
<td>SOB</td>
<td>Shortness of breath</td>
</tr>
<tr>
<td>Soln</td>
<td>Solution</td>
</tr>
<tr>
<td>SOS</td>
<td>If there is need</td>
</tr>
<tr>
<td>Abbr.</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Stat</td>
<td>Immediately</td>
</tr>
<tr>
<td>Sub Q</td>
<td>Subcutaneous</td>
</tr>
<tr>
<td>Supp</td>
<td>Suppository</td>
</tr>
<tr>
<td>Susp</td>
<td>Suspension</td>
</tr>
<tr>
<td>Syr</td>
<td>Syrup</td>
</tr>
<tr>
<td>Tab</td>
<td>Tablet</td>
</tr>
<tr>
<td>TAC</td>
<td>Triamcinolone</td>
</tr>
<tr>
<td>Tbl</td>
<td>Tablespoon</td>
</tr>
<tr>
<td>TID</td>
<td>Three times daily</td>
</tr>
<tr>
<td>Tinct, Tr</td>
<td>Tincture</td>
</tr>
<tr>
<td>TKO</td>
<td>To keep open</td>
</tr>
<tr>
<td>Top</td>
<td>Topical</td>
</tr>
<tr>
<td>TPN</td>
<td>Total parenteral nutrition</td>
</tr>
<tr>
<td>TRA</td>
<td>To run at</td>
</tr>
<tr>
<td>Tsp</td>
<td>Teaspoon</td>
</tr>
<tr>
<td>U</td>
<td>Unit</td>
</tr>
<tr>
<td>Ud</td>
<td>Use as directed</td>
</tr>
<tr>
<td>UD</td>
<td>Unit dose</td>
</tr>
<tr>
<td>Ung</td>
<td>Ointment</td>
</tr>
<tr>
<td>USP</td>
<td>U.S. Pharmacopeia</td>
</tr>
<tr>
<td>UTI</td>
<td>Urinary tract infection</td>
</tr>
<tr>
<td>Vag</td>
<td>Vaginal</td>
</tr>
<tr>
<td>W/A</td>
<td>While awake</td>
</tr>
</tbody>
</table>
Chapter Eight
Pharmacy Calculations

Pharmacy technicians must calculate dosages and make conversions quickly and accurately. To do so, you need to understand weights and measures as well as the math behind pharmacy calculations. An understanding of pharmacy math and calculations is essential for success on the pharmacy technician certification exam.

Numeric Systems

The basic numeric system you use in everyday life is called the Arabic system; it is made up of the figures 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9. You have probably seen Roman numerals used in copyrights and other places – the Superbowl, for example. In the Roman style, eight letters are used to designate numbers.

Pharmacies may still use a system of measurement known as the apothecaries' system. This method utilizes Roman numerals instead of Arabic numerals, and you need to understand the difference between the two and how to convert them.

Arabic & Roman Conversions

<table>
<thead>
<tr>
<th>Arabic</th>
<th>Roman</th>
</tr>
</thead>
<tbody>
<tr>
<td>½</td>
<td>ss</td>
</tr>
<tr>
<td>1</td>
<td>I or i</td>
</tr>
<tr>
<td>5</td>
<td>V or v</td>
</tr>
<tr>
<td>10</td>
<td>X or x</td>
</tr>
<tr>
<td>50</td>
<td>L or l</td>
</tr>
<tr>
<td>100</td>
<td>C or c</td>
</tr>
</tbody>
</table>
Roman numerals have different rules than Arabic numerals. For example, when a letter is repeated, the value of that symbol is also repeated.

### Examples

<table>
<thead>
<tr>
<th>Arabic</th>
<th>Roman</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>D or d</td>
</tr>
<tr>
<td>1000</td>
<td>M or m</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>XX</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>(10 + 10)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MM</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1000 + 1000)</td>
<td></td>
</tr>
</tbody>
</table>

You may not repeat a letter more than three times, and the symbols V, L and D are never repeated.

If a smaller number is placed in front of a larger number, it is subtracted. Conversely, when a smaller number comes after a larger number, it is added.

### Examples

<table>
<thead>
<tr>
<th>Arabic</th>
<th>Roman</th>
</tr>
</thead>
<tbody>
<tr>
<td>IX</td>
<td>9</td>
</tr>
<tr>
<td>(10 - 1)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>XI</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>(10 + 1)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CM</th>
<th>900</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1000 - 100)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MC</th>
<th>1100</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1000 + 100)</td>
<td></td>
</tr>
</tbody>
</table>
Variables and Fractions

When you're performing a pharmacy calculation, you may need to find an unknown quantity, called a variable. While you may use any letter of the alphabet to signify a variable, the letter “x” is often used.

For example, you may have a prescription for 120 ml of Robitussin DM® liquid that you need to convert to ounces. Therefore, x ounces is equal to 120 ml. As another example, a patient has a prescription for Amoxicillin 250 mg and they are instructed to take one capsule orally twice a day for 10 days. You need to calculate how many doses, (x), are necessary to fill the prescription.

A fraction is a part of a whole number. A common fraction is an expression of division where one number is placed over another number. Examples include ¼ and 2/3.

The denominator is the bottom number of a fraction while the numerator is the top number. The denominator stands for the total number of parts that the whole number is divided into. For example, in ¾, the whole number is divided into 4 parts. The numerator signifies how many of those parts you need to work with.

**Decimal Fractions**

<table>
<thead>
<tr>
<th>Example</th>
<th>Parts to work with (Numerator)</th>
<th>Total number of parts (Denominator)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

Decimals are simply fractions that have a denominator that is a multiple of 10, such as 10, 100, 1000 or 10,000. Decimal fractions are different than other fractions because they show the denominator by using a decimal point placed to the left of the numerator.
The first place to the right of the decimal is tenths, the second place is hundredths, the third is thousandths, the fourth is ten thousandths and so on.

<table>
<thead>
<tr>
<th>Tenths</th>
<th>Hundredths</th>
<th>Thousandths</th>
<th>Ten Thousandths</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.3 = 3/10</td>
</tr>
<tr>
<td>0.133</td>
<td></td>
<td></td>
<td></td>
<td>0.133 = 133/1000</td>
</tr>
</tbody>
</table>

**Measurement**

There are three primary units used in the metric system:

- **Meter** – measures length
- **Liter** – measures volume
- **Gram** – measures weight

In the metric system, each primary unit is subdivided by a multiple of ten. The prefix of each unit identifies what part of the unit to consider. For example:

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kilo</td>
<td>1000 or one thousand</td>
</tr>
<tr>
<td>Centi</td>
<td>1/100 or 0.01 or one hundredth</td>
</tr>
<tr>
<td>Milli</td>
<td>1/1000 or 0.001 or one thousandth</td>
</tr>
<tr>
<td>Micro</td>
<td>1/1000000 or 0.000001 or one millionth</td>
</tr>
</tbody>
</table>

If you want to multiply a metric unit by 10, move the decimal one place to the right for each zero in the multiplier. When dividing by 10, move the decimal one place to the left for each zero in the multiplier.
When doing conversions within the metric system a helpful hint is to think of the alphabet. When moving from the letter G to M in the alphabet you are moving to the right. Therefore, when converting Grams to Milligrams, move the decimal 3 places to the right. When moving a decimal where no number exists, just add zeros.

Example

\[
\begin{align*}
2.5 \text{ GM} &= 2.500 = 2500 \text{ MG} \\
&\rightarrow
\end{align*}
\]

When converting Milligrams to Grams move the decimal point 3 places to the left, just as moving from the letter M to G in the alphabet you move to the left.

Example

\[
\begin{align*}
200 \text{ MG} &= 200. = 0.200 \text{ GM} \\
&\leftarrow
\end{align*}
\]

When converting milligrams to micrograms move the decimal point 3 places to the right, just as moving from the letter I to O in the alphabet you move to the right.

Example

\[
\begin{align*}
1.5 \text{ MG} &= 1.500 = 1500 \text{ MCG} \\
&\rightarrow
\end{align*}
\]

When converting micrograms to milligrams move the decimal point 3 places to the left, just as moving from the letter O to I in the alphabet you move to the left.

Example

\[
\begin{align*}
100 \text{ MCG} &= 100. = 0.100 \text{ MG} \\
&\leftarrow
\end{align*}
\]
When you work with metric units, there are some important procedures to follow.

1. Write the number before the abbreviation
2. Use a zero before the decimal when the fraction is less than 1. For example, 0.150 instead of .150. Without the zero, the fraction may be misread.
3. Do not use a zero after the decimal if working with whole numbers. So write 15, but not 15.0 – which could be misread as 150.
4. Convert decimals to show fractions when using metric measurement

*Apothecaries' and Avoirdupois Systems*

While both systems are used less and less, there are still times when a pharmacy or health care provider may use them. It’s a good idea to have a familiarity with the systems in the event you need to make conversions to the metric system. The following conversion table contains the primary units that may appear on the exam.

**Conversions to Memorize**

<table>
<thead>
<tr>
<th>Weight</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 gram (g)</td>
<td>30 milliliters (mL)</td>
</tr>
<tr>
<td>1 grain (gr)</td>
<td></td>
</tr>
<tr>
<td>1 pound (lb)</td>
<td>16 fluid ounces/480 mL</td>
</tr>
<tr>
<td>1 kilogram (kg)</td>
<td></td>
</tr>
<tr>
<td>1 ounce (oz)</td>
<td></td>
</tr>
</tbody>
</table>

- 15.4 grains (gr)
- 65 milligrams (mg)/0.065 grams (g)
- 454 grams (g)/0.454 kilograms (kg)
- 2.2 pounds (lb)/ (1000/454 = 2.2)
- 28.4 grams (g)/ (454 grams/16 = 28.4 grams)
### Household Measurements

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Equivalent (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 gallon</td>
<td>3840 mL</td>
</tr>
<tr>
<td>1 teaspoonful (tsp)</td>
<td>5 mL</td>
</tr>
<tr>
<td>1 tablespoonful (tbsp)</td>
<td>15 mL</td>
</tr>
<tr>
<td>1 fluid ounce (oz)</td>
<td>30 mL</td>
</tr>
<tr>
<td>1 pint (pt)</td>
<td>480 mL</td>
</tr>
</tbody>
</table>

### Ratio and Proportions

A **ratio** describes the relationship between two amounts. For example, ½ or 2/4. It also describes how to amounts relate to one another, i.e. 1 is to 2 or 2 is to 4. A **proportion** is made up of two equal ratios. For example, k/l = m/n.

Once you know how to calculate a ratio or proportion problem, you can easily solve many pharmacy technician calculations.

#### Rules for Using Ratio and Proportion

- You must know three of the four values.
- The numerators and denominators must have the same units.

\[
\frac{\text{Numerator}}{\text{Denominator}} = \frac{\text{Numerator}}{\text{Denominator}}
\]

Or

\[
\frac{1 \text{ bottle}}{20 \text{ tablets}} = \frac{3 \text{ bottles}}{60 \text{ tablets}}
\]
If one bottle is equal to 20 tablets, then 3 bottles is equal to 60 tablets.

As long as 3 of the four values are known, the fourth value can be determined.

**Example**

If one bottle contains 120 mls, how many mls are contained in 3 equal bottles?

1) Set up the problem in a ratio using the equation \( have = want \).

\[
\begin{align*}
\text{(Have) } & \quad \text{(Want)} \\
1 \text{ bottle} & \quad 3 \text{ bottles} \\
120 \text{ ml} & \quad X \text{ ml}
\end{align*}
\]

\( X \) is the unknown variable that needs to be solved

2) Cross multiply

\[
1 \times X = 120 \times 3
\]

\( 1 \times X = 360 \)

3) Divide to determine \( X \)

\[
X = 360 \text{ divided by } 1
\]

\( X = 360 \text{ (mls)} \)

3 bottles would contain 360ml
Solving proportion problems

1. Set up your problem with the same units on the top and the same units on the bottom using the equation \((\text{have} = \text{want})\).

2. Cross multiply

3. Divide to determine \(X\)

Concentrations

The amount of active drug in a specified volume is called the concentration. Concentrations are described in terms of weight to volume or volume to volume.

**Weight to volume:** grams per milliliters \(\text{g/mL}\)

**Volume to volume:** milliliters per milliliters \(\text{mL/mL}\)

**Example:** Azithromycin 200mg/5ml 15 ml bottle. The active drug Azithromycin has a concentration of 200mg active drug per 5 ml of liquid.

A concentration indicates the information you have when setting up a proportion using the \(\text{have} = \text{want}\) equation.

Example: For the Azithromycin 200 mg/5ml 15 ml bottle how many milliliters are needed for a 100mg dose?

To solve the problem, you again use the equation \(\text{have} = \text{want}\).

*Have* is your concentration and want is your variable.
1) Set up the problem in a ratio using the equation \((\text{have} = \text{want})\).

\[
\frac{200 \text{ mg}}{5 \text{ ml}} = \frac{100 \text{ mg}}{X \text{ ml}}
\]

\(X\) is the unknown variable that needs to be solved.

2) Cross multiply

\[
200 \times X = 5 \times 100
\]

\[
200 \times X = 500
\]

3) Divide to determine \(X\)

\[
X = \frac{500}{200}
\]

\[
X = 2.5 \text{ (mls)}
\]

The 100mg dose would require 2.5ml of the 200mg per 5ml suspension.

Another way to describe a concentration is \(-\) : \(-\), where the first blank would represent the amount of active drug and the second blank would represent the indicated volume.

For example \(1 : 5000\) would be read as “1 to 5000” and defined as 1 gram in 5000 grams or milliliters.

Setting up your problem would be just like above where the concentration represents what you \textit{have} when using the \(\text{have} = \text{want}\) equation.

\textbf{Example:} How many grams of active drug would be contained in 250 ml of a 1:400 solution?

To solve the problem, you again use the equation \(\text{have} = \text{want}\).
Have is your concentration and want is your variable.

1) Set up the problem in a ratio using the equation \((\text{have} = \text{want})\).

\[
\frac{1 \text{ gram}}{400 \text{ ml}} = \frac{X \text{ gram}}{250 \text{ ml}}
\]

\(X\) is the unknown variable that needs to be solved.

2) Cross multiply

\[
400 \times X = 1 \times 250
\]

\[
400 \times X = 250
\]

3) Divide to determine \(X\)

\[
X = \frac{250}{400}
\]

\[
X = 0.625 \text{ (grams)}
\]

There are 0.625 grams of active drug in the 250ml of solution.

**Percents**

Indicated by the % symbol, a percentage is typically shown as a fraction, but the denominator is always 100.

When describing a **liquid volume** percent always means grams of the active drug over **100 milliliter** (ml).
When describing a **topical volume** it means **grams** of the active drug over **100 grams** (g).

25% would mean 25 grams of active drug in either 100 mls or grams.

**Example:** What is the percentage strength of a 1:400 solutions?

To solve the problem, you again use the equation *have = want*.

*Have* is your concentration and *want* is your variable.

1) Set up the problem in a ratio using the equation \((\text{have} = \text{want})\).

\[
\begin{align*}
(\text{Have} & = \text{Want}) \\
1 \text{ gram} & = X \text{ gram} \\
400 \text{ ml} & = 100 \text{ ml}
\end{align*}
\]

\(X\) is the unknown variable that needs to be solved.

2) Cross multiply

\[
400 \times X = 1 \times 100
\]

\[
400 \times X = 100
\]

3) Divide to determine \(X\)

\[
X = 100 \text{ divided by } 400
\]

\[
X = 0.25 \text{ (grams)}
\]

There are 0.25 grams of active drug per 100ml of solution.

The percent strength would then be 0.25%
Flow Rate/Rate of Administration

You may need to calculate the flow rate or the rate of administration for an IV solution. To do so, you use a ratio and proportion equation. Typically you calculate the rate in the number of milliliters per hour (ml/hour), but if a pump is to be used to dispense the IV fluid, you may need to use ml/min or even gtt/min (drops per minute). To find drops per minute you will first calculate the ml/min and then use a “drop factor” to convert milliliters to drops.

**Example:** D5½NS 1000ml is to run over 8 hours. How many drops per minute would the pump be set at if the drop factor is 12 drops per milliliter?

To solve the problem, you again use the equation \( \text{have} = \text{want} \).

\( \text{have} \) is your ml over hours and \( \text{want} \) is your ml over minutes.

1) Set up the problem in a ratio using the equation \( \text{have} = \text{want} \).

\[
\frac{\text{Have}}{\text{Want}} = \frac{\text{1000 ml}}{\text{X ml}} = \frac{\text{8 hours}}{\text{1 minute}}
\]

\( X \) is the unknown variable that needs to be solved

Note that the bottom units do not match so the hours needs to be changed to minutes

\[
\frac{\text{Have}}{\text{Want}} = \frac{\text{1000 ml}}{\text{X ml}} = \frac{\text{480 minutes}}{\text{1 minute}}
\]
2) Cross multiply

\[ 480 \times X = 1 \times 1000 \]

\[ 480 \times X = 1000 \]

3) Divide to determine X

\[ X = \frac{1000}{480} \]

\[ X = 2.08 \text{ ml} \]

The rate is 2.08 ml per minute.

To convert to drops per minute simply multiply by the drop factor (12 gtts/ml)

\[ 2.08 \text{ ml} \times 12 \text{ drops/ml} = 24.96 \text{ drops per minute} \]

The pump would be set at 25 drops per minute to infuse the 1000ml bag over 8 hours.

**Alligations**

If the desired percentage concentration of a solution, ointment, or cream is unavailable, it may be compounded by mixing a more concentrated and a less concentrated formula to obtain the desired strength. To determine the number of parts or proportions of each the alligation method may be used. Alligations are sometimes referred to as “Tic-Tac-Toe” problems because the formula has a resemblance to the game’s pattern. The following example demonstrates the mixing of two IV solutions but keep in mind the alligation method will also work for creams and ointments as well.

A prescription order requires 35% dextrose solution in 1 liter (1000ml), and the pharmacy stocks 70% and 20% dextrose solution; how much of the 70% solution will you use to fill the order?
To solve the problem, begin by drawing your “tic-tac-toe” grid:

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Insert the larger formulation in the top left corner; the smaller in the bottom left corner, and the desired amount in the center square.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td></td>
</tr>
<tr>
<td></td>
<td>35</td>
</tr>
<tr>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

Subtract the center square from each corner box. So, 70% minus 35% equals 35, and 20% minus 35% equals 15 (even though it is a negative number, only use positives with allegations.)

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>35</td>
</tr>
<tr>
<td>20</td>
<td>35</td>
</tr>
</tbody>
</table>
Now you know how many parts of each formula you need to use to get the appropriate amount.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>15 Parts of the 70% Soln</td>
</tr>
<tr>
<td>35</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>35 Parts of the 20% Soln</td>
</tr>
<tr>
<td>35</td>
<td></td>
</tr>
</tbody>
</table>

Add the two right-hand boxes together and you have the number of total parts.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>15 Parts of the 70% Soln</td>
</tr>
<tr>
<td>35</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>35 Parts of the 20% Soln</td>
</tr>
<tr>
<td>50</td>
<td>50 Total Parts</td>
</tr>
</tbody>
</table>
Now that the proportional parts have been determined, the quantities of the higher and lower concentrated solutions may be calculated by setting each equal to $X$ divided by the total quantity of the preparation to compounded. Cross multiply and divide to find $X$.

\[
\begin{align*}
\text{Quantity of Higher} & \quad \frac{\# \text{ Parts of Higher}}{\# \text{ Total Parts}} = \frac{X}{\text{Total Quantity to be Compounded}} \\
\text{Quantity of Lower} & \quad \frac{\# \text{ Parts of Lower}}{\# \text{ Total Parts}} = \frac{X}{\text{Total Quantity to be Compounded}}
\end{align*}
\]

70% Dextrose

\[
\frac{15}{50} = \frac{X}{1000 \text{ ml}} \quad X = 300 \text{ ml}
\]

20% Dextrose

\[
\frac{35}{50} = \frac{X}{1000 \text{ ml}} \quad X = 700 \text{ ml}
\]

To compound this prescription order, 300ml of 70% dextrose is added to 700ml of 20% dextrose to make a total of 1 liter of a 35% dextrose solution.
Useful alligation hints

- If water or an ointment base containing no medication is used to dilute then 0 (zero) is placed in the lower left hand corner of the “tic-tac-toe” grid.

- Always check your answer by adding together the quantity of each component to make sure it adds up to the total quantity required. (From prior example the 700ml + 300ml = the 1000ml total required quantity)

Business Math

Typical math requirements in a retail setting include addition, subtraction and percentages. Pharmacy technicians may be called upon to do mark-ups or discounts on products, as well as bookkeeping calculations. An understanding of the following business concepts and examples will be beneficial in completing the certification exam.

**Overhead** The cost of doing business

**Gross Profit** The difference between the purchase price and the selling price.

\[
Selling\ Price - Purchase\ Price = Gross\ Profit
\]

$250,000 (sales) - $60,000 (cost of goods) = $190,000 (gross profit)

**Net Profit** The amount of money that remains after the cost of purchasing, handling, storing, selling of the drug. This cost is subtracted from the selling price to derive the net profit.

\[
Selling\ Price - (Purchase\ Price + Overhead) = Net\ Profit
\]

$250,000 (sales) – [$60,000 (cost of goods) + $30,000 (overhead)] = $160,000 (net profit)
**Markup**  The difference between the purchase price and the selling price.

*Selling Price – Purchase Price = Markup*

$119 (selling price) - $90 (purchase price) = $29 (markup)

*Markup/Cost = Markup Rate*

$29 (markup) / $90 (cost) = 32.2% (markup rate)

**Discount**  The reduced price, or a deduction from the amount due.

**AWP**  The average wholesale price of a drug or device.

*Acquisition Cost = AWP – Discount*
Chapter Nine
Practice Tests and Answers

Practice Test #1

1. The form for ordering Schedule II drugs is:
   a. DEA Form 122
   b. DEA Form 200
   c. DEA Form 212
   d. DEA Form 222

2. Which of the following lipoproteins is considered “good cholesterol”?
   a. low density lipoproteins (LDL)
   b. high density lipoproteins (HDL)
   c. triglycerides
   d. none of the above

3. A bottle has the labeled strength of 1/200 grains. What would this be in milligrams?
   a. 0.3mg
   b. 3 mg
   c. 30 mg
   d. 300 mg
4. If you are working in a community Pharmacy setting, you will have a refrigerator to store medications that require a storage temperature of
   a. -10 - 0 degrees Celsius
   b. 0 - 1 degrees Celsius
   c. 2 - 8 degrees Celsius
   d. 4 - 8 degrees Celsius

5. What auxiliary label should you use for this particular sig; ii gtts OU bid
   a. for the ear
   b. for the eye
   c. take with meals
   d. avoid alcohol

6. Which of the following deals with the sale of certain drugs that have a potential for abuse?
   a. Controlled Substance Act
   b. Federal Hazardous Substances Act
   c. Orphan Drug Act
   d. FDA Modernization Act

7. The exact metric weight of sixteen ounces is
   a. 154 grams
   b. 380 grams
   c. 454 grams
   d. 580 grams
8. Of the following schedules, which one deals with drugs that have an accepted medical use and a high potential with severe psychic or physical dependence liability?
   a. Schedule I
   b. Schedule II
   c. Schedule III
   d. Schedule IV

9. With a Class A Prescription Balance
   a. the final measurement should be determined with the cover up
   b. the weight goes on the left pan and the material goes on the right pan
   c. the weight goes on the right pan and the material goes on the left pan
   d. the weights are made of plastic

10. The MSDS (Material Safety Data Sheet)
    a. provides information concerning hazardous substances
       b. provides information for fire drills
       c. provides information in the event of a natural disaster
       d. none of the above

11. What is the correct expiration date for this drug if the container states: 11/2011
    a. 11/01/2011
    b. 11/30/2011
    c. 10/31/2011
    d. 12/31/2011
12. You are due to receive a 5% refund from your pharmacy invoice totaling $11,352. What approximate amount of refund should you receive?
   a. $368.00
   b. $468.00
   c. $568.00
   d. $668.00

13. According to the Poison Prevention Packaging Act (PPPA), which of the following medications would not need a safety cap?
   a. Nitrostat®
   b. Viroptic®
   c. Zantac®
   d. Amoxil®

14. Hospital pharmacies are required to follow regulations governed by which of the following organization?
   a. ASCP
   b. JCAHO
   c. USP
   d. ASHP

15. What type of infection is known as a “hospital borne” infection?
   a. infectious
   b. air borne
   c. nosocomial
   d. superinfection
16. The Omnibus Budget Reconciliation Act (OBRA) in 1990, helped in requiring
   a. the counseling of patients by pharmacists
   b. the Controlled Substance Act
   c. established pharmacy budgets
   d. inventory management

17. Furosemide is used as a
   a. sedative
   b. diuretic
   c. anti-inflammatory agent
   d. an analgesic

18. What does the following order mean: ii gtts AU tid
   a. two drops in each eye three times a day
   b. two drops in each ear three times a day
   c. two drops in each eye two times a day
   d. two drops in each ear two times a day

19. Most drugs are metabolized by the
   a. gall bladder
   b. kidney
   c. liver
   d. heart
20. **Ativan® is the same as**
   a. enalapril
   b. fluoxetine
   c. lisinopril
   d. lorazepam

21. **When a liquid formulation is dissolved completely and does not appear cloudy in nature, we call this liquid a**
   a. suspension
   b. emulsion
   c. solution
   d. gel

22. **The cost of 60 grams of Fluocinolone 0.025% ointment is $12.75. What would be the cost of 15 grams?**
   a. $2.25
   b. $3.09
   c. $3.19
   d. $4.25

23. **Zithromax® is the same as**
   a. erythromycin
   b. clarithromycin
   c. azithromycin
   d. none of the above
24. Which drug can be used as a patch
   a. Triamcinolone
   b. Estrogen
   c. Ciprofloxacin
   d. Vitamin D

25. How much diluent do you need to add to a 5 gram vial to get a concentration of 250 mg/ml? Disregard the space the powder may occupy.
   a. 12 ml
   b. 18 ml
   c. 20 ml
   d. 25 ml

26. The infusion rate of an IV is over 8 hours. The total exact volume is 500 ml. What would be the infusion rate in ml's per minute?
   a. 0.44 ml/minute
   b. 1.04 ml/minute
   c. 2.08 ml/minute
   d. 2.40 ml/minute

27. There are many types of Insulin and many forms of it. Insulins are derived synthetically or from animal sources such as pork or beef. Which of the following insulins would be considered fast acting?
   a. Lantus®
   b. NPH, lente
   c. PZI, ultralente
   d. insulin lispro
28. You have a 70% solution of Dextrose. How many kilograms of Dextrose is in 500ml of this solution?
   a. 0.12 kg  
   b. 0.35 kg  
   c. 1.2 kg   
   d. 3.5 kg  

29. The approximate size container for the dispensing of 120 ml of liquid medication would be?
   a. 2 oz.  
   b. 4 oz.  
   c. 6 oz.   
   d. 8 oz.  

30. Which of the following drugs would be used to decrease blood pressure?
   a. amiodarone  
   b. digoxin  
   c. propranolol  
   d. nitroglycerin  

31. The first set of digits of the NDC number are indicative of
   a. the lot number  
   b. package size  
   c. product identification  
   d. the manufacturer
32. A small volume intravenous bag specifically used to deliver medication is called an
   a. injection
   b. buetrol
   c. IVPB
   d. none of the above

33. Of the following class of antibiotics, which one tends to bind with metals such as calcium, aluminum, iron, and magnesium?
   a. tetracyclines
   b. sulfonamides
   c. aminoglycosides
   d. cephalosporins

34. Topical anti-infectives include antibiotics, antivirals, and antifungals. Which of the following drugs would be used as an antifungal agent?
   a. bacitracin
   b. clotrimazole
   c. polysporin
   d. valcyclovir

35. You receive a prescription for Amoxicillin 250 mg / 5 ml 100 mg QID for ten days. How many ml's do you need to fill this prescription to last the full ten days?
   a. 40 ml
   b. 60 ml
   c. 80 ml
   d. 100 ml
36. From the following directions, how many tablets should be dispensed
   1 tab po qid x 2 days, then 1 po tid x 2 days, then 1 po bid x 2 days, then dc
   a. 12
   b. 18
   c. 22
   d. 24

37. The enzyme HMG-CoA reductase is involved in the synthesis of cholesterol from fat. Which of the following drugs is considered a HMG-CoA reductase inhibitor?
   a. cholestyramine
   b. fenofibrate
   c. gemfibrozil
   d. simvastatin

38. Histamine-2 (H2) blockers such as famotidine (Pepcid®) mechanism of drug action is to block H2 receptor sites in the stomach. By doing this
   a. you increase acid secretion
   b. you inhibit acid secretion
   c. you inhibit stomach smooth muscle contraction
   d. none of the above

39. All aseptic manipulations in the Laminar Flow Hood should be preformed at least
   a. four inches within the hood
   b. six inches within the hood
   c. eight inches within the hood
   d. ten inches within the hood
40. An example of a major drug-drug interaction would be
   a. warfarin – plavix
   b. digoxin – dilitazem
   c. penicillin – cephalosporin
   d. hydrocodone – codeine

41. How many mls are needed to inject 25 units of U100 insulin
   a. 0.25
   b. 0.35
   c. 0.45
   d. 0.55

42. Of the following Group Names, which one would be used for allergies?
   a. Antiseptics
   b. Antitussives
   c. Antihistamines
   d. Antibiotics

43. The DEA number consists of 2 letters and seven digits, with the second letter corresponding to the prescriber’s
   a. last name
   b. specialty
   c. state of practice
   d. none of the above
44. Injection into the muscle tissue below the skin, is what type of injection?
   a. intradermal
   b. intramuscular
   c. intravenous
   d. subcutaneous

45. How many 30 mg KMNO4 (Potassium Permanganate) tablets are needed to make the following solution: KMNO4 1:5000 900 ml
   a. 3 tablets
   b. 4 tablets
   c. 6 tablets
   d. 8 tablets

46. How much of a D20W 1000 ml and D5W 1000 ml is needed to make a D8.5W 400 ml?
   a. 112.2 ml / 287.8 ml
   b. 104.5 ml / 295.5 ml
   c. 93.3 ml / 306.7 ml
   d. 84.6 ml / 315.4 ml

47. Which of the following is not a Schedule II Controlled Substance?
   a. Adderall®
   b. Ativan®
   c. Oxycontin®
   d. Percocet®
48. A dose is written for 5 mg/kg every 12 hours for three days. The adult to take this medication weighs 120 pounds. How much drug will be needed to fill this order?
   a. 600 mg
   b. 980 mg
   c. 1636 mg
   d. 1682 mg

49. How much NaCl is in the following IV bag:
   D 5 ½ NS 250ml (NS is 0.9% NaCl)
   a. 0.9 grams
   b. 1.25 grams
   c. 3.25 grams
   d. 8 grams

50. Of the following drugs, which one is not a chemo drug?
   a. Doxorubicin
   b. 5-Flouraracil
   c. Paclitaxel
   d. Valacyclovir

51. One pound is equal to
   a. 2.2 g
   b. 454 g
   c. 1000 mg
   d. 2200 mg
52. The mixing of calcium additive with this other additive could result in precipitation or the forming of solids in the IV admixture:
   a. calcium gluconate
   b. zinc
   c. magnesium sulfate
   d. potassium chloride

53. The drug Omeprazole is what we call a proton pump inhibitor, of the following disease states, what would this drug most likely be used for?
   a. hypertension
   b. diabetes
   c. infection
   d. gastro esophageal reflux disease

54. A patient is on the drug Ciprofloxacin. What is this patient most likely being treated for?
   a. hypertension
   b. diabetes
   c. infection
   d. gastro esophageal reflux disease

55. Of the following needles, which size of needle is least likely to cause “coring”?
   a. 13 G
   b. 16 G
   c. 20 G
   d. 23 G
56. Metered Dose Inhaler (MDI) units are used by asthmatic patients as a quick way to deliver medications via oral inhalation. Of the following products, which is available as a MDI unit?
   a. Theobromine
   b. Theophylline
   c. Ipratropium
   d. Aminophylline

57. Of the following reference sources, which one contains the manufacturers package insert?
   a. PDR
   b. Red book
   c. Remington's
   d. Facts and Comparisons

58. While working in the laminar flow hood, the major source of contamination will be:
   a. the IV bag
   b. the medication vial
   c. the individual preparing the product
   d. the syringe being used

59. In intravenous administration, a short tubing inserted into the vein to receive the IV tubing and help prevent coagulation at the site is called a
   a. heparin lock
   b. stopper needle
   c. vein plug
   d. IV attachment
60. All legend drugs require a manufacture package insert attached or inside the container. In many cases these inserts are not given to the patient. Which of the following drugs require the pharmacist to give a patient the manufacturer insert?
   a. Atenolol
   b. Conjugated Estrogens
   c. Lithium Carbonate
   d. Potassium Chloride

61. You have a prescription for a one month supply of Valacyclovir. If the doctor requests, up to how many refills can be obtained from this prescription?
   a. no refills
   b. 1 refill
   c. 6 refills
   d. 11 refills

62. Which of the following class of drug shows a cross-sensitivity to penicillin?
   a. cephalosporin
   b. fluoroquinolone
   c. macrolide
   d. tetracycline

63. For a cart exchange in the hospital setting, how many hour supply of medication is placed in the patient’s bin?
   a. 8 hours
   b. 12 hours
   c. 24 hours
   d. 36 hours
64. **Trituration is defined as**
   a. the grinding of a powder to finer particle size using a mortar and pestle
   b. the grinding of a powder to finer particle size using a mortar, pestle, and liquid
   c. the measurement involving the graduated cylinder
   d. the infusion of IV solution and IV Admixtures

65. **To ensure sterility of an IV product from bacteria, what size micron filter is needed?**
   a. 0.2 microns
   b. 0.22 microns
   c. 0.45 microns
   d. 1.0 microns

66. **How much of a 1:400 solution is needed to make a 1:1200 500 ml?**
   a. 66 ml
   b. 84 ml
   c. 167 ml
   d. 176 ml

67. **The correct size of syringe to use for a 4.5 ml dose would be what size?**
   a. 1 ml
   b. 3 ml
   c. 5 ml
   d. 10 ml

68. **Which of the following information is not needed for unit dose medication?**
   a. expiration date
b. lot number
c. manufacturer
d. patient's name

69. The more concentrated a solution, the more stable the solution
   a. True
   b. False

70. For the following IV, what would the approximate infusion rate be in gtts / minute?
   (Drop factor 13 gtts/ml)
   NS 1000 ml over 8 hours
   a. 18 gtts/min
   b. 27 gtts/min
   c. 34 gtts/min
   d. 41 gtts/min

71. You receive a bottle in milligram strength, but your prescription is for Levothyroxine gr 1/200. What is grain 1/400 equal to in milligrams?
   a. 0.05 mg
   b. 0.1 mg
   c. 0.15 mg
   d. 0.2 mg

72. In the formulation of a capsule, the strength of the capsule is
   a. the weight of the capsule itself
   b. the weight of the active ingredient
c. the weight of the dosage

d. the does to be given

73. What is the percentage strength of a 1:2000 epinephrine solution?

a. 0.05%
b. 0.25%
c. 0.5%
d. 1%

74. State regulation of pharmacies and licensing of pharmacies is done by what department?

a. Drug Enforcement Agency (DEA)
b. Food and Drug Administration (FDA)
c. State Board of Pharmacy
d. State legislature

75. Aminosyn is an Amino Acid sometimes used in TPN orders to provide protein for cellular growth and repair. An order is written for Aminosyn 2.5% 1000ml. The pharmacy only has Aminosyn 8.5% 1000ml. Using a sterile evacuated container, how do you prepare the ordered TPN?

a. add 157 ml of Aminosyn 8.5% and qs with sterile water to 1000ml
b. add 276 ml of Aminosyn 8.5% and qs with sterile water to 1000ml
c. add 294 ml of Aminosyn 8.5% and qs with sterile water to 1000ml
d. add 314 ml of Aminosyn 8.5% and qs with sterile water to 1000ml
76. Which of the following IV solutions is considered to be isotonic?
   a. 0.22% NaCL
   b. 0.45% NaCL
   c. 0.9% NaCL
   d. 2% NaCL

77. Which drug is most likely to cause a photosensitivity reaction?
   a. Levaquin®
   b. Cephalexin®
   c. Tetracycline®
   d. Cipro®

78. Which of the following medications may not be crushed?
   a. Ecotrin® 325mg
   b. Losartan® 50mg
   c. Percocet® 5/325mg
   d. Robaxin® 500mg

79. Pseudoephedrine, a common ingredient in cold medications, is contraindicated in which of the following disease states?
   a. GERD
   b. Glaucoma
   c. Hypertension
   d. Sunburn
80. A prescription is written for Penicillin VK 250mg tabs po qid for 5 days. If the patient cannot swallow tablets and requests a liquid dosage form, what volume of 250mg/5ml suspension should be dispensed?
   a. 50ml  
   b. 100ml  
   c. 150ml  
   d. 200ml

81. Lidoderm® is available in which dosage form?
   a. IV  
   b. oral  
   c. patch  
   d. topical cream

82. Amoxicillin oral suspension is stable in a refrigerator for how many days after reconstitution?
   a. 7 days  
   b. 14 days  
   c. 20 days  
   d. 30 days

83. Which of the following drugs is a benzodiazepine?
   a. Florcet®  
   b. Klonopin®  
   c. MS Contin®  
   d. Percodan®
84. The expiration date on a bottle of Furosemide 40 mg tablets states 4/12. When does this drug expire?
   a. midnight 3/31/12  
   b. midnight 4/1/12  
   c. midnight 4/30/12  
   d. midnight 5/1/12

85. The directions for use of a medication is “3 ml im prn”. What is the meaning of “im”?
   a. into the eye  
   b. into the muscle  
   c. into the skin  
   d. under the tongue

86. Normal Saline contains
   a. 0.33% NaCl  
   b. 0.45% NaCl  
   c. 0.9% NaCl  
   d. 1.9% NaCl

87. What kind of measuring device should be used to measure 4 ml of a liquid for compounding?
   a. 2 ml pipette  
   b. 5 ml beaker  
   c. 10 ml conical graduate  
   d. 10 ml cylindrical graduate
88. What volume of a 2% triamcinolone solution can be made from 10 grams of triamcinolone powder?
   a. 250 ml  
   b. 500 ml  
   c. 750 ml  
   d. 1000 ml

89. What type of prescription balance must be used for compounding 60 grams of a cream?
   a. bulk prescription balance 
   b. class A prescription balance 
   c. class B prescription balance 
   d. class C prescription balance

90. Three different drugs are needed to make a 1:3:6 120 g ointment. How much of each drug is needed?
   a. 12 g, 36 g, 72 g 
   b. 18 g, 54 g, 90 g 
   c. 30 g, 60 g, 90 g 
   d. 40 g, 60 g, 80 g
## Practice Test #1 Answers

1. d  
2. b  
3. b  
4. c  
5. a  
6. a  
7. c  
8. b  
9. c  
10. a  
11. b  
12. c  
13. a  
14. b  
15. c  
16. a  
17. b  
18. b  
19. c  
20. d  
21. c  
22. c  
23. c  
24. b  
25. c  
26. b  
27. d  
28. b  
29. b  
30. c  
31. d  
32. c  
33. a  
34. b  
35. c  
36. b  
37. d  
38. b  
39. b  
40. a  
41. a  
42. c  
43. a  
44. b  
45. c  
46. c  
47. b  
48. c  
49. b  
50. d  
51. b  
52. a  
53. d  
54. c  
55. d  
56. c  
57. a  
58. c  
59. a  
60. b  
61. d  
62. a  
63. c  
64. a  
65. b  
66. c  
67. c  
68. d  
69. b  
70. b  
71. c  
72. b  
73. a  
74. c  
75. c  
76. c  
77. c  
78. a  
79. c  
80. b  
81. c  
82. b  
83. b  
84. c  
85. b  
86. c  
87. d  
88. b  
89. b  
90. a
Practice Test #2

1. Which drug agency is responsible to regulate medical devices?
   a. DEA
   b. FDA
   c. JCAHO
   d. OSHA

2. What drug can be used for toxicity of methotrexate?
   a. Acetylcysteine
   b. Ipecac
   c. Leucovorin
   d. Taxol® injection

3. Safety in the workplace is the responsibility of what government agency?
   a. DEA
   b. FDA
   c. NDA
   d. OSHA

4. Tagamet® IV has been ordered to run at 2.5 drops/min. It contains 875 mg of Tagamet® in a total of 250 ml. How many milligrams of Tagamet® will the patient receive per hour if the set is calibrated to deliver 15 gtts/ml?
   a. 35 mg/hr
   b. 40 mg/hr
   c. 45 mg/hr
   d. 50 mg/hr
5. When dispensing ProAir HFA® Inhaler, how often must the Patient Package Insert (PPI) be included with the drug product?
   a. every other time that the prescription is dispensed
   b. every time the prescription is dispensed
   c. at the time the original prescription is dispensed
   d. there is never a time that it needs to be dispensed

6. Grinding tablets in a mortar to make a fine powder is an example of
   a. emulsification
   b. flocculation
   c. levigation
   d. trituration

7. What is the Latin abbreviation for “bedtime”?
   a. ac
   b. hs
   c. pc
   d. qd

8. A doctor prescribes Cipro® 500 mg po bid. What is wrong with this prescription?
   a. the prescription does not have a duration of therapy
   b. the prescription does not have a route of drug administration
   c. the prescription does not have directions for use
   d. the prescription does not have a drug strength
9. At what temperature should procaine penicillin G be stored?
   a. 0-4 degrees
   b. 2-8 degrees
   c. 10-20 degrees
   d. 30-40 degrees

10. A neighboring pharmacy calls for a copy of a prescription and the pharmacist is counseling a patient. What should the pharmacy technician do?
   a. Give the pharmacy the information they are requesting.
   b. Tell the pharmacy to contact the physician instead.
   c. Ask the pharmacist to take the call now.
   d. Ask the pharmacy to call back when the pharmacist is not busy.

11. Three of the following numbers are acceptable DEA numbers, which one is not?
   a. AH 1327142
   b. AH 1462136
   c. AH 2361424
   d. AH 3126426

12. How often must a laminar flow hood be checked?
   a. every month
   b. every 3 months
   c. every 6 months
   d. it does not need to be checked
13. The middle set of digits in a National Drug Code (NDC) number represents
   a. the cost of the product
   b. the manufacturer
   c. the product size
   d. the product strength and dosage form

14. What drug in a dose of 20 mg qd is used to treat edema?
   a. Dilantin®
   b. Inderal®
   c. Lasix®
   d. Pepcid®

15. What does the abbreviation “NPO” mean?
   a. allergy
   b. carcinogenic
   c. nothing by mouth
   d. take with meals

16. What ratio of 25% dextrose and 10% dextrose should be mixed to make a 20% dextrose solution?
   a. 1:1
   b. 1:2
   c. 2:1
   d. 3:1
17. The directions for use for a medication is “ii gtts ou bid”. What does “ou” mean?
   a. left eye
   b. both eyes
   c. left ear
   d. both ears

18. What size filter is considered a sterilizing filter?
   a. 0.22 micron
   b. 0.3 micron
   c. 0.45 micron
   d. 5 micron

19. How long may a schedule IV drug be refilled
   a. no refills
   b. 6 months or 5 refills
   c. 1 year
   d. unlimited refills

20. Which of the following drugs is not an OTC product?
   a. Ibuprofen 400 mg tablets
   b. Nuprin®
   c. Tylenol®
   d. Zyrtec®
21. Fentanyl, meperidine and codeine all belong to which controlled schedule?
   a. Schedule I
   b. Schedule II
   c. Schedule III
   d. Schedule IV

22. How many 100 mg tablets will be needed to make ½ liter of a 1:250 solution?
   a. 5 tablets
   b. 10 tablets
   c. 20 tablets
   d. 40 tablets

23. Which solution is recommended for cleaning a laminar flow hood?
   a. acetone
   b. betadine
   c. isopropyl alcohol
   d. soap and water

24. If a manufacturer’s labeling results in a temporary adverse health consequence, what type of FDA recall would be instituted?
   a. Class I
   b. Class II
   c. Class III
   d. Class IV
25. What is diphenhydramine used for?
   a. to sweeten prescriptions
   b. to induce vomiting
   c. to suppress a cough
   d. to relieve itching from hives

26. Who implements formulary review?
   a. ASHP
   b. DEA
   c. FDA
   d. P and T Committee

27. Digoxin is available in a concentration of 0.1 mg/ml. How many ml are required to administer a 50 mcg dose?
   a. 0.05 ml
   b. 0.25 ml
   c. 0.5 ml
   d. 0.75 ml

28. What dosage form should be dispensed with the following order? Acetaminophen 325 mg PR q8h prn.
   a. capsules
   b. suppositories
   c. syrup
   d. tablets
29. After opening an ampule, you do all of the following EXCEPT
   a. break the ampule with an alcohol pad covering the neck
   b. filter the contents with a filter needle upon withdrawal
   c. wipe the neck with an alcohol pad
   d. dry the neck with a paper towel after wiping with an alcohol pad

30. A prescription states “refill prn”, how long may this prescription be refilled?
   a. no refills
   b. 1 month
   c. 6 months
   d. 1 year

31. Which of the following is a narcotic analgesic?
   a. Celebrex®
   b. Diltiazem
   c. Meperidine
   d. Piroxicam

32. How many 10 mg minoxidil tablets would be needed to make 60 ml of a 2% solution?
   a. 20 tablets
   b. 60 tablets
   c. 120 tablets
   d. 240 tablets
33. What temperature is “controlled room temperature”?
   a. 0-4 degrees Centigrade
   b. 10-15 degrees Centigrade
   c. 15-30 degrees Centigrade
   d. 30-40 degrees Centigrade

34. Insulin is to be added to an IV admixture. What type of insulin should you use?
   a. Glargine
   b. Isophane
   c. Regular
   d. Ultra Lente

35. A patient visits the pharmacy complaining of dry, nonproductive cough. What should the pharmacy technician do?
   a. Suggest the use of Guafenisen
   b. Suggest the patient go to the ER
   c. Suggest the patient contact their doctor
   d. Suggest the patient speak to the pharmacist

36. Heparin is available in a vial labeled 20,000U per ml. How many ml are required for a 5,000U dose?
   a. 0.25 ml
   b. 0.5 ml
   c. 0.625 ml
   d. 0.75 ml
37. What is the proper way to clean a laminar flow hood?
   a. clean the hood from side to side starting from the back of the hood towards the front of the hood
   b. clean the hood from side to side starting from the front of the hood working towards the rear of the hood
   c. clean the plexiglass side with isopropyl alcohol
   d. wipe the hood with a cloth

38. Which dosage form is formulated to dissolve under the tongue rather than the stomach?
   a. enteric coated
   b. intranasal
   c. sublingual
   d. transdermal

39. When a drug crosses a membrane into the blood stream, it is called
   a. absorption
   b. distribution
   c. elimination
   d. metabolism

40. Which drug information source should be consulted to determine a possible drug interaction?
   a. American Drug Index
   b. Facts and Comparisons
   c. Orange Book
   d. Red Book
41. Which characteristic is important when preparing an IV admixture?
   a. aroma
   b. color
   c. palpability
   d. stability

42. Cleocin® suspension is available in a concentration of 75 mg/5 ml. How many ml are required for a 300 mg dose?
   a. 15 ml
   b. 20 ml
   c. 25 ml
   d. 30 ml

43. Two drugs are to be combined in a 2:1 ratio. How much of each is required to make 90 ml of the suspension?
   a. 15 ml/75 ml
   b. 30 ml/60 ml
   c. 60 ml/30 ml
   d. 75 ml/15 ml

44. How far within a hood is a pharmacy technician suppose to work?
   a. 1 inch within the hood
   b. 3 inches within the hood
   c. 6 inches within the hood
   d. no guidelines as long as you are in the hood
45. Controlled substances need to be physically inventoried how often?
   a. every month
   b. every 6 months
   c. once a year
   d. once every two years

46. Accreditation of institutional settings in the responsibility of what agency?
   a. AMA
   b. ASHP
   c. FDA
   d. JCAHO

47. The process where a drug is transformed by the liver is called
   a. absorption
   b. digestion
   c. elimination
   d. metabolism

48. A patient states that they need their empty bottle of Concerta® refilled. What do you tell the patient?
   a. State that the medication is not refillable
   b. Refill the medication
   c. Have the pharmacist contact the physician for a refill
   d. Contact the patient’s insurance company
49. The medication instructions state “ii gtts au q8h x 2d”. What does the “au” stand for?
   a. in the right ear
   b. in the left eye
   c. in both eyes
   d. in both ears

50. How does the “C” designation for controlled substances need to appear?
   a. in red in the lower right hand corner of the prescription
   b. in black in the lower right hand corner of the prescription
   c. in red in the center of the prescription
   d. in black in the center of the prescription

51. XL in Roman numerals is equivalent to
   a. 20
   b. 30
   c. 40
   d. 50

52. State the number of ounces in one pint.
   a. 4
   b. 8
   c. 16
   d. 24
53. **U-100 insulin contains**
   - a. 100 units per 1 ml
   - b. 100 units per 10 ml
   - c. 100 units per 50 ml
   - d. 100 units per 100 ml

54. **All of the following are requirements for the safeguarding of controlled substances except**
   - a. dispensing records
   - b. inventory records
   - c. storage records
   - d. transport records

55. **What type of product information does an MSDS provide?**
   - a. product ingredients
   - b. product side effects
   - c. product contraindications
   - d. product warnings

56. **How many ml are in 1 and ½ tablespoons?**
   - a. 12.5 ml
   - b. 15 ml
   - c. 22.5 ml
   - d. 30 ml
57. A prescription states the following instructions: 2 tabs tid for 3 days, 3 tabs po bid for 2 days, 2 tabs po qd for 2 days, 1 tab po qd for 1 day, ½ tab po qd for 1 day. How many tablets should be dispensed?
   a. 30 tablets
   b. 32 tablets
   c. 34 tablets
   d. 36 tablets

58. How many gallons are contained in 136 pints?
   a. 17 gallons
   b. 19 gallons
   c. 21 gallons
   d. 23 gallons

59. The dispensing label on an outpatient pharmacy prescription requires
   a. cost to the patient
   b. legal name of pharmacy and address
   c. physician's license number
   d. physician's DEA number

60. A piggyback has 50 ml of antibiotic infusing at a rate of 30 gtts/min. How long will it take for this solution to be administered if the set is calibrated to deliver 15 gtts/ml?
   a. 10 minutes
   b. 20 minutes
   c. 25 minutes
   d. 35 minutes
61. The purpose of OSHA is to:
   a. ensure proper pharmacy licensing
   b. monitor drug recalls
   c. assure a safe workplace
   d. ensure safe and effective drug therapy

62. Which of the following groups is usually a member of the P and T Committee?
   a. medical representative
   b. nursing representative
   c. pharmacy representative
   d. all of the above

63. Which of the following is not a diuretic?
   a. Furosemide
   b. Hydrochlorothiazine
   c. Lotensin®
   d. Maxzide®

64. A compounded prescription requires using 12 capsules costing $20.00 per 50
    capsules and 120 grams of an ointment base costing $7.50 per pound. If a $3.00
    dispensing fee is included, how much should the patient be charged?
   a. $9.78
   b. $11.78
   c. $13.50
   d. $15.55
65. Bulk solid dosage forms are repacked into unit dosed packages. What expiration date will now appear on the packages?
   a. 1 month
   b. 3 months
   c. 50% of labeled expiration date to a maximum of 1 year
   d. the original expiration date on the bulk solid

66. Which law created the DEA?
   a. a. 1938 Food Drug and Cosmetic Act (FDC)
   b. b. Omnibus Budget Reconciliation Act (OBRA)
   c. c. 1970 Controlled Substance Act (CSA)
   d. d. 1997 FDA Modernization Act

67. A pharmacy technician can do all the following except
   a. accept a verbal medication order from a physician
   b. b. place drug labels on prescription containers
   c. contact the wholesaler for a drug order
   d. prescription data entry into a computer

68. A vial of reconstituted doxorubicin breaks inside a vertical flow hood. What should the technician do?
   a. clean up the spill with a "spill kit"
   b. dilute the spill with bleach
   c. dilute the spill with alcohol
   d. wipe up the spill with paper towels
69. Determine the flow rate of an IVPB containing 120 ml of tobramycin. The solution is to be infused over a 1 hour time period and the administration set is calibrated to deliver 10 drops per ml.
   a. 5 gtts/min
   b. 10 gtts/min
   c. 15 gtts/min
   d. 20 gtts/min

70. A nonsolvent liquid is added to a powder to form a paste prior to the incorporation of a powder into an ointment or cream base. This is called
   a. flocculation
   b. micturition
   c. levigation
   d. trituration

71. Where would a pharmacy technician find information to assist them in compounding a lotion?
   a. Facts and Comparisons
   b. Remington's Pharmaceutical Sciences
   c. PDR
   d. Merck Manual

72. What legislation regulates the use and distribution of substances with high abuse potential?
   a. CSA
   b. DEA
   c. FDA
   d. OBRA
73. A formula for a cough syrup contains 1 gr of codeine per fluid ounce. How many grains are contained in one tablespoon?
   a. 1/8 gr
   b. 1/6 gr
   c. ¼ gr
   d. ½ gr

74. A patient on warfarin therapy should be cautioned to not take which of the following medications?
   a. Aspirin
   b. Demerol®
   c. Percocet®
   d. Tylenol®

75. Which of the following is a Scheduled IV controlled substance?
   a. Ativan®
   b. Lomotil®
   c. Percocet®
   d. Tramadol

76. 180 ml is equivalent to how many fluid ounces?
   a. 5.5
   b. 6.0
   c. 6.25
   d. 6.5
77. A TPN order is to contain 2 mg/l of folic acid. If the stock vial of folic acid contains 5 mg/ml, what volume would be required to prepare 2000 ml of TPN?
   a. 0.4 ml  
   b. 0.8 ml  
   c. 1.2 ml  
   d. 1.6 ml  

78. The computer program used for dispensing medication in the pharmacy setting is
   a. hardware  
   b. server  
   c. software  
   d. terminal  

79. 5 liters of Magic Mouthwash suspension is divided into an equal number of 10 ml and 15 ml unit dose dispensing cups. How many 10 ml dispensing cups can be made from this quantity of suspension?
   a. 150 ml  
   b. 200 ml  
   c. 250 ml  
   d. 300 ml  

80. Which medication is an anticonvulsant?
   a. carbamazepine  
   b. lorazepam  
   c. metoprolol  
   d. sumatriptan  

81. How many milligrams is 1/200 gr of Nitrostat?
   a. 0.2 mg
   b. 0.3 mg
   c. 0.4 mg
   d. 0.5 mg

82. Which of the following drug classes have cross sensitivity?
   a. cephalosporin and erythromycin
   b. erythromycin and penicillin
   c. penicillin and cephalosporin
   d. tetracycline and penicillin

83. How many mls of water should be added to 95% ethyl alcohol to make 1 liter of a 30% ethyl alcohol solution?
   a. 225 ml
   b. 325 ml
   c. 685 ml
   d. 775 ml

84. A 12 month old child has just consumed half a bottle of Children's Motrin®. What should the pharmacy technician NOT do?
   a. ask them to go to the nearest ER
   b. ask them to speak to the pharmacist
   c. give them the poison control center number
   d. tell them to induce vomiting
85. Warfarin belongs to which pharmacological category?
   a. antibiotic
   b. anticoagulant
   c. anticonvulsant
   d. anti-inflammatory

86. What does the red “C” in the lower right corner of a prescription mean?
   a. The drug is Schedule I controlled substance only
   b. The drug is Schedule II controlled substance only
   c. The drug is Schedule II, III, IV or V controlled substances
   d. none of the above

87. What volume of 24% trichloroacetic acid (TCA) is needed to prepare eight 3 ounce bottles of 10% TCA solution?
   a. 150 ml
   b. 200 ml
   c. 250 ml
   d. 300 ml

88. Which of the following drugs is an antiarrhythmic?
   a. Percocet®
   b. Pravachol®
   c. Pronestyl®
   d. Pyridium®
89. 30 grams of hydrocortisone 2.5% ointment is combined with 15 grams of hydrocortisone 1% ointment. What is the percentage of hydrocortisone in the final product?
   a. 1%
   b. 1.5%
   c. 2.0%
   d. 2.5%

90. What is the percentage strength of a kg of an ointment that contains 350 grams of active ingredient?
   a. 30%
   b. 35%
   c. 40%
   d. 45%
### Practice Test #2 Answers

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**Answers:**
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2. c  
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11. d  
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17. b  
18. a  
19. b  
20. a  
21. b  
22. c  
23. c  
24. b  
25. d
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