Drug Storage

Unit: Handling, Storing, and Packaging Drugs

Problem Area: Storage Protocols

Lesson: Drug Storage

Student Learning Objectives.

Instruction in this lesson should result in students achieving the following objectives:

1. **Review approved drug storage procedures.**
2. **Comply with drug storage temperature standards.**

Resources.

The following resources may be useful in teaching this lesson:

E-unit(s) corresponding to this lesson plan. CAERT, Inc. http://www.mycaert.com.

Aiken, Cheryl, and Robert J. Anderson. *Certification Exam Review for Pharmacy Technicians*, 3rd ed. Paradigm, 2014.

Ballington, Don A., and Robert J. Anderson. *Pharmacy Practice for Technicians*, 6th ed. Paradigm, 2017.

Central California Alliance for Health. Accessed March 28, 2017. http://www.ccah-alliance.org/.

Mizner, James J. *Mosby's Review for the Pharmacy Technician Certification Examination*, 3rd ed. Elsevier, 2014.

Perspective Press Editors. *The Pharmacy Technician*, 6th ed. Morton, 2016.

"Registration of Manufacturers, Distributers, and Dispensers of Controlled Substances," *United States Department of Justice: Drug Enforcement Administration, Diversion Control Division.* Accessed March 28, 2017. http://www.deadiversion.usdoj.gov/21cfr/cfr/1301/1301_72.htm.



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Equipment, Tools, Supplies, and Facilities

- ✓ Overhead or PowerPoint projector
- ✓ Visual(s) from accompanying master(s)
- ✓ Copies of sample test, lab sheet(s), and/or other items designed for duplication
- ✓ Materials listed on duplicated items
- ✓ Computers with printers and Internet access
- ✓ Classroom resource and reference materials

Key Terms.

The following terms are presented in this lesson (shown in bold italics):

- compounded medications
- controlled substances
- efficacy
- generic drug name
- intravenous
- narcotic
- ophthalmic
- oral
- potency
- topical
- United States Pharmacopeia (USP)

Interest Approach.

Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Share the following with your students: Did you know that there are serious health and safety consequences if your medication is not properly stored? Many of us store our medications in the bathroom cabinet. Each time we take a shower, we expose those medications to humidity. In addition, the bathroom's temperature may be higher than recommended for storage. Heat, air, light, and moisture can cause medications to break down and become less effective. Exposure of medications to inappropriate conditions may even cause them to become harmful if ingested. Discuss some alternative areas in your home or office to store medications. Where might medications be safely stored when you are travelling?*

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CONTENT SUMMARY AND TEACHING STRATEGIES

Objective 1: Review approved drug storage procedures.

Anticipated Problem: What are the approved drug storage procedures?

I. Approved drug storage procedures

A. When pharmaceutical companies develop medications, they examine many factors: effective dose, drug administration, safety, and efficacy. ***Efficacy*** is the ability to produce a desired effect (e.g., the desired drug effect). Drug companies also spend a significant amount of time studying the effects of various drug storage protocols. These studies determine if the medication is stable at room temperature, needs to be refrigerated, or needs to be frozen.

B. Labeling and storing drugs

1. After drugs are received in the pharmacy, they must be stocked or shelved under proper labeling and storage conditions. All pharmaceutical products should be stored in containers that do not adversely affect the quality of the product and that provide adequate protection from external influences. Drugs must be stored properly to:
   a. Avoid deterioration
   b. Avoid contamination
   c. Maintain packaging integrity
   d. Guarantee quality and ***potency*** (the capacity to produce strong physiological or chemical effects)
   e. Reduce prescription errors
2. Drug storage environments include the following characteristics:
   a. Adequate temperature
   b. Sufficient lighting
   c. Clean conditions
   d. Humidity controls
   e. Cold storage facilities
   f. Adequate shelving
3. Most hospital pharmacies organize drug storage according to a precise system. Two systems of organization are used by most facilities.
   a. Route of administration: Typically, medications are categorized and placed in defined areas of the pharmacy based on the specific route of administration, such as:
      (1) ***Intravenous*** is medication administered into a vein.
      (2) ***Ophthalmic*** is medication related to the eye.

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(3) ***Topical*** is medication applied directly to a part of the body.

(4) ***Oral*** is medication related to the mouth. Oral drugs may be further divided into solid dosage forms (capsules and tablets) and liquids (suspensions and solutions) and placed in separate areas.

b. Another way medications are organized is in alphabetical order using the generic name of each drug. A ***generic drug name*** is the chemical name of a medication marketed under its chemical composition rather than a brand name. Medications should be stored in their original packaging. For example, Diazepam is a chemical name (generic name) of a sedative. It is marketed under several other names, including Valium.

c. A ***narcotic*** is a controlled substance or drug that relieves pain. ***Controlled substances*** are drugs whose manufacture, possession, or use is regulated by the government. Narcotics and other controlled substances are often stored in a secure area of the hospital pharmacy. These drugs may be placed in a locked cabinet or in an automatic dispensing cabinet that requires a personal code and password.

d. Hospital pharmacies typically have a separate storage area for intravenous bags and medications that have been compounded. ***Compounded medications*** are treatments produced by combining two or more ingredients or parts; they are often prepared in anticipation of a prescriber order.

4. Medications stocked in the retail pharmacies can be organized in several ways.

a. In some pharmacies, organization of medications is alphabetically by the medication name on the bottle. In this case, similar brand and generic products may not be located next to each other.

b. In some pharmacies, organization of medications is alphabetically by brand name, with the generic located next to the brand name product.

c. In some pharmacies, organization of medications is alpha-generically in which all products are stored in alphabetical order by their generic name.

d. In some pharmacies, organization of medications is in alphabetical order, but drugs are assembled into subgroups (section categories). For example, section-specific categories could include the following, with all in alphabetical order within each section:

(1) Eye drops

(2) Liquids

(3) Suspensions

(4) Topicals

(5) Capsules and tablets

e. Some pharmacies have separate sections for certain types of medications that are not “mixed in” with the stock bottles of pills. Separate areas may include:

(1) Birth control pills

(2) Liquids

(3) Topical treatments

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(4) Injectable medications
(5) Inhalers

f. Some pharmacies store fast-moving medications close to the dispensing counter.

g. Controlled substances should be stored separately from other medications. These medications are generally kept in a locked cabinet or safe that only the pharmacist can access. Controlled substances may be organized alphabetically by brand, generic, or the name listed on the bottle.

(1) The building used to store controlled substances must have an electronic alarm system connected directly to a local law enforcement agency.

(2) The room in which controlled substances are stored must be equipped with self-closing and self-locking doors. The doors must be kept closed and locked at all times when not in use.

(3) Refrigerated controlled substances must be stored in a locked refrigerator separate from any other refrigerated medications. The room must also be lockable and locked after hours.

C. Regardless of the type of stock organization protocol used, similar error-prevention strategies should be incorporated.

1. Separating similar bottles or products that are different dosages of the same medications with dividers helps prevent technicians from pulling the wrong medication off the shelf to fill an order.
2. Stickers or signs are used for high-alert medications or for those prone to more dangerous errors.

Teaching Strategy: *Many techniques can be used to help students master this objective. Use VM–A to review. Discuss how each of these factors contributes to the safety and efficacy of a medication. Create some scenarios of improper medication storage, and discuss some possible solutions to those scenarios.*

Objective 2: Comply with drug storage temperature standards.

Anticipated Problem: What are the approved drug storage temperature standards?

II. Drug storage temperature standards

A. All medications have specific storage conditions determined by the manufacturer. All prescription drugs shall be stored at appropriate temperatures and under appropriate conditions in accordance with requirements, if any, in the labeling of such medications or with requirements set forth by the ***United States Pharmacopeia (USP)***—a collection of legally recognized standards for drugs. Many medications are approved for storage at room temperature.

1. USP defines room temperature as a range between 59°F and 86°F or 15°C and 30°C. Drugs should not be stored above or below this temperature range

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unless authorized by the manufacturer. Some medications are sensitive to light and can decompose under these conditions. It is recommended to store medications in the original container or an amber-colored vial to decrease the transmission of light through the bottle.

2. Some drugs require refrigeration to maintain stability. Refrigerated temperatures are in the range of 36°F to 46°F or 2°C to 8°C. Medications should not be stored on the refrigerator door or in bins; they should be placed on shelves in the middle of the refrigerator to ensure the most stable temperatures.
   a. Thermometers should be placed in the refrigerator to maintain adequate temperatures.
   b. A temperature log is kept that documents the temperature of the refrigerator twice a day.
   c. Medications stored in the refrigerator should be given space between each item to allow adequate airflow between products.
3. Frozen medications are stored between –13°F and –14°F or –25°C and –10°C. If a pharmacy stores frozen medication, it should be in a standalone freezer. The temperatures in a standalone freezer are more stable than temperatures in a freezer located on top of a refrigerator. As was true with refrigerated medications, with frozen medications:
   a. Thermometers should be placed in the freezer to maintain adequate temperatures.
   b. A temperature log should be kept that documents the temperature of the freezer twice a day.

B. Medication storage temperature terminology
   1. Freezer storage: Any temperature between –13°F and –14°F or –25°C and –10°C
   2. Cold storage: Not to exceed 46°F or 8°C
   3. Cool storage: Any temperature between 46°F and 59°F or 8°C and 15°C
   4. Room temperature storage: Any temperature between 59°F and 86°F or 15°C and 30°C
   5. Warm storage: Any temperature between 86°F and 104°F or 30°C and 40°C
   6. Excessive heat storage: Any temperature above 104°F or 40°C
   7. Dry storage: Conditions not in excess of 40 percent humidity at room temperature

Teaching Strategy: *Many techniques can be used to help students master this objective. Use VM–B to illustrate a medication inventory sheet used to keep track of medications and the safe storage of medications. Explain that everyone should keep an updated list of all prescription medications in their home. Taking a medication inventory twice a year is a good way to safeguard and dispose of outdated or unsafe medications you may have in your home. Distribute a copy of VM–B to students. Have students take the sheet home and fill out the inventory. Then have students share the inventory with their families to determine if they are storing their medications properly. Have students voluntarily share any findings with the class. Assign LS–A.*

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Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. If a textbook is being used, questions at the ends of chapters may be included in the Review/Summary.

Application. Use the included visual master(s) and lab sheet(s) to apply the information presented in the lesson.

Evaluation. Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activities. A sample written test is provided.

Answers to Sample Test:

Part One: Matching

1. e
2. f
3. d
4. b
5. c
6. a

Part Two: Completion

1. controlled substances
2. USP
3. manufacturer
4. compounded
5. refrigerated
6. 40 percent

Part Three: True/False

1. T
2. T
3. T
4. F
5. T
6. F

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Sample Test

Name _____

Drug Storage

Part One: Matching

Instructions: **Match the term with the correct definition.**

a. narcotics
b. potency
c. ophthalmic
d. generic drug name
e. efficacy
f. topical

_____1. The ability to produce a desired effect

_____2. Medication applied directly to a part of the body

_____3. The chemical name of a medication marketed under its chemical composition rather than a brand name

_____4. The capacity to produce strong physiological or chemical effects

_____5. Related to the eye

_____6. A controlled substance or drug that relieves pain

Part Two: Completion

Instructions: **Provide the word or words to complete the following statements.**

1. Those drugs whose manufacture, possession, or use is regulated by the government are _____.
2. A collection of legally recognized standards for drugs is _____.
3. All medications have specific storage conditions determined by the _____.
4. Hospital pharmacies may have a separate area for intravenous bags and medications that have been _____.



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5. Temperatures for drug storage in the range of 36°F to 46°F or 2°C to 8°C are considered _____ storage.

6. Dry conditions for drug storage do not exceed _____ humidity at room temperature.

Part Three: True/False

Instructions: **Write *T* for true or *F* for false.**

_____1. The specific route of administration is a common way for hospital pharmacies to categorize and place drugs in defined storage areas.

_____2. Some pharmacies organize medications alpha-generically in which all products are organized in alphabetical order by their generic name.

_____3. Drugs must be stored properly to avoid deterioration.

_____4. Frozen medications are stored between –13°F and –14°F or –25°C and –35°C.

_____5. Some pharmacies choose to store fast-moving medications close to the dispensing counter.

_____6. Refrigerated medications are safely stored in the refrigerator door or in bins.

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PROPER STORAGE ENVIRONMENT FOR PHARMACEUTICAL PRODUCTS

1. Adequate temperature
2. Sufficient lighting
3. Clean conditions
4. Humidity controls
5. Cold storage facilities
6. Adequate shelving



Notice that the insulin vials look "misted" because they were recently removed from refrigerated storage.

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VM–B

HOME MEDICATION INVENTORY SHEET

Medication Name	Date Received	Dosage Strength	Quantity	Expiration Date	Storage Requirements

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Name _____

Temperature Conversions

Purpose

The purpose of this activity is to convert between Fahrenheit and Celsius temperature scales.

Objectives

1. Convert temperatures from Fahrenheit to Celsius.
2. Convert temperatures from Celsius to Fahrenheit.
3. Solve pharmacy problems by converting between °F and °C scales.

Materials

- lab sheet
- conversion formulas
- pencil
- paper
- practice problems
- calculator (optional)

Procedure

1. Use the following conversion formulas to solve each problem:
   a. $°F = (1.8 \times °C) + 32°$
   b. $°C = (°F - 32°) \div 1.8$
2. Solve each of these temperature conversion problems:
   a. According to the medication package insert, the manufacturer requires that a vial of reconstituted antibiotic be stored at room temperature between 4° and 8°C. What is



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the equivalent Fahrenheit temperature range? Where is the medication stored? (e.g., at room temperature, in the refrigerator, or in the freezer)?

b. A mother phones the pharmacy on Friday night indicating her 12-month-old child has a fever. Her thermometer records the child's temperature as 38.6°C. Her doctor told her to call if the child's temperature reached 101°F. Should the mother place a call to the child's doctor?

c. A medication package insert requires that a medication be stored at room temperature 59°F to 86°F. What is that temperature range in degrees Celsius?

d. Excessive heat is considered to be above 40°C. What is that equivalent temperature in degrees Fahrenheit?

3. Turn in your completed temperature conversion problems to your instructor.

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Temperature Conversions

1. First, convert the degrees Celsius at the low end of the range.

   °F = (1.8 × °C) + 32°
   °F = (1.8 × 4°) + 32°
   °F = 7.2° + 32°
   °F = 39.2°

   Second, convert the degrees Celsius at the high end of the range.

   °F = (1.8 × 8°) + 32°
   °F = 14.4° + 32°
   °F = 46.4°

   The thermostat should be set between 39.2°F and 46.4°F.

   The medication would be stored in the refrigerator.

2. °F = (1.8 × 38.6°) + 32°
   °F = 69.48° + 32°
   °F = 101.48°

   The mother should call the doctor.

3. First, convert the degrees Fahrenheit at the low end of the range.

   °C = (°F – 32°) ÷ 1.8
   °C = (59° – 32°) ÷ 1.8
   °C = 27° ÷ 1.8
   °C = 15°

   Second, convert the degrees Fahrenheit at the high end of the range.

   °C = (86° – 32°) ÷ 1.8
   °C = 54° ÷ 1.8
   °C = 30°

   The temperature range is 15°C to 30°C.

4. °F = (1.8 × °C) + 32°
   °F = (1.8 × 40°) + 32°
   °F = 72° + 32°
   °F = 104°

   Excessive heat is above 104°F.

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