Pharmacy Technician Program

Lecture 20: PHARMACY CALCULATIONS for Technicians Using Household Measures in Pharmacy Calculations

Coursework 103

KADUCEUS
"Hands-On" Career Training

PHARMACY CALCULATIONS for Technicians Using Household Measures in Pharmacy Calculations

This chapter provides an overview of household measurements as they are related to pharmacy.

I. Household Measure

- Converting Household Volume Measures
- Converting between Household Measure and the Metric System
- Converting Body Weight

I. Household Measure

A. Household Measure

1. Measuring volume using the household measure is less accurate than using other systems because the measuring utensils can vary in size.
2. However, the system is often used by patients when administering drugs at home.

I. Household Measure

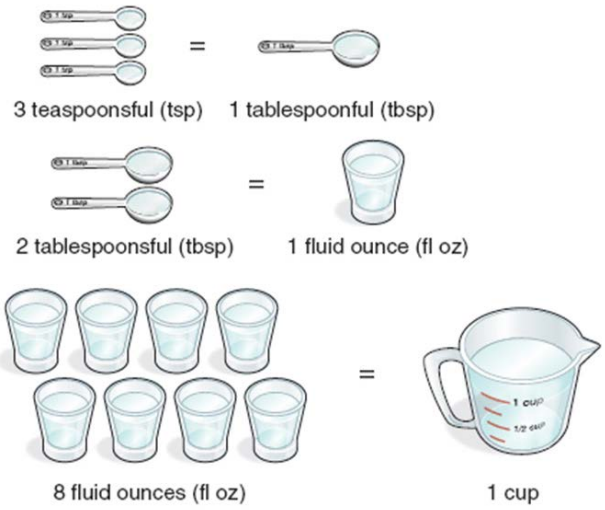
3. Terms to Remember

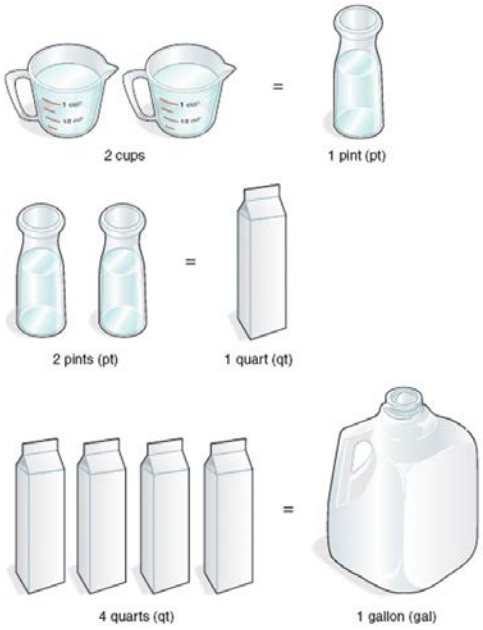
a. household measure - a system of measure used in homes, particularly in kitchens, in the United States; units of measure for volume include teaspoonful, tablespoonful, cup, pint, quart, and gallon; units for weight are pound and ounce

I. Household Measure

Volume equivalents : Household Measures

3 tsp = 1 tbsp
2 tbsp = 1 fl oz
8 fl oz = 1 cup
2 cups = 1 pt
2 pt = 1 qt
4 qt = 1 gal





I. Household Measure

4. SAFETY NOTE: To avoid misreading c for 0, do not abbreviate cup.
5. Weight equivalents 1 lb = 16 oz
6. Remember:
   a. apothecary pound (lb) = 12 oz
   b. household pound (lb) = 16 oz

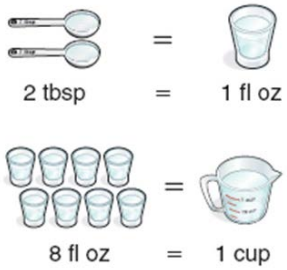
I. Household Measure

B. Converting Household Volume Measures

1. Like all systems, units of the household volume measure can be converted to larger or smaller units.
2. How many tablespoons are in 2 cups of medication?

Begin by noting the appropriate equivalences:

2 tbsp = 1 fl oz
1 cup = 8 fl oz



I. Household Measure

C. Conversion Example

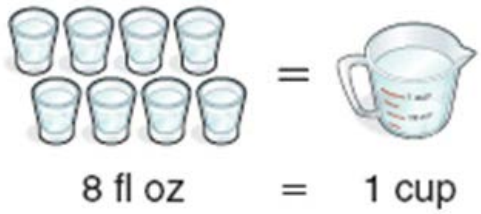
1. How many tablespoons are in 2 cups of medication?

a. Solution 1: Using the ratio-proportion method, first determine the number of fluid ounces in 2 cups.

$$\frac{x \text{ fl oz}}{2 \text{ cups}} = \frac{8 \text{ fl oz}}{1 \text{ cup}}$$

$$\frac{(2 \text{ cups})\, x \text{ fl oz}}{2 \text{ cups}} = \frac{(2 \text{ cups})\, 8 \text{ fl oz}}{1 \text{ cup}}$$

$$x \text{ fl oz} = 16 \text{ fl oz}$$



I. Household Measure

D. Conversion Example

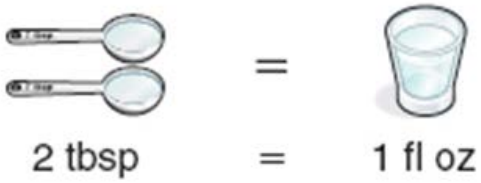
1. How many tablespoons are in 2 cups of medication?

a. Solution 1: Second, determine the number of tablespoons in 16 fl oz

$$\frac{x \text{ tbsp}}{16 \text{ fl oz}} = \frac{2 \text{ tbsp}}{1 \text{ fl oz}}$$

$$\frac{(16 \text{ fl oz})\, x \text{ tbsp}}{16 \text{ fl oz}} = \frac{(16 \text{ fl oz})\, 2 \text{ tbsp}}{1 \text{ fl oz}}$$

$$x \text{ tbsp} = 32 \text{ tbsp}$$



I. Household Measure

E. Conversion Example

1. How many tablespoons are in 2 cups of medication?

a. Solution 2: Using the dimensional analysis method,

$$x \text{ tbsp} = 2 \cancel{\text{cups}} \times \frac{8 \cancel{\text{fl oz}}}{1 \cancel{\text{cup}}} \times \frac{2 \text{ tbsp}}{1 \cancel{\text{fl oz}}} = 32 \text{ tbsp}$$

I. Household Measure

F. SAFETY NOTE: When converting several equivalences using dimensional analysis, it is helpful to make a notation of the units you want in the final answer. Here, we are starting the solution with x tbsp. because we want the answer to be the number of tablespoons.

I. Household Measure

G. Conversion Example

1. How many 1 tsp doses are in 3 cups of medication?
2. Begin by noting the appropriate equivalences:

3 tsp = 1 tbsp
2 tbsp = 1 fl oz
8 fl oz = 1 cup

I. Household Measure

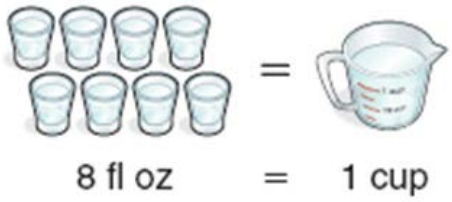
H. Conversion Example

1. How many 1 tsp. doses are in 3 cups of medication?
   a. Solution 1: Using the ratio-proportion method, first determine the number of fluid ounces in 3 cups.

$$\frac{x \text{ fl oz}}{3 \text{ cups}} = \frac{8 \text{ fl oz}}{1 \text{ cup}}$$

$$\frac{(3 \text{ cups})\, x \text{ fl oz}}{3 \text{ cups}} = \frac{(3 \text{ cups})\, 8 \text{ fl oz}}{1 \text{ cup}}$$

$$x \text{ fl oz} = 24 \text{ fl oz}$$



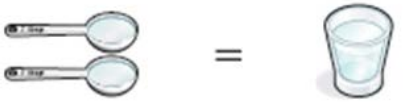
I. Household Measure

b. Solution 1: Second, determine the number of tablespoons in 24 fl oz.

$$\frac{x \text{ tbsp}}{24 \text{ fl oz}} = \frac{2 \text{ tbsp}}{1 \text{ fl oz}}$$

$$\frac{(24 \text{ fl oz})\, x \text{ tbsp}}{24 \text{ fl oz}} = \frac{(24 \text{ fl oz})\, 2 \text{ tbsp}}{1 \text{ fl oz}}$$

$$x \text{ tbsp} = 48 \text{ tbsp}$$

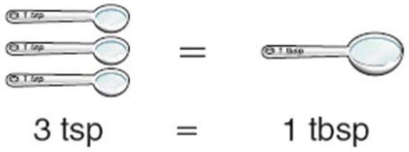


c. Solution 1: Third, determine the number of teaspoons in 48 tbsp.

$$\frac{x \text{ tsp}}{48 \text{ tbsp}} = \frac{3 \text{ tsp}}{1 \text{ tbsp}}$$

$$\frac{(48 \text{ tbsp})\, x \text{ tsp}}{48 \text{ tbsp}} = \frac{(48 \text{ tbsp})\, 3 \text{ tsp}}{1 \text{ tbsp}}$$

$$x \text{ tsp} = 144 \text{ tsp}$$



I. Household Measure

d. **Solution 2: Using the dimensional analysis method,**

$$x \text{ tsp} = 3 \cancel{\text{cups}} \times \frac{8 \cancel{\text{fl oz}}}{1 \cancel{\text{cup}}} \times \frac{2 \cancel{\text{tbsp}}}{1 \cancel{\text{fl oz}}} \times \frac{3 \text{ tsp}}{1 \cancel{\text{tbsp}}} = 144 \text{ tsp}$$

I. Household Measure

I. Converting between Household and Metric

1. Convert from household to metric for measuring within the pharmacy.
2. Metric is used more often in the pharmacy.
3. Converting between Household and Metric

II. Volume

1 tsp	=	5 mL
1 tbsp	=	15 mL
1 fl oz	=	30 mL
1 cup	=	240 mL
1 pt	=	480 mL
1 qt	=	960 mL
1 gal	=	3840 mL

II. Volume

A. Conversion Example

1. A patient is to purchase a 12 fl oz bottle of antacid. The patient is to take 15 mL before each meal and at bedtime. How many doses does the bottle contain?

   a. Solution 1: Using the ratio-proportion method,

$$\frac{x \text{ doses}}{360 \text{ mL}} = \frac{1 \text{ dose}}{15 \text{ mL}}$$

$$x \text{ dose} = 24 \text{ doses}$$

II. Volume

A. Conversion Example

b. Solution 2: Using the dimensional analysis method and the metric system,

$$360 \text{ mL} \times \frac{1 \text{ dose}}{15 \text{ mL}} = 24 \text{ doses}$$

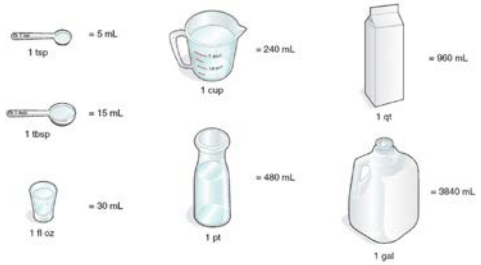
c. Solution 2: Using the dimensional analysis method and the household system,

$$12 \text{ fl oz} \times \frac{1 \text{ dose}}{0.5 \text{ fl oz}} = 24 \text{ doses}$$

II. Volume

B. Discussion

1. How many milliliters are in 1 tsp?
   a. Answer: 5 mL



2. How many milliliters are in 1 fl oz?
   a. Answer: 30 mL

II. Volume

C. Conversion Example

1. You have a 1 lb jar of ointment available. You are instructed to use this stock to fill smaller jars with 20 g of ointment each. How many jars can you fill?
   a. Remember:

      1 lb = 454 g.

      30 g = 1 oz

      454 g = 1 lb

II. Volume

2. You have a 1 lb jar of ointment available. You are instructed to use this stock to fill smaller jars with 20 g of ointment each. How many jars can you fill?
   a. Solution 1: Using the ratio-proportion method,

$$\frac{x \text{ jars}}{454 \text{ g}} = \frac{1 \text{ jar}}{20 \text{ g}}$$

$$x \text{ jar} = 22.7 \text{ jars, or } 22 \text{ full jars}$$

II. Volume

b. Solution 2: Using the dimensional analysis method,

$$454\ \text{g} \times \frac{1\ \text{jar}}{20\ \text{g}} = 22.7\ \text{jars, or 22 full jars}$$

c. In both solutions, there is 0.7 jar of ointment remaining. You can figure out how many grams of ointment are left over with the following calculation.

$$\frac{20\ \text{g}}{\text{jar}} \times 0.7\ \text{jar leftover ointment} = 14\ \text{g leftover ointment}$$

III. Converting Body Weight

A. Drug manufacturers often provide recommended dose based on a specific dose in milligrams per kilogram of patient's weight.

1. If a patient's weight is documented in pounds, the weight will need to be converted to kilograms.
2. Remember: 2.2 lb = 1 kg

III. Converting Body Weight

B. Conversion Example

1. A patient weighs 134 lb. What is the patient's weight in kilograms?
   a. Solution 1: Using the ratio-proportion method,

$$\frac{x \text{ kg}}{134 \text{ lb}} = \frac{1 \text{ kg}}{2.2 \text{ lb}}$$

$$x \text{ kg} = 60.909 \text{ kg, rounded to } 60.9 \text{ kg}$$

   b. Solution 2: Using the dimensional analysis method,

$$134 \text{ lb} \times \frac{1 \text{ kg}}{2.2 \text{ lb}} = 60.909 \text{ kg, rounded to } 60.9 \text{ kg}$$

III. Converting Body Weight

2. A patient in the neonatal ICU weighs 1250 g. How many pounds is this?
   a. First, convert grams to kilograms.

      1250 g = 1.25 kg

   b. Second, convert kilograms to pounds.

      1.25 kg × 2.2 lb/kg = 2.75 lb

3. Check the answer by converting the answer from pounds back to kilograms.

   2.75 lb × 1 kg/2.2 lb = 1.25 kg

IV. Problem Set Drug Labels

(Page 122, problems 54 and 57)

A. A prescription states that a patient is to take one-half tsp of furosemide oral solution daily.

Using the furosemide label shown above, how many milligrams are in a dose?

IV. Problem Set Drug Labels

(Page 122, problems 54 and 57

Using the furosemide label shown, how many days will a 4 fl oz bottle last a patient taking 20 mg daily?

IV. Problem Set Drug Labels

(Page 122, problems 54 and 57)

B. A prescription states that a patient is to take 10 mg of Zerit daily.

Using the provided label, calculate the equivalent dose measured in teaspoonful.

IV. Problem Set Drug Labels

(Page 122, problems 54 and 57

How many days will the bottle of Zerit last a patient if the patient is taking 1 tsp daily?

V. Oral Doses

Determining Pediatric Doses Using Dosing Tables
Dispensing Liquid Medications
Calculating the Amount to Dispense

A. Oral Doses

1. Oral medications are prescribed over other dose forms whenever possible.
2. Oral medications are safe and cost-effective.
3. Liquid medications are most commonly used by children and by adults who have difficulty swallowing solids.

V. Oral Doses

B. Determining Pediatric Doses Using Dosing Tables

1. Dosing tables are used to determine dose forms for young patients.
2. Such tables can provide an age range and/or a weight range with corresponding doses.

C. Terms to Remember

1. dosing table - a table providing dose recommendations based on the age and/or the weight of the patient; often used for determining the safe dose for a pediatric patient

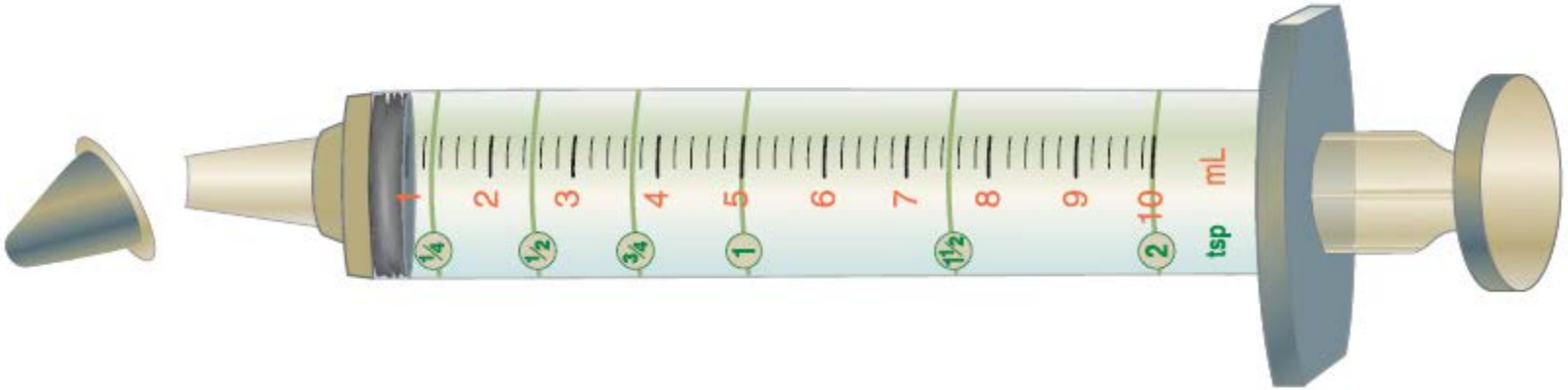
V. Oral Doses

D. Dispensing Liquid Medications

1. Many liquid medications are actually solids, suspended in a liquid.
2. Indicated by the number of milligrams per milliliter.
3. Usually, an oral liquid medication's written prescription will include
   a. a specific volume to be given at each dose, and
   b. a total volume to dispense.

V. Oral Doses

4. This oral syringe is marked with both household and metric units of measure.



V. Oral Doses

E. Oral Dose Example

1. The pharmacy receives a prescription for 100 mg of Amoxicillin to be taken three times daily for 10 days. The pharmacy has a 150 mL bottle of 125 mg/5 mL amoxicillin. How many milliliters of the suspension will be dispensed, and what will the patient's dosing instructions on the label say?

V. Oral Doses

a. Solution1: Using the ratio-proportion method,

$$\frac{x \text{ mL}}{100 \text{ mg}} = \frac{5 \text{ mL}}{125 \text{ mg}}$$

$$x \text{ mL} = 4 \text{ mL}$$

V. Oral Doses

b. Solution 2: Using the dimensional analysis method,

$$100\ \text{mg} \times \frac{5\ \text{mL}}{125\ \text{mg}} = 4\ \text{mL}$$

V. Oral Doses

c. Using the amount determined for a single dose, determine the total amount of suspension to be dispensed for 10 days.

4 mL × 3 doses/day × 10 days = 120 mL

The patient's instructions will say, "Take 4 mL three times daily for 10 days."

The patient will need a dosing syringe to dispense the required amount of medication.

V. Oral Doses

F. Calculating the Amount to Dispense

1. The amount to be dispensed is calculated by multiplying the amount of drug needed for
   a. A single day by the number of days of treatment.
2. Needed for insurance purposes
3. Needed to confirm patient can complete treatment

V. Oral Doses

4. Dispensing Example

a. A patient is to take 1 tsp of a medication twice daily, and she has a 4 fl oz bottle of medication. How much medication will the patient take in a day, and how many days will the medication last?

Begin by converting all of the stated volumes to the metric system.

1 tsp = 5 mL; therefore 1 tsp/dose = 5 mL/dose

1 fl oz = 30 mL; therefore, 4 fl oz/bottle = 120 mL/bottle

V. Oral Doses

Begin by converting all of the stated volumes to the metric system.

1 tsp = 5 mL; therefore 1 tsp/dose = 5 mL/dose
1 fl oz = 30 mL; therefore 4 fl oz/bottle = 120 mL/bottle

1 tsp = 5 mL

1 fl oz = 30 mL

V. Oral Doses

Next, determine how much medication is needed for one day. The dose is taken twice daily, so there are 2 doses/day.

2 doses/day × 5 mL/dose = 10 mL/day

Finally, determine the number of days the medication will last.

120 mL/bottle × 1 day/10 mL = 12 days/bottle

V. Oral Doses

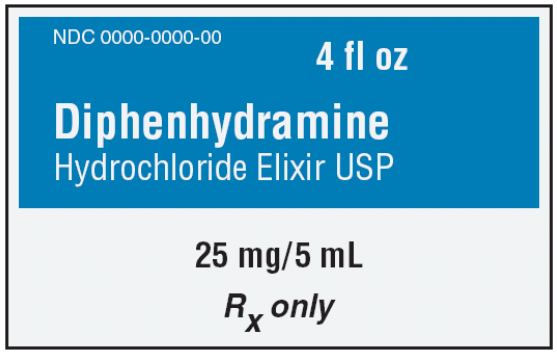
G. Discussion

1. How might a prescriber write 1 tsp of a medication twice daily on a prescription?
   a. Answer: 1 tsp q12 h
2. How might a prescriber write 1 tsp of a medication three times daily on a prescription?
   a. Answer: 1 tsp tid

VI. Problem Set Drug Labels

(Page 134, problems 29 -34)

A. A mother has two children with Poison Ivy. One child takes 1 tsp tid and the other child takes 2 tsp tid. How many bottles of Diphenhydramine elixir will be needed to supply both for 4 days?

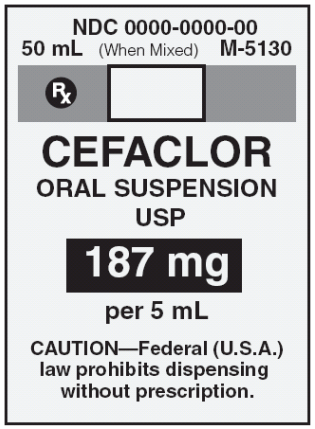


How many milligrams are contained in each of the children's doses

VI. Problem Set Drug Labels

(Page 134, problems 29 -34)

B. Using the Cefaclor label answer the following:



1. How many milligrams are in ¾ tsp?
2. How many milligrams are in 1 ½ tsp?
3. How many milliliters are needed to provide 125 mg?
4. How many milliliters are needed to provide 500 mg?

VII. Temperature Measurement

Understanding Temperature Measurement Systems

Converting Celsius and Fahrenheit Temperatures

Completing a Temperature Chart

A. Temperature Measurement

1. Temperature Scales
   a. Celsius
   b. Fahrenheit

VII. Temperature Measurement

B. Terms to Remember

1. Celsius - a thermometric scale in which 100 degrees is the boiling point of water and 0 degrees is the freezing point of water
2. Fahrenheit - a thermometric scale in which 212 degrees is the boiling point of water and 32 degrees is the freezing point of water

VII. Temperature Measurement

3. Converting Celsius to Fahrenheit

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

or

$$°F = (1.8 \times °C) + 32$$

4. Converting Fahrenheit to Celsius

$$°C = (°F - 32) \times \frac{5}{9}$$

or

$$°C = \frac{°F - 32°}{1.8}$$

VII. Temperature Measurement

C. Completing a Temperature Chart

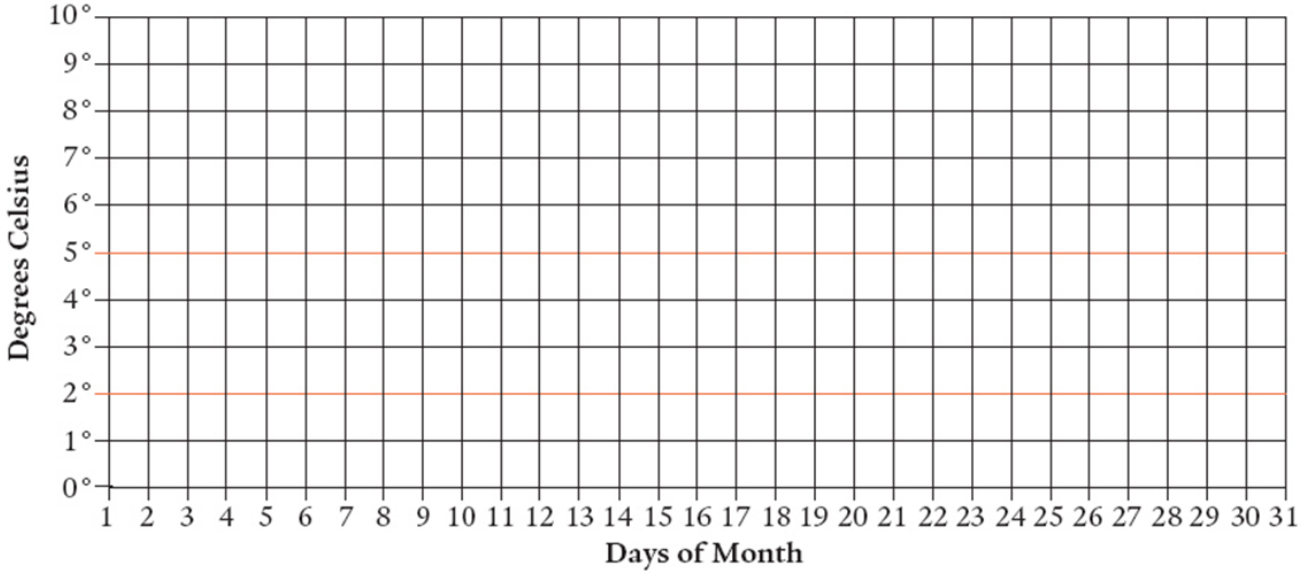
1. To store medication under “refrigerated” conditions means to store it between 2°C and 5°C (35.6°F to 41°F).
2. Charts are often used to record temperatures of refrigerators and freezers.

VII. Temperature Measurement

D. Temperature Chart

E. Celsius

Month _____



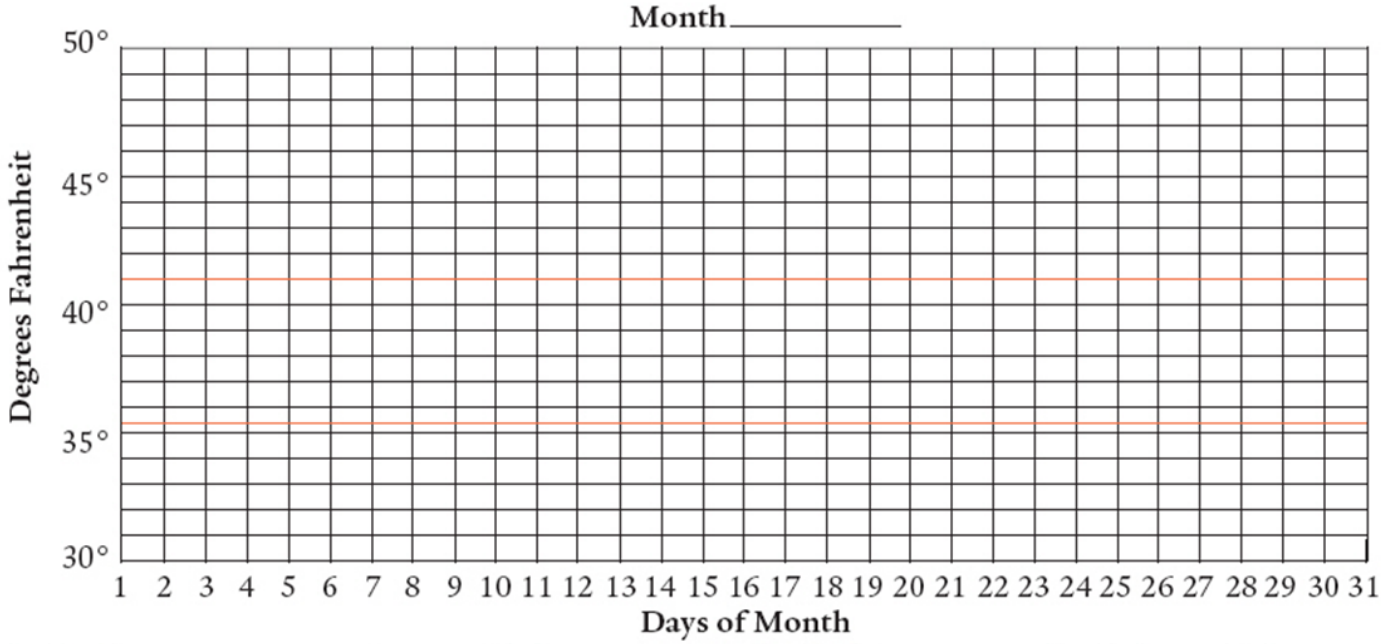
Graph refrigerator temperature on chart once daily. If temperature is less than **2 degrees** or greater than **5 degrees**, check the thermostat setting and correct as necessary. Recheck temperature in one hour, and if temperature is out of stated range, contact maintenance for evaluation and repair. Contact the appropriate area for storage of supplies.

Documentation of Repairs: _____

Documentation of Cleaning: _____

VII. Temperature Measurement

F. Fahrenheit



Graph refrigerator temperature on chart once daily. If temperature is less than **35.6 degrees** or greater than **41 degrees**, check the thermostat setting and correct as necessary. Recheck temperature in one hour, and if temperature is out of stated range, contact maintenance for evaluation and repair. Contact the appropriate area for storage of supplies.

Documentation of Repairs: _____

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Documentation of Cleaning: _____

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VII. Temperature Measurement

G. Discussion

1. How can a pharmacy technician help in ensuring proper refrigeration of medications?
   a. Answer: Maintain careful temperature charts documenting safe temperatures.