COMMON SYSTEMS OF MEASUREMENTS-PART 1

Lecture Four

Dr. Hanan M. Alharbi

COLLEGE OF PHARMACY
UMM AL–QURA UNIVERSITY

Learning Objectives

Upon successful completion of this lecture, the student will be able to:

■ Identify the units and symbols used in Apothecary measures.

■ Identify the units and symbols used in Avoirdupois measures.

■ Perform basic calculations to convert between various systems.

Common Measurement Systems

- Common measures are approximate.

- Three types of common measures are used in the pharmacy:
    - *Apothecary*
    - *Avoirdupois*
    - *Household*

- Common measures are often converted to metric equivalents.

I. Apothecaries' System

Unlike the metric system, which has units for weight, volume, and the length, the apothecaries' system has units for weight and volume only. This is an old system, and its use is rapidly declining. However, some physicians still write prescriptions using this system. A few drug labels that were originally produced under the apothecaries' system still state the apothecaries' equivalent on the label. As a few examples, phenobarbital, aspirin, codeine, sodium bicarbonate, and potassium iodide labels appear in the metric as well as apothecary units.

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Nitrostat®
(Nitroglycerin Tablets, USP)
0.4 mg (1/150 gr)
℞ only
100 SUBLINGUAL TABLETS

Ⓟ **PARKE-DAVIS**

Warning—To prevent loss of potency, keep these tablets in the original container. Close tightly immediately after each use.

Usual Dosage—0.3 to 0.6 mg sublingually as needed.
See package insert for full prescribing information.
Keep this and all drugs out of the reach of children.
Dispense in original, unopened container.
Store at Controlled Room Temperature 20°-25°C (68°-77°F) [see USP].
Manufactured by:
Parke Davis Pharmaceuticals, Ltd.
Vega Baja, PR 00694
Distributed by:
PARKE-DAVIS
Div of Warner-Lambert Co
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Apothecaries' System

The basic unit for weight is grain (gr), and that of volume is minim (℥). Unlike the metric units, the amount is expressed in Roman numerals after the apothecaries' symbol. For example, ½ grain is expressed as gr ss and not ½ gr. Twenty minims are expressed as ℥-xx. Sometimes some physicians also use Arabic numerals in the apothecary system. For example, 12 ounces can be written as ℥-XII or 12-oz and 4 ounces as ℥-IV or 4-oz. Tables 4.4 and 4.5 show the relationships between measures of liquid volume and solid weight in the apothecaries' system.
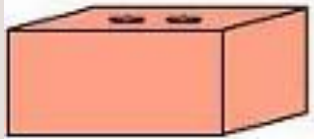
Apothecaries' System

TABLE 4.4
Apothecaries' Liquid Measures

60 minims (♏)	=	1 fluid dram (fʒ)
8 fluid drams (fʒ)	=	1 fluid ounce (fℨ)
16 fluid ounces (fℨ)	=	1 pint (pt or O)
2 pints (O)	=	1 quart (qt)
4 quarts (qt)	=	1 gallon (gal or C)

TABLE 4.5
Apothecaries' Weight Measures

20 grains (gr)	=	1 scruple (℈)
3 scruples (℈)	=	1 dram (ʒ)
8 drams (ʒ)	=	1 ounce (ℨ)
12 ounces (ℨ)	=	1 pound (lb)
1 pound (lb)	=	5760 grains (gr)

Weight

1 pound (lb) = 16 ounces (oz)
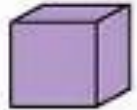
1 ounce (oz) = 8 drams (dr)

1 dram (dr) = 60 grains (gr)

Volume
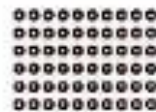
1 gallon (gal) = 4 quarts (qt) = 8 pints (pt)

1 pint (pt) = 16 fluid ounces (fl oz)

1 fluid ounce (fl oz) = 8 fluid drams (fl dr)

1 fluid dram (fl dr) = 60 minim (M)

Apothecaries' System

Apothecary Notation Rules

When writing a value in the apothecary system:

1. If a value is less than 1, write it as a fraction.

2. Unless the value is one-half, write it as the abbreviation *ss*.

3. Write the values with lowercase Roman numerals.

4. Write the abbreviation, symbol or unit before the quantity.

II. Avoirdupois System

- Widely used in the U.S. in measuring body weight and in selling goods by ounce or pound.

TABLE 5.6 Avoirdupois System

Measurement Unit	Equivalent within System	Metric Equivalent
1 gr (grain)	–	65 mg
1 oz (ounce)	437.5 gr	30 g (28.35 g)*
1 lb (pound)	16 oz or 7000 gr	454 g

*An avoirdupois ounce actually contains 28.34952 g; however, we often round up to 30 g. It is common practice to use 454 g as the equivalent for a pound (28.35 g × 16 oz/lb = 453.6 g/lb, rounded to 454 g/lb).

Examples for Practice

1. Write *four grains* using apothecary notation.

gr iv or gr $\overline{\text{iv}}$

2. Write *two and one-half grains* using apothecary notation.

gr iiss

3. Write *twelve ounces* using apothecary notation.

℥ xii

Examples for Practice

Write the following, using Roman numerals and symbols:

1. 3 grains _____
2. 5 drams _____
3. 8 fluidrams _____
4. 10 minims _____
5. 20 1/2 minims _____
6. 5 pints _____

Solve the following:

7. 8 quarts = _____ gallon(s)
8. f$\bar{3}$ ii = _____ minim(s)
9. f$\bar{3}$ iv = _____ fluidram(s)
10. gr xxx = _____ dram(s)
11. f$\bar{3}$ viii = _____ ounce(s)
12. 4 pints = _____ quart(s)
13. 4 ounces = _____ pint(s)
14. gr xv = _____ dram(s)
15. 1/4 $\bar{3}$ = _____ dram(s)
16. $\bar{3}$ $\bar{\bar{ss}}$ = _____ dram(s)

Example 1:

If a prescription calls for gr iii thyroid desiccated tablets and the pharmacist has gr ss tablets in stock, how many tablets of gr ss should be provided?

gr iii = 3 grains
gr ss = ½ grain
3/½ = 6 tablets of gr ss, answer

Example 2:

How many doses of f℥ iv are present in O ii of Maalox®?

O ii = 2 pints
$= 2 \times 16$ ounces = 32 ounces
$= 32 \times 8 = 256$ fluid drams
$= 256/4 = 64$ doses, answer

TABLE 5.5 Apothecary System

Measurement Unit	Equivalent within System	Metric Equivalent
Volume		
1 ♏ (minim)	–	0.06 mL
16.23 ♏	–	1 mL
1 f ʒ (fluidram)	60 ♏	5 mL (3.75 mL)*
1 f ℥ (fluid ounce)	6 f ʒ	30 mL (29.57 mL)†
1 pt (pint)	16 f ℥	480 mL
1 qt (quart)	2 pt or 32 f ℥	960 mL
1 gal (gallon)	4 qt or 8 pt	3840 mL
Weight		
1 gr (grain)	–	65 mg††
15.432 gr	–	1 g
1 Ә (scruple)	20 gr	1.3 g
1 ʒ (dram)	3 Ә or 60 gr	3.9 g
1 ℥ (ounce)	8 ʒ or 480 gr	30 g (31.1 g)
1 # (pound)	12 ℥ or 5760 gr	373.2 g

*In reality, 1 f ʒ contains 3.75 mL; however, that number is usually rounded up to 5 mL or 1 tsp.
†In reality, 1 f ℥ contains 29.57 mL; however, that number is usually rounded up to 30 mL.
††Many manufacturers use 60 mg instead of 65 mg as the equivalent for 1 gr (grain).

- Conversion To Metric System

Example 3:

A doctor ordered morphine sulfate gr 3/5, and the pharmacist has a stock solution of gr 1/8 per mL of morphine sulfate. How many mL of the stock solution is required to fill the prescription?

gr 3/5	= 0.6 grains needed
gr 1/8	= 0.125 grains per mL
0.125/mL	= 0.6/X
X	= 0.6/0.125
or X	= 4.8 mL of the stock solution, answer

1. If two quarts of generic Tylenol elixir are present in the inventory, how many f℥-iv prescriptions can be filled?
2. If approximately 12 prescriptions of f℥-vi Ventolin® syrup are filled per day, how many gallons of the syrup would be used in 15 days?
3. How many minims of a topical keratolytic solution are contained in a 4-fluid-dram bottle?

4. If 36 APAP suppositories of 2 grains each are dispensed, how many scruples of drug are dispensed?
5. How many apothecary ounces are represented in lbs iiiss?
6. How many fluid drams remain after 4 fluid drams, 60 minims, and 1/2 fluid ounce of Robitussin (generic) are removed from one pint of a solution?

35. How many grains are represented in lb XX?
36. How many ℨ are represented in lbs-vii?
37. How many ℨ are represented in gr-civ?
38. How many ℨ are contained in gr-cxx?

Supply the appropriate equivalent as indicated:

- 3.4 pint to liters =

- 106 kg to lb=

- Gal xii to liters=

- F-oz viss to mL=

- ¼ gr to mg=

■ How many mg of dexamethasone are needed to formulate 100 tablets, each tablet containing gr 1/5 of dexamethasone?

- ■ What size bottle in f-oz, you must dispense 240 mL of Ilosone liquid oral suspension?