
ROMAN NUMERALS

Remember:

Dates are always
capital letters

MCMXC (1990).

The Roman numeral system does not utilize numerals. Instead, the putting together of alpha characters that follows specific rules represents each number. The alpha characters used are **c, d, i, l, m, s, v,** and **x**. These letters can be small case or capitalized—it does not matter. One exception is that dates (2009) always use capital letters. Each letter represents a specific number.

$$ss = \frac{1}{2}$$

$$I \text{ or } i = 1$$

$$V \text{ or } v = 5$$

$$X \text{ or } x = 10$$

$$L \text{ or } l = 50$$

$$C \text{ or } c = 100$$

$$D \text{ or } d = 500$$

$$M \text{ or } m = 1000$$

The Roman numeral system is not used to do calculations. It is used to document values or quantities only. In order to perform calculations, Roman numerals have to be converted to Arabic numerals. Once you know the rules, this becomes easy to do. When a number is represented by two letters, and the second letter corresponds to a number with the same value or a smaller value than the first one, you add them together.

$$VI = 5 + 1 = 6$$

$$II = 1 + 1 = 2$$

$$XV = 10 + 5 = 15$$

When there are two letters and the second one represents a number with a greater value than the first letter, you subtract the first from the second.

$$IX = I \rightarrow 1, X \rightarrow 10, 10 - 1 = 9$$

$$XL = X \rightarrow 10, L \rightarrow 50, 50 - 10 = 40$$

When there are more than two letters used to represent a number, you apply the subtraction rule first. Remember, you subtract any smaller value letter from a larger value letter that follows it. Once that is done, you add all the values together to determine the number.

$$XLIV = X \rightarrow 10, L \rightarrow 50, 50 - 10 = 40; I \rightarrow 1, V \rightarrow 5, 5 - 1 = 4; 40 + 4 = 44$$

$$CXXIV = C \rightarrow 100, X \rightarrow 10, I \rightarrow 1, V \rightarrow 5; 100 + 10 + 10 + (5 - 1) = 124$$

$$CCXLIX = 100 + 100 + (50 - 10) + (10 - 1) = 249$$

Prescriptions also can be written with Roman numerals. It is important that you are able to translate these scripts properly.

Anywhere Pharmacy 1234 Main St. Light, CO 81504 Name: Joe Simpleton Zantac: 150 mg 2 tabs po bid disp XXIV No refills Dr. Smalley	Anywhere Pharmacy 1234 Main St. Light, CO 81504 Name: Joe Simpleton Zantac: 150 mg po ii bid #24 No refills Dr. Smalley
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Both scripts read as follows: Zantac 150 mg, take 2 tablets twice a day; dispense 24 tablets.

Practice Problems 1.1

Convert the Arabic to the Roman.

- | | | |
|---------------|---------------|----------------|
| 1. 2010 _____ | 10. 787 _____ | 19. 1496 _____ |
| 2. 1949 _____ | 11. 400 _____ | 20. 999 _____ |
| 3. 24 _____ | 12. 231 _____ | 21. 315 _____ |
| 4. 520 _____ | 13. 86 _____ | 22. 18 _____ |
| 5. 13 _____ | 14. 66 _____ | 23. 540 _____ |
| 6. 93 _____ | 15. 39 _____ | 24. 77 _____ |
| 7. 42 _____ | 16. 161 _____ | 25. 104 _____ |
| 8. 375 _____ | 17. 684 _____ | |
| 9. 6 _____ | 18. 57 _____ | |

Convert the Roman to the Arabic.

- | | | |
|-------------------|----------------------|---------------------|
| 26. MMVII _____ | 35. dc _____ | 44. CCL _____ |
| 27. dxxiv _____ | 36. MCDLVI _____ | 45. mv _____ |
| 28. cix _____ | 37. vi _____ | 46. XXI _____ |
| 29. LIII _____ | 38. xxxvi _____ | 47. xliii _____ |
| 30. XLIX _____ | 39. iii _____ | 48. MCMLXXXII _____ |
| 31. iv _____ | 40. LXXV _____ | 49. xxviii _____ |
| 32. viii _____ | 41. cxxiv _____ | 50. MDCCXCVI _____ |
| 33. CCCXXIV _____ | 42. mmmcccxxix _____ | |
| 34. LXI _____ | 43. dxliv _____ | |

What quantity will be dispensed for the following prescriptions?

51. Anywhere Pharmacy
1234 Main St.
Light, CO 81504

Name: Joe Simpleton

Amoxicillin: 250 mg po tid × 10 days disp XXX

No refills Dr. Smalley

52. Anywhere Pharmacy
1234 Main St.
Light, CO 81504

Name: Joe Simpleton

Motrin: 80 mg po tid
Disp CXX

No refills Dr. Smalley

53. Anywhere Pharmacy
1234 Main St.
Light, CO 81504

Name: Joe Simpleton

Synthroid: 0.1 mg 3 tabs
daily × 14 days disp XLII

No refills Dr. Smalley

54. Anywhere Pharmacy
1234 Main St.
Light, CO 81504

Name: Joe Simpleton

Coumadin: 2.5 mg po daily
Disp XXI

No refills Dr. Smalley

55. Anywhere Pharmacy
1234 Main St.
Light, CO 81504

Name: Joe Simpleton

Zithromax: 250 mg 2 tabs now,
then 1 po daily for 10 days
Disp XII

No refills Dr. Smalley

METRIC SYSTEM

The measurement systems in place for pharmacy are:

- Metric
- Avoirdupois
- Apothecary

The avoirdupois system is based on British standards and states that 1 pound is equivalent to 16 ounces. Apothecary systems used the base of grains and minims. They are still seen occasionally in pharmacy calculations today. Other units you will see in the apothecary system are drams, ounces, and pounds.

The most common system is metric. The three basic units of measure are meter, gram, and liter. The two most common units in pharmacy are grams (weight) and liters (volume). The liter is based on the volume of 1000 cubic centimeters (cc) of

Remember:

It takes lots of small parts to equal one large part!

Remember:

It only takes a portion of a large part to equal a smaller part.

water. One cubic centimeter is equivalent to 1 milliliter (mL), so 1000 mL equals 1 liter. The gram is based on the weight of 1 cubic centimeter of distilled water at 4°C.

The metric system was developed in the late 18th century in France. The United States adopted this system in the late 1800s and made it our standard of measure in 1893. It is the accepted system of measure for scientists all around the world because of its simplicity.

The liter is the base unit for measuring liquid volumes in the metric system. It represents the volume of a cube that is one-tenth of a meter on each side. The most common units used for volume in pharmacy are the liter, milliliter, and microliter. **Table 1.1** displays the measures of metric volume.

Use the liter as your homebase. Kilo- (large) and milli- (small) each represent 1000. If 1 L = 1, then dividing by 1000 will give you Kg (0.001 Kg), which represents small to large. Multiplying by 1000 will give you mg (1000 mg), which is large to small. Hecto- and centi- represent 100. Deka- and deci- represent 10.

When doing calculations with metric measures, you must be sure all your values are in the same measure. If your final answer needs to be in milligrams (mg) and you are dealing with grams (g), you need to convert your values into the desired measure. You can do this before you begin, or once the calculations are completed. If you are dealing with multiple measures, you need to convert them all into one common measure. To convert from a large measure to a smaller one, you need to multiply. To convert from small measures to large measures, division is the tool to use.

TABLE 1.1 Metric Volumes

Volume Label	Abbreviation	Liters	Comparison to a Liter
Kiloliter	kL	1000	0.001 kL
Hectoliter	hL	100	0.01 hL
Dekaliter	dkL	10	0.1 dkL
Liter	L	1	1.0 L
Deciliter	dL	0.1	10 dL
Centiliter	cL	0.01	100 cL
Milliliter	mL	0.001	1000 mL
Microliter	mcL (μL)	0.000001	1,000,000 mcL

EXAMPLE 1

You have a 3 L bottle of cough syrup. How many milliliters are in this container?

3 L
 (1 L = 1000 mL)
 $3 \text{ L} \times 1000 = 3000 \text{ mL}$

EXAMPLE 2

You have an IV bag that contains 600 mL. How many liters is this?

- 1 L
 (1 L = 1000 mL)
 $1 \times 1000 \text{ mL} = 1000 \text{ mL}$
- $600 \text{ mL} \div 1000 \text{ mL} = 0.6 \text{ L}$
 (1000 mL = 1 L)

EXAMPLE 3

A 5 L bag of fluid contains how many microliters?

1. 5 L
(1 L = 1000 mL)
 $5 \times 1000 \text{ mL} = 5000 \text{ mL}$
2. 5000 mL
(1 mL = 1000 mcL)
 $5000 \times 1000 = 5,000,000 \text{ mcL}$

Practice Problems 1.2

Convert the following.

1. 2 L = _____ mL
2. 3000 mL = _____ L
3. 1 L = _____ mL
4. 3 mL = _____ mL
5. 100 mL = _____ L
6. 500 mL = _____ L
7. 500 mL = _____ mL
8. 1000 L = _____ kL
9. 540 L = _____ kL
10. 30 mL = _____ mL
11. 350,000 mL = _____ L
12. 1500 mL = _____ mL

The gram is the base unit of measure for weight in the metric system. It represents the weight of 1 cubic meter (cm^3) of water at 4°C . The amount, or concentration, of a drug is measured in metric weight. The most common measures used are grams, milligrams, and micrograms. Oral tablets and capsules are labeled in this manner. Some examples are Lasix 10 mg tablets, Ampicillin 250 mg capsules, or even Augmentin 1 g tablets. Liquid medications include both weight and volume. Lasix 10 mg/5 mL, Ampicillin 250 mg/5 mL, and Augmentin 1 g/50 mL are examples of liquid medications.

Medications can also be dosed based on the patient's weight. For example, a medication may be written as 50 mg/kg/day, or 10 mg/kg/dose. Therefore, a patient's weight must be converted to kilograms from pounds in order to calculate the proper dose for treatment. One kilogram (kg) is equivalent to 2.2 (lbs). A person when weighing 165 pounds weighs 75 kg. **Table 1.2** displays the measures of metric weight.

TABLE 1.2 Metric Weights

Weight Label	Abbreviation	Grams	Comparison to a Gram
Kilogram	kg	1000	0.001 kg
Hectogram	hg	100	0.01 hg
Dekagram	dkg	10	0.1 dkg
Gram	g	1	1 g
Decigram	dg	0.1	10 dg
Centigram	cg	0.01	100 cg
Milligram	mg	0.001	1000 mg
Microgram	mcg (μg)	0.000001	1,000,000 mcg

The most common conversions are micrograms → milligrams, milligrams → grams, and grams → kilograms.

$$1000 \text{ mcg} = 1 \text{ mg}$$

$$1000 \text{ mg} = 1 \text{ g}$$

$$1000 \text{ g} = 1 \text{ kg}$$

EXAMPLE 4

How many mg are in 5.4 g?

$$(1 \text{ g} = 1000 \text{ mg})$$

$$5.4 \times 1000 = 5400 \text{ mg}$$

Remember that you want to know how many small parts are in the big part.

EXAMPLE 5

Convert 15,000 mg to grams.

$$15,000 \div 1000 = 15 \text{ g}$$

EXAMPLE 6

150,000 mcg is equivalent to how many grams?

$$(1 \text{ g} = 1000 \text{ mg})$$

$$(1 \text{ mg} = 1000 \text{ mcg})$$

$$150,000 \div 1000 = 150 \text{ mg} \div 1000 = 0.15 \text{ g}$$

EXAMPLE 7

A patient weighs 25 kg. The medication is dosed at 10 mg/kg/day. What is the daily dose required?

The patient's weight is already in kg, so you need to multiply 25 kg × 10 mg for the dose.

$$25 \text{ kg} \times 10 \text{ mg} = 250 \text{ mg daily}$$

EXAMPLE 8

A patient weighs 132 lbs. The medication is dosed at 50 mg/kg/dose. How much is needed per dose?

The patient's weight must be converted to kg first.

$$132 \text{ lbs} \div 2.2 = 60 \text{ kg}$$

$$60 \text{ kg} \times 50 \text{ mg} = 300 \text{ mg per dose}$$

Practice Problems 1.3

Convert the following.

- | | | |
|------------------------|------------------------|------------------------|
| 1. 2 g = _____ mcg | 8. 500 mg = _____ g | 15. 22 g = _____ mg |
| 2. 1 mg = _____ mcg | 9. 630 mg = _____ kg | 16. 320 mcg = _____ g |
| 3. 100 mg = _____ g | 10. 5.4 kg = _____ g | 17. 66 lbs = _____ kg |
| 4. 2 kg = _____ g | 11. 0.2 mg = _____ mcg | 18. 10 kg = _____ lbs |
| 5. 5 kg = _____ mg | 12. 4 g = _____ kg | 19. 95 kg = _____ lbs |
| 6. 4000 mcg = _____ mg | 13. 250 mcg = _____ mg | 20. 220 lbs = _____ kg |
| 7. 3 g = _____ mg | 14. 0.5 mg = _____ mcg | |

Metric Conversions

Converting different measurements to a common one makes it easier to perform calculations. There are many different types of measurements. The most common used by people outside the medical and scientific community are the household measurements (e.g., tsp, tbsp, ounce, quart, gallon). While these are the least accurate, they are the easiest ones to direct patients on dosing at home. The common tablespoon can vary from 15 mL up to 22 mL in measurement. The accurate dose of a tablespoon is 15 mL when comparing to the metric system. Knowing common conversions can help ensure that proper doses are being calculated and dispensed. Most retail pharmacies will send a dispensing spoon home with liquid medications because it has “mL” markings along with teaspoon/tablespoon markings to ensure accurate dosing.

EXAMPLE 9

A medication has 5 mg/mL and the patient needs to take 1 tablespoon four times a day.

If the patient takes 15 mL per dose, he or she will receive 60 mL daily. If he or she takes 22 mL per dose, that will be 88 mL daily. At 60 mL daily, the patient receives 300 mg (prescribed). At 88 mL daily, the patient receives 440 mg (overdose).

Conversions are done in relation to the metric system. The metric system is always used to perform calculations. **Table 1.3** lists some common conversions that should be committed to memory. These are used almost daily in the pharmacy. Many products list both measures on their labels. The United States may be the only country in the world that does not use the metric system as its standard.

Practice this exercise to become familiar with common conversions:

- 1 tsp = 5 mL
- 1 tbsp = 3 tsp = 15 mL
- 2 tbsp = 6 tsp = 30 mL = 1 ounce

TABLE 1.3 Household to Metric Conversions

Household Measure	Metric Measure
1 teaspoon	5 mL
1 tablespoon	15 mL
1 ounce	30 mL
8 ounces ($\frac{1}{2}$ pint)	240 mL
1 pint (16 ounces)	473 mL (480 mL)
1 quart (32 ounces)	946 mL
1 gallon (128 ounces)	3785 mL
1 pound (lb)	454 g
2.2 pounds (lbs)	1 kg

Practice Problems 1.4

Convert the following.

1. $\frac{1}{2}$ tsp = _____ mL a. 1.55 b. 2.5 c. 1.75
2. 3 tsp = _____ mL a. 10 b. 12 c. 15
3. 2 pints = _____ mL a. 946 b. 900 c. 500
4. $\frac{1}{2}$ lb = _____ g a. 225 b. 227 c. 300
5. 3 qts = _____ mL a. 2838 b. 2800 c. 3000
6. 3 tbsp = _____ mL a. 40 b. 48 c. 45
7. 2 oz = _____ mL a. 60 b. 65 c. 75
8. 3 oz = _____ mL a. 80 b. 90 c. 95
9. 45 mL = _____ oz a. 1.5 b. 2 c. 3
10. 15 mL = _____ tsp a. 2 b. 3 c. 4
11. $\frac{1}{4}$ tsp = _____ mL a. $\frac{1}{2}$ b. $\frac{1}{4}$ c. 1.25
12. 20 mL = _____ tsp a. 4 b. 5 c. 6
13. 100 kg = _____ lbs a. 120 b. 100 c. 220
14. 66 lbs = _____ kg a. 33 b. 30 c. 20
15. 1892 mL = _____ gal a. $\frac{1}{2}$ b. $\frac{3}{4}$ c. 1
16. 2 qts = _____ pts a. 2 b. 4 c. 3
17. 8 oz = _____ tsp a. 48 b. 24 c. 12
18. 7.5 mL = _____ tsp a. 3 b. $1\frac{1}{2}$ c. $\frac{1}{2}$
19. 45 mL = _____ tbsp a. 3 b. 2 c. 1
20. 8 oz = _____ tbsp a. 8 b. 6 c. 16

APOTHECARY SYSTEM

The apothecary system uses the measure units of minims, drams, and grains for smaller measures, and then progresses to ounces, pints, quarts, gallons, and pounds as seen in the household measure system. This system is seldom used

TABLE 1.4 Apothecary Conversions

Apothecary	Abbreviation/Symbol	Household Conversion	Metric Conversion
1 minim	\mathfrak{m}		0.06 mL
16.23 minims	\mathfrak{m}		1 mL
1 dram	\mathfrak{d}	1 teaspoon (5 mL)	3.69 mL (4 mL)
8 drams (volume)	\mathfrak{d}	1 ounce (6 drams)	29.57 mL (30 mL)
8 drams (weight)	\mathfrak{d}	1 ounce	30 g
1 grain	gr		65 mg
15.4 grains	gr		1 g
1 pound	lb	1 pound	454 g

For calculating purposes, 6 drams = 1 oz based on the dram being 5 mL, even though the true measure would be 8 drams (4 mL).

Grains

Sometimes
1 gr = 60 mg.
It depends
on the
manufacturer:
Codeine
1 gr = 60 mg
Phenobarb
1 gr = 65 mg

anymore but does make an appearance in pharmacy occasionally. For calculation purposes, these units are also converted to metric. (See **Table 1.4**.)

The liquid measures are minims, drams, ounces, pints, quarts, and gallons. You will occasionally see prescriptions written with drams as a unit of measure and, very rarely, the unit of minims is used. A dram is a little less than a teaspoon. Typically, it is converted to a teaspoon measure (5 mL) when calculating or dispensing liquid medications.

The weight measure of grains is still used today for many medications (e.g., aspirin, 5 grains). Many older medications are still measured in grains also (e.g., thyroid, phenobarbital). You will often see both grains and milligrams on the packaging of medications that are dispensed with grains as their unit of measure. Some examples are aspirin 5 grains (325 mg) tablets or phenobarbital 1 grain (65 mg) tablets.

Practice Problems 1.5

Convert the following.

- 3 gr = _____ mg a. 185 b. 190 c. 195
- $\frac{1}{2}$ gr = _____ mg a. 32 b. 32.5 c. 33
- 3 drams = _____ oz a. $\frac{1}{2}$ b. 1 c. 3
- 130 mg = _____ gr a. 2 b. 3 c. 4
- 2 oz = _____ g a. 30 b. 45 c. 60
- 30 mL = _____ drams a. 8 b. 6 c. 3
- 4 oz = _____ g a. 100 b. 120 c. 140
- $\frac{1}{2}$ dram = _____ tsp a. 2 b. $\frac{1}{2}$ c. 3
- 10 gr = _____ mg a. 400 b. 325 c. 650
- 2 drams = _____ tsp a. 2 b. 3 c. $\frac{1}{2}$

CHAPTER 1 QUIZ

Convert the following Arabic numerals to Roman numerals.

1. 84
2. 310
3. 490
4. 19
5. 28

Convert the following Roman numerals to Arabic numerals.

1. MCMXCVI
2. CCXXXIV
3. XCV
4. MMIX
5. DCCC

Perform the following conversions.

1. 3 L = _____ mL
2. 2 g = _____ mcg
3. 500 mL = _____ L
4. 3 kg = _____ mg
5. 5000 mcL = _____ L
6. 700 mg = _____ mcg
7. 1.5 L = _____ mL
8. 650 mcg = _____ mg
9. 100 mL = _____ mcL
10. 3500 g = _____ kg
11. 2 L = _____ mcL
12. 4.5 g = _____ mg
13. 300 mL _____ mcL
14. 5 kg = _____ g
15. 8000 mcL = _____ mL
16. 450 mg = _____ g
17. 1300 mL = _____ L
18. 6 g = _____ mcg
19. 4.2 L = _____ mL
20. 8200 mg = _____ g

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Convert the following household measures.

1. 2 tsp = _____ mL
2. 2 pts = _____ mL
3. 2 lbs = _____ g
4. 2 qts = _____ mL
5. 3 tbsp = _____ mL
6. 176 lbs = _____ kg
7. 6 oz = _____ tsp
8. 5 gr = _____ mg
9. 5 oz = _____ g
10. 650 mg = _____ gr
11. 8 oz = _____ mL
12. 25 kg = _____ lbs
13. 15 mL = _____ tsp
14. 60 mL = _____ tbsp
15. 120 mL = _____ oz
16. 180 g = _____ oz
17. 7.5 mL = _____ tsp
18. $\frac{1}{4}$ tsp = _____ mL
19. 45 mL = _____ tbsp
20. 275 lbs = _____ kg