Measurement Conversion

CONVERSION FRACTIONS

Conversion fractions are used in many contexts to convert between different measurement units in a variety of fields.

Example 1: Convert 3 pints to fluid ounces.

Solution: We set up a conversion factor to translate between the unit we have and the unit we want.

We *have* pints. We must set up a conversion fraction with pints and fluid ounces so that "pints" cancels. We check the table on the next page, and find a column with pints and fluid ounces. The two entries are "1 pint" and "16 fl. oz.", so the conversion equation is 1 pt. = 16 fl. oz. Since we want "pints" to cancel, it goes on the bottom of the fraction:

$$3\ pt. \times \frac{16\ fl.oz.}{1\ pt.} = 48\ fl.oz.$$

With the conversion fraction, we'll never forget whether we need to multiply or divide.

Example 2: Convert 20 drams to millilitres.

Solution: We don't have a direct conversion from drams to mL (see the table on the next page), but we can still use conversion fractions. We can convert to tablespoons, and then millilitres. (It doesn't have to be tablespoons; anything else that acts as a stepping stone from one to the other will do, although it is best to avoid converting to metric and back again since this can make your calculation less precise.)

$$20\ drams \times \frac{1\ tbsp.}{4\ drams} \times \frac{15\ mL}{1\ tbsp.} = (20 \times 15 \div 4)\ mL = 75\ mL$$

Example 3: There are 5280 feet in a mile, 12 inches in a foot, and according to US law, an inch is exactly 2.54 cm. Convert 12.9 km to miles.

Solution: We can figure this out by using a longer chain of conversions. It doesn't matter how many we use, as long as we remember that we must cancel any unit that we don't want in the end.

$$12.9\ km \times \frac{1000\ m}{1\ km} \times \frac{100\ cm}{1\ m} \times \frac{1\ in.}{2.54\ cm} \times \frac{1\ ft.}{12\ in.} \times \frac{1\ mi.}{5280\ ft.} = \frac{12.9 \times 1000 \times 100}{2.54 \times 12 \times 5280}\ mi. = 8.02\ mi.$$

Example 4: A doctor orders 50 cc of medication X to infuse over 30 min. What is the rate per hour?

Solution: We need to convert the time into hours from minutes:

$$\frac{50\ cc}{30\ \text{min}} \times \frac{60\ \text{min}}{1\ h} = (50 \times 60 \div 30)\ {}^{cc}/_{h} = 100\ {}^{cc}/_{h}$$

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Volume

Each column in this table represents the same amount. Each row represents the same unit. Take a look at Examples 1 and 2 to see how to use the table. Metric units are on the bold-outlined rows of the table; Imperial measures are on the other lines.

					½ qt.	**1 quart**
				½ pt.	**1 pint**	2 pt.
				1 cup	2 c.	4 c.
		½ fl. oz.	**1 fluid ounce**	8 fl. oz.	16 fl. oz.	32 fl. oz.
		1 tablespoon	2 tbsp.	16 tbsp.	32 tbsp	
	1 teaspoon	3 tsp.	6 tsp.	48 tsp.		
1 fluid dram	1⅓ drams	4 drams	8 drams			
	5 cc 5 mL	15 cc 15 mL	~30 cc ~30 mL	~240 cc ~240 mL*****	~475 mL	~950 mL
45 gtts (drops)	60 gtts					
60 minims						

***** In cooking, a cup is usually equated to 250 mL. This figure is a bit more precise.

Weight

					1 kg
				1 pound	2.2 lb.
			1 lb. ap.*		2.68 lb. ap.
		1 ounce ap.	12 oz. ap.		32.2 oz. ap.
	1 dram	8 dram	96 dram		
1 gram	3.9 g	31.1 g	373 g	454 g	1000 g
~15 grains	60 gr.				
1000 mg					

***** The pound used to measure medications consists of 12 **apothecary ounces**. In medicine, it's called the **apothecary pound**. (The same system is used for precious metals, only it's called the troy ounce and the troy pound.) On your bathroom scale at home, each pound has 16 ounces. It is important to remember that there are two different ounces (plus fluid ounces) and two different pounds.

Temperature

$$^\circ C = (^\circ F - 32) \div 1.8$$
$$^\circ F = ^\circ C \times 1.8 + 32$$

COMMON FRACTIONS

1	1.000…	100%
¾	0.75	75%
½	0.5	50%
⅓	0.333…	33⅓%
¼	0.25	25%
1/10	0.1	10%
1/100	0.01	1%

EXERCISES

A. Convert the following:

1) 12½ fl. drams → cups
2) 1 L → tbsp.
3) 5½ oz. ap. → grains
4) 1.4 lb. ap. → mg
5) body temp 37° C → ° F
6) fever of 102° F → ° C

B. Convert the following using conversion fractions (you may need some information from the examples at the beginning of this worksheet):

1) 34.7 g → lb. ap.
2) 5.0 yd. → cm (3 ft. = 1 yd.)
3) 0.72 m^3 → L (1 000 000 cc = 1 m^3)
4) 0.50 lb. ap. of gold → mL (1 cc of gold = 19.3 g)
5) 24 fl. oz → mm^3 (1 cc = 1000 mm^3)
6) 2.91 mm^3 of gold → dollars (1 oz. ap. of gold = $1225.54)
7) €300 → drams of gold ($1.00 = €0.6287)
8) 2.00 moles of gold → dollars (1 mole of gold = 196.97 g)

C. Convert the following dosage amounts to the required units:

1) 1.5 $^{L}/_{day}$ → $^{cc}/_{h}$
2) 0.32 $^{oz}/_{h}$ → $^{g}/_{day}$
3) 2.5 $^{g}/_{day}$ four times per day → $^{mg}/_{dose}$
4) 150 $^{mL}/_{dose}$ BID → $^{fl.\ oz}/_{h}$

D. An adult patient has a blood glucose level of 0.025 $^{oz.\ ap}/_{pt.}$. Assuming 5 L of blood in the human body, normal blood sugar levels range from 3.3 g – 7.0 g of glucose in the blood. Is this patient's blood level too high, too low, or within normal parameters?

SOLUTIONS

A. (1) 0.195 c. (2) 66.7 tbsp. (3) 2640 gr. (4) 522 200 mg (5) 98.6° F (6) 38.9° C

B. (1) 0.0929 lb. ap. (2) 457.2 cm (3) 720 L (4) 9.66 mL (5) 720 000 mm^3
(6) $2.21 (7) 3.115 dr. (8) $15 522.27 Answers may vary in this section

C. (1) 62.5 $^{cc}/_{h}$ (2) 238.8 $^{g}/_{day}$ (3) 625 $^{mg}/_{dose}$ (4) 0.417 $^{fl.\ oz}/_{h}$

D. The patient's glucose level converts to 1.6368 g/L, which is 8.18 g in 5 L. The patient's glucose level is too high