

DIY: Unit Conversion

To review Unit Conversion, watch the following set of YouTube videos introducing concept of unit conversion and how to convert units using dimensional analysis. They are followed by several practice problems for you to try, covering all the basic concepts covered in the videos, with answers and detailed solutions. Some additional resources are included for more practice at the end.

1. Introduction: - <https://www.youtube.com/watch?v=HZ9weUkSdoY>
2. Dimensional Analysis with one unit:- <https://www.youtube.com/watch?v=7N0IRJLwpPI>
3. Dimensional Analysis w/ multiple conversion factors:-
<https://www.youtube.com/watch?v=LdZ000FAfaQ>
4. Dimensional Analysis with multiple units: - <https://www.youtube.com/watch?v=BKsPi-VXp5U>
5. Converting Metric Units of Volume: - <https://www.youtube.com/watch?v=Ynp6rG45RZA>
6. Unit Conversions with Area and Volume: - <https://www.youtube.com/watch?v=aFAk8JA4-d8>
7. Drug dosage calculation-simple: - <https://www.youtube.com/watch?v=AxaBNFs7pe0>
8. Drug dosage Calculation-Advanced: - <https://www.youtube.com/watch?v=5ofqkWIEuYc>

CONVERSION CHART

<i>Liquid Measure</i>	<i>Dry Measure</i>	<i>Linear Measure</i>
8 ounces = 1 cup	2 pints = 1 quart	12 inches = 1 foot
2 cups = 1 pint	4 quarts = 1 gallon	3 feet = 1 yard
16 ounces = 1 pint	8 quarts = 2 gallons or 1 peck	5.5 yards = 1 rod
4 cups = 1 quart	4 pecks = 8 gallons or 1 bushel	40 rods = 1 furlong
1 gill = 1/2 cup or 1/4 pint	16 ounces = 1 pound	8 furlongs (5280 feet) = 1 mile
2 pints = 1 quart	2000 lbs. = 1 ton	6080 feet = 1 nautical mile
4 quarts = 1 gallon		
31.5 gal. = 1 barrel		
	<i>Conversion of US Weight and Mass Measure to Metric System</i>	<i>Conversion of US Linear Measure to Metric System</i>
3 tsp = 1 tbsp	.0353 ounces = 1 gram	1 inch = 2.54 centimeters
2 tbsp = 1/8 cup or 1 fluid ounce	1/4 ounce = 7 grams	1 foot = .3048 meters
4 tbsp = 1/4 cup	1 ounce = 28.35 grams	1 yard = .9144 meters
8 tbsp = 1/2 cup	4 ounces = 113.4 grams	1 mile = 1609.3 meters or 1.6093 kilometers
1 pinch = 1/8 tsp or less	8 ounces = 226.8 grams	.03937 in. = 1 millimeter
1 tsp = 60 drops	1 pound = 454 grams	.3937 in. = 1 centimeter
	2.2046 pounds = 1 kilogram	3.937 in. = 1 decimeter
<i>Conversion of US Liquid Measure to Metric System</i>	.98421 long ton or 1.1023 short tons = 1 metric ton	39.37 in. = 1 meter
1 fluid oz. = 29.573 milliliters		3280.8 ft. or .62137 miles = 1 kilometer
1 cup = 230 milliliters		
1 quart = .94635 liters		
1 gallon = 3.7854 liters		
.033814 fluid ounce = 1 milliliter		
3.3814 fluid ounces = 1 deciliter		
33.814 fluid oz. or 1.0567 qt. = 1 liter		

To convert a Fahrenheit temperature to Centigrade,
do the following:
a. Subtract 32 b. Multiply by 5 c. Divide by 9

To convert Centigrade to Fahrenheit, do the following:
a. Multiply by 9 b. Divide by 5 c. Add 32

METRIC CONVERSION TABLE

KILOMETER-MILE CONVERSION

KILOMETERS	MILES	MILES	KILOMETERS
1	0.6	1	1.6
5	3.1	5	8.05
10	6.2	10	16.0
20	12.4	20	32.1
30	18.6	30	48.2
40	24.8	40	64.3
50	31.1	50	80.5
60	37.3	60	96.6
70	43.5	70	112.7
80	49.7	80	128.7
90	55.9	90	144.8
100	62.1	100	160.9
500	310.7	500	804.7
1,000	621.4	1,000	1609.3

METRIC TABLES

CAPACITY		AREA	
10 milliliters	= 1 centiliter	100 sq. millimeters	= 1 sq. centimeter
10 centiliters	= 1 deciliter	100 sq. centimeters	= 1 sq. decimeter
10 deciliters	= 1 liter	100 sq. decimeters	= 1 sq. meter (centare)
10 liters	= 1 dekaliter	100 sq. meters	= 1 are
10 dekaliters	= 1 hectoliter	10,000 sq. meters	= 1 hectare
1,000 liters	= 1 kiloliter (stere)	100 hectares	= 1 sq. kilometer
LENGTH		WEIGHT	
10 millimeters	= 1 centimeter (cm)	10 milligrams	= 1 centigram
10 centimeters	= 1 decimeter	10 centigrams	= 1 decigram
10 decimeters	= 1 meter (m)	10 decigrams	= 1 gram
10 meters	= 1 dekameter	1,000 grams	= 1 kilogram (kilo)
100 meters	= 1 hectometer	100 kilograms	= 1 quintal
1,000 meters	= 1 kilometer	1,000 kilograms	= 1 metric ton

METRIC EQUIVALENT OF U.S. WEIGHTS AND MEASURES

DRY MEASURE		LONG MEASURE	
1 pint	= .550599 liter	1 inch	= 2.54 centimeters
1 quart	= 1.101197 liters	1 yard	= .914401 meter
1 peck	= 8.80958 liters	1 mile	= 1.609347 kilometers
1 bushel	= .35238 hectoliter		
LIQUID MEASURE		SQUARE MEASURE	
1 pint	= .473167 liter	1 sq. inch	= 6.4516 sq. centimeters
1 quart	= .946332 liter	1 sq. foot	= 9.29034 sq. decimeters
1 gallon	= 3.785329 liters	1 sq. yard	= .836131 sq. meter
		1 acre	= .40469 hectare
		1 sq. mile	= 2.59 sq. kilometers
		1 sq. mile	= 259 hectares
AVOIRDUPOIS MEASURE		CUBIC MEASURE	
1 ounce	= 28.349527 grams	1 cu. inch	= 16.3872 cu. centimeters
1 pound	= .453592 kilogram	1 cu. foot	= .028317 cu. meter
1 short ton	= .90718486 metric ton	1 cu. yard	= .76456 cu. meter
1 long ton	= 1.01604704 metric tons		

APPROXIMATE EQUIVALENTS

Apothecaries System	Metric System
15 or 16 minims	= 1 ml, cc
1 fluid dram (f3) or 3	= 4 ml
1 dram	= 4 grams
1 fluid ounce	= 30 ml
1 ounce	= 30 grams
1 pint	= 500 ml
1 quart	= 1000 ml = 1 liter
15 or 16 grains	= 1 gram
1 grain	= 60-65 mg
2.2 lb.	= 1 kg

Household Measures	Apothecaries Systems
1 tsp.	= 5 ml = 1 dram
1 Tbsp.	= 3 tsp. = 4 drams
2 Tbsp.	= 8 drams = 1 ounce

Apothecaries Systems	Metric System
1 dram	= 4 ml
4 drams	= 15 or 16 ml
1 ounce	= 30 ml

1 ml glucose = 4 calories

INTERNAL CONVERSIONS

Apothecary Weight

60 grains	= 1 dram
8 drams	= 1 ounce

Apothecary Measure

60 minims	= 1 dram
8 drams	= 1 ounce
16 ounces	= 1 pint
32 ounces	= 1 quart
2 pints	= 1 quart
4 quarts	= 1 gallon

Household

3 tsp.	= 1 Tbsp.
2 Tbsp.	= 1 ounce
8 ounces	= 1 cup
2 cups	= 1 pint

Metric

1000 μ g	= 1 mg
1000 mg	= 1 g
1000 g	= 1 kg
100 cm	= 1 m

Practice problems: The following problems use the techniques demonstrated in the above videos. The answers are given after the problems. Then detailed solutions, if you need them, are provided after the answer section. For further assistance and help please contact [Math Assistance Area](#).

Use the conversion chart above for the following problems

1. Perform the following conversions:

- a) 2 cups = _____ pints b) 200 miles = _____ km c) 1000 mm = _____ cm d) 25 miles = _____ ft.
e) 96 ml = _____ quart(s) f) 2 Tbps = _____ tsp g) 50 yds = _____ m h) 5000 lbs = _____ tons
i) 19 min = _____ sec j) 102 ml = _____ fl oz. k) 10000 μg = _____ mg l) 3 dram = _____ ml

2. Convert:

- a) $565\text{km}^2 =$ _____ sq. miles b) 8 cc = _____ ℓ
c) $24\text{in}^2 =$ _____ ft^2 d) 7 gallons = _____ kilo liters

3. Convert:

- a) $18952\text{m/s} =$ _____ miles/hr. b) $46.3\text{gm/cm}^2 =$ _____ mg/mm^2
c) $35^\circ\text{C} =$ _____ $^\circ\text{F}$ d) 600 grains = _____ ml
e) 69 cups = _____ ℓ f) 1 ton = _____ oz.
g) 2.5×10^{-2} lbs./ cubic inch = _____ g/ml

4. A box is 12ft wide, 3.1 yds long and 48 inches in height. What is the volume of this box in cubic centimeters?

5. A swimming pool holds 5000 gallons of water. What is the volume of the pool in ml?

6. If a car travels at an average speed of 73mph, how many kilometers does the car travel in 3 hours? If the mileage for the car is 20mpg then how many gallons of gas will be used during the 3 hours travel?

7. A doctor ordered 15 oz. of a laxative agent for a patient. The cup the patient used holds 6 oz. . How many cupfuls should the patient drink?

8. An infant drinks 4 ounces of formula every 3 hours during the day and night. The formula comes in 1-quart cans. How many cans of formula would be need to feed the infant for a week?

9. A patient is prescribed 7.5mg of a medicine. The medicine is available in a liquid solution. The label reads 0.5mg per 2 ml. How many ml of medicine should the patient be given? How may tablespoons would that be?

Answers:

1.

- | | | | |
|-------------------|------------------|------------|---------------------|
| a) 1 pint | b) 321.86 km | c) 100cm | d) 132,000 ft |
| e) 0.01014 quarts | f) 6 tsp | g) 45.72 m | h) 2.5 tons |
| i) 1,140 s | j) 3.44903 fl oz | k) 10 mg | l) 12 ml or 11.25ml |

2.

- | | | | |
|-----------------|------------|--------------------------|-----------------------|
| a) 218.16 miles | b) 0.008 ℓ | c) 0.167 ft ² | d) 0.0265 kilo liters |
|-----------------|------------|--------------------------|-----------------------|

3.

- | | | |
|-------------------------|---------------------------|---------|
| a) 42,395.6
miles/hr | b) 463 mg/mm ² | c) 95°F |
|-------------------------|---------------------------|---------|

- | | | | |
|----------|-------------------------|------------------|---------------|
| d) 40 ml | e) 65.296925 ℓ ≈ 65.3 ℓ | f) 32,000 ounces | g) 11.35 g/ml |
|----------|-------------------------|------------------|---------------|

4. 12,640,640.3 cc

5. 18,927,000 ml

6. 352.44 km ; 10.95 gal

7. 2.5 cupfuls

8. 7qt/week or 7 cans

9. 30ml ; 2 tablespoon

See detailed solution on the next page

-1-
Detailed Solutions

1 a) $2 \cancel{\text{cups}} \times \frac{1 \text{ pint}}{2 \cancel{\text{cups}}} = \boxed{1 \text{ pint}}$ [we know 2 cups = 1 pint]

b) $200 \cancel{\text{miles}} \times \frac{1.6093 \text{ km}}{1 \cancel{\text{mile}}} = \boxed{321.86 \text{ km}}$ [we know 1 mile = 1.6093 km]

c) $100 \cancel{\text{mm}} \times \frac{1 \text{ cm}}{10 \cancel{\text{mm}}} = \boxed{10 \text{ cm}}$ [we know 10 mm = 1 cm]

d) $25 \cancel{\text{miles}} \times \frac{5280 \text{ ft}}{1 \cancel{\text{mile}}} = \boxed{132,000 \text{ ft}}$ [we know 1 mile = 5280 ft]

e) $96 \cancel{\text{ml}} \times \frac{1 \cancel{\text{L}}}{1000 \cancel{\text{ml}}} \times \frac{1 \text{ quart}}{0.94635 \cancel{\text{L}}} = \boxed{0.01014 \text{ quart}}$ [we know 1 L = 1000 mL, 1 quart = 0.94635 L]

f) $2 \cancel{\text{Tbps}} \times \frac{3 \text{ tsp}}{1 \cancel{\text{Tbps}}} = \boxed{6 \text{ tsp}}$ [we know 1 Tbps = 3 tsp]

g) $50 \cancel{\text{yds}} \times \frac{0.9144 \text{ m}}{1 \cancel{\text{yd}}} = \boxed{45.72 \text{ m}}$ [we know 1 yd = 0.9144 m]

h) $5000 \cancel{\text{lbs}} \times \frac{1 \text{ ton}}{2000 \cancel{\text{lbs}}} = \boxed{2.5 \text{ tons}}$ [we know 2000 lbs = 1 ton]

i) $19 \cancel{\text{min}} \times \frac{60 \text{ sec}}{1 \cancel{\text{min}}} = \boxed{1,140 \text{ sec}}$ [we know 1 min = 60 sec]

j) $102 \cancel{\text{ml}} \times \frac{0.033814 \text{ fl oz}}{1 \cancel{\text{ml}}} = \boxed{3.44903 \text{ fl oz}}$ [we know 1 ml = 0.033814 fl oz]

k) $10000 \cancel{\mu\text{g}} \times \frac{1 \text{ mg}}{1000 \cancel{\mu\text{g}}} = \boxed{10 \text{ mg}}$ [we know 1000 μg = 1 mg]

l) $3 \cancel{\text{drams}} \times \frac{4 \cancel{\text{ml}}}{4 \cancel{\text{drams}}} = \boxed{12 \text{ ml}}$ [we know 4 dram = 15.6 ml]
if we use $3 \cancel{\text{drams}} \times \frac{15 \text{ ml}}{4 \cancel{\text{drams}}} = \boxed{11.25 \text{ ml}}$ we get

2 a) $565 \text{ km}^2 = \boxed{218.16 \text{ sq miles}}$

now we know
 $(1 \text{ mile})^2 = (1.6093 \text{ km})^2$
 $1 \text{ mile}^2 = 2.5898 \text{ km}^2$

Therefore
 $565 \cancel{\text{km}^2} \times \frac{1 \text{ sq mile}}{2.5898 \cancel{\text{km}^2}} = 218.16$

2b) 8 cc = $\boxed{0.008 \text{ l}}$

now we know
 1 cc = 1 ml
 and 1000 ml = 1 l

Therefore
 $8 \text{ cc} \times \frac{1 \text{ ml}}{1 \text{ cc}} \times \frac{1 \text{ l}}{1000 \text{ ml}} = 0.008 \text{ l}$

2c) 24 in² = $\boxed{0.167 \text{ ft}^2}$

now we know
 (1 ft)² = (12 in)²
 1 ft² = 144 in²

Therefore
 $24 \text{ in}^2 \times \frac{1 \text{ ft}^2}{144 \text{ in}^2} \approx 0.167 \text{ ft}^2$

2d) 7 gallons = $\boxed{0.265 \text{ kiloliters}}$

now we know
 1 gallon = 3.785329 l
 1000 l = 1 kiloliter

Therefore
 $7 \text{ gallons} \times \frac{3.785329 \text{ l}}{1 \text{ gallon}} \times \frac{1 \text{ kiloliter}}{1000 \text{ l}} = 0.026497303 \text{ kl} \approx 0.0265 \text{ kl}$

3a) 18952 m/s = $\boxed{42,395.6 \text{ miles/hr.}}$

we know
 1 mile = 1609.3 m
 1 hr = 60 min
 1 min = 60 sec

Therefore
 $\frac{18952 \text{ m}}{1 \text{ s}} \times \frac{1 \text{ mile}}{1609.3 \text{ m}} \times \frac{60 \text{ sec}}{1 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hr}} = 42,395.6 \text{ miles/hr.}$

3b) 46.3 g/cm² = $\boxed{4.63 \text{ mg/mm}^2}$

we know that
 1000 mg = 1 g
 (10 mm)² = (1 cm)²
 100 mm² = 1 cm²

Therefore
 $\frac{46.3 \text{ g}}{1 \text{ cm}^2} \times \frac{1000 \text{ mg}}{1 \text{ g}} \times \frac{1 \text{ cm}^2}{100 \text{ mm}^2} = 463 \text{ mg/mm}^2$

3c) 35°C = $\frac{73}{5} \times 9 + 32 = 63 + 32 = 95^\circ \text{F}$

3d) 600 grains = $\boxed{40 \text{ ml}}$

we know
 60 grain = 1 dram
 1 dram = 4 ml

Therefore
 $\frac{600 \text{ grains}}{60 \text{ grain}} \times \frac{1 \text{ dram}}{1 \text{ dram}} \times \frac{4 \text{ ml}}{1 \text{ dram}} = 40 \text{ ml}$

- 3 -

3 e) 69 cups = $\boxed{65.296925 \text{ l} \approx 65.3 \text{ l}}$

4 cups = 1 quart

4 quarts = 1 gal

1 gal = 3.785329 l

Therefore
 $69 \text{ cups} \times \frac{1 \text{ quart}}{4 \text{ cups}} \times \frac{1 \text{ gal}}{4 \text{ quarts}} \times \frac{3.785329 \text{ l}}{1 \text{ gal}}$
 = 65.296925 l

3 f) 1 ton = $\boxed{32,000 \text{ oz}}$

we know

2000 lbs = 1 ton

16 oz = 1 lbs

Therefore

$1 \text{ ton} \times \frac{2000 \text{ lbs}}{1 \text{ ton}} \times \frac{16 \text{ oz}}{1 \text{ lbs}} = 32000 \text{ oz}$

3 g) $2.5 \times 10^{-2} \text{ lbs/in}^3 = \boxed{11.35 \text{ g/ml}}$

1 lbs = 454 gm

$(1 \text{ cm})^3 = (0.3937 \text{ in})^3$

1 cc = 0.0610 in³

1 cc = 1 ml

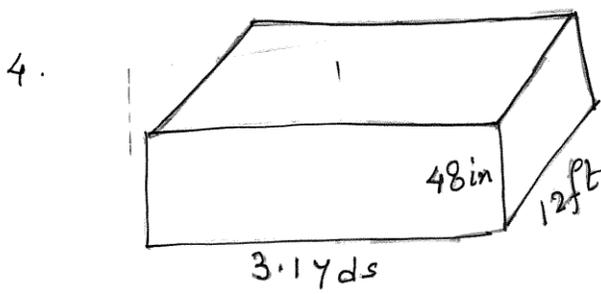
therefore

$2.5 \times 10^{-2} \text{ lbs} \times \frac{0.0610 \text{ in}^3}{1 \text{ in}^3} \times \frac{1 \text{ cc}}{1 \text{ ml}} \times \frac{454 \text{ g}}{1 \text{ lbs}}$

= $1.135 \times 10^{-2} \text{ g/ml}$

= $\frac{1.135 \times 10^3}{10^2} \text{ g/ml}$

= $1.135 \times 10 \text{ gm/ml} \approx 11.35 \text{ g/ml}$



length = 3.14 ds
 width = 12 ft
 height = 48 in

Let us convert everything to inches

we know that

12 in = 1 foot

3 feet = 1 yd.

Therefore

length = $3.14 \text{ yds} \times \frac{3 \text{ ft}}{1 \text{ yd}} \times \frac{12 \text{ in}}{1 \text{ ft}} = 111.6 \text{ in}$

width = $12 \text{ ft} \times \frac{12 \text{ in}}{1 \text{ ft}} = 144 \text{ in}$

height = 48 in

Volume = length \times width \times height

= $111.6 \text{ in} \times 144 \text{ in} \times 48 \text{ in}$

= $771,379.2 \text{ in}^3$

we know

$$(1 \text{ inch})^3 = (2.54 \text{ cm})^3$$

$$1 \text{ in}^3 = 16.39 \text{ cm}^3$$

Therefore

$$771,379.2 \text{ in}^3 \times \frac{16.39 \text{ cc}}{1 \text{ in}^3} = \boxed{12,640,640.3 \text{ cc}}$$

5. we know

$$1 \text{ gallon} = 3.7854 \text{ l}$$

$$1000 \text{ ml} = 1 \text{ l}$$

$$\text{Therefore } 5000 \text{ gal} \times \frac{3.7854 \text{ l}}{1 \text{ gal}} \times \frac{1000 \text{ ml}}{1 \text{ l}} = \boxed{18,927,000 \text{ ml}}$$

6. average speed = 73 mph

Now 1 mile = 1.6093 km

$$\text{Average speed} = \frac{73 \text{ miles}}{\text{hour}} \times \frac{1.6093 \text{ km}}{1 \text{ mile}} = 117.4789 \text{ km/hr}$$
$$= 117.49 \text{ km/hr.}$$

Distance = Speed \times time

$$= \frac{117.49 \text{ km}}{1 \text{ hr}} \times 3 \text{ hr} = \boxed{352.44 \text{ km}}$$

Mileage = 20 miles or 20 mpg

$$\text{Distance in miles} = 352.44 \text{ km} \times \frac{1 \text{ mile}}{1.6093 \text{ km}} = 219 \text{ miles}$$

$$\text{gallons of gas used} = \frac{219 \text{ miles}}{1} \times \frac{1 \text{ gallon}}{20 \text{ miles}} = \boxed{10.95 \text{ gallons}}$$

$$7) \quad \frac{15 \text{ oz}}{1} \cdot \frac{1 \text{ cup}}{6 \text{ oz}} = \frac{15}{6} \text{ cup} = 2.5 \text{ cup} \quad \left[\begin{array}{l} \text{we know that} \\ \text{patient's cup holds 6 oz} \end{array} \right]$$

$$8) \quad \frac{4 \text{ oz}}{1 \text{ feeding}} \cdot \frac{8 \text{ feedings}}{1 \text{ day}} \cdot \frac{7 \text{ days}}{1 \text{ week}} = 224 \text{ oz/week}$$

$$\frac{224 \text{ oz}}{1 \text{ week}} \cdot \frac{1 \text{ qt}}{32 \text{ oz}} = \boxed{7 \text{ qts/week}} \quad \left[\begin{array}{l} \text{we know} \\ 1 \text{ qt} = 32 \text{ oz} \end{array} \right]$$

$$9) \quad 7.5 \text{ mg} \times \frac{2 \text{ ml}}{.5 \text{ mg}} = \boxed{30 \text{ ml}} \quad \left[\begin{array}{l} \text{we know} \\ 0.5 \text{ mg per 2 ml} \end{array} \right]$$

$$30 \text{ ml} \cdot \frac{1 \text{ fl oz}}{29.573 \text{ ml}} \cdot \frac{2 \text{ tablespoons}}{1 \text{ fl oz}} \quad \left[\begin{array}{l} \text{since we know} \\ 1 \text{ fl oz} = 29.573 \text{ ml} \\ 2 \text{ tablespoons} = 1 \text{ fl oz} \end{array} \right]$$

$$= 2.03 \text{ tablespoons}$$

$$\approx \boxed{2 \text{ table spoons}}$$

Additional Resources

1. Go To <https://www.visionlearning.com/en/library/Math-in-Science/62/Unit-Conversion/144/quiz>
2. Take the quiz and score it to test your knowledge
3. To practice dosage conversion visit http://users.stlcc.edu/dosage-calc/PDF/Mod3_PracTest_keyDmAnalysis.pdf
4. For help please contact the [Math Assistance Area](#).