THE METRIC SYSTEM

The metric system is a system for measuring volume, length, and mass. This system is based on groups of ten, and its basic prefixes are as follows:

<u>Unit Number Line</u>

1000	100	10	1	0.1	0.01	0.001
Kilo- (K)	Hecto- (h)	Deca- (D)	Unit	Deci- (d)	Centi- (c)	Milli- (m)

The units are:

volume - liter (l)	for example:	milliliter (ml)
length - meter (m)		centimeter (cm)
mass - gram (g)		kilogram (kg)

To convert from one prefix to another (milli- to centi-), find out how many of the smaller prefix are in the larger (how many milligrams in a gram). To do this, look at the unit number line above. There is a difference of a multiple of ten between each prefix. To find out how many milligrams are in one gram, count over on the unit line, multiplying by ten for each step.

There are 1000 milligrams in 1 gram. You can use the same trick to go from a larger prefix to a smaller prefix. (But remember, there are always more of the smaller prefix than the larger prefix, so the number you get will be how many “smallers” are in the larger.) To go from kilometers to centimeters, use the same process as above, going the opposite direction. (See graphic representation on next page)

There are 100,000 centimeters in 1 kilometer. This can be used to convert from one prefix to another. The problems can be set up so that the unwanted prefix will cancel out, leaving the desired prefix.

<u>Example 1</u>: Change 50 cm to m.

1. Use the conversion 1 m = 100 cm by the method stated above.

2. Set up the problem with the prefix to be canceled on the bottom.

$$50\ cm \bullet \frac{1\ m}{100\ cm}$$

3. Cancel out the unwanted prefix.

$$50 \bullet \frac{1\ m}{100}$$

4. Divide 50 by 100 (= 0.5).

5. Answer is 0.5 m.

<u>Example 2</u>: Change .2 m to mm.

1. The conversion is 1 m = 1,000 mm.

2.

$$0.2\ m \bullet \frac{1{,}000\ mm}{1}$$

3.

$$0.2 \bullet \frac{1{,}000\ mm}{1}$$

4. Multiply 0.2 by 1,000 (= 200).

5. Answer is 200 mm.

<u>Example 3</u>: Change 100 °C to °F, (use the formula °F = (9/5)(°C) + 32

1. Fill the °C into the formula: °F = (9/5)(100 °C) + 32

2. Multiply 100 and 9; then divide by 5:
   $100 \times 9 \div 5 = 180$

3. Add 32: 180 + 32 = 212.

4. °F = 212, so 100 °C = 212 °F.

<u>Example 4</u>: Change 21 °F to °C, (use the formula °C = [(5/9)(°F - 32)]

1. Fill 21 °F into the formula: °C = (5/9)(21 °F - 32)

2. Subtract 32 from 21: 21 - 32 = -11

3. Multiply -11 by 5; then divide by 9.
   $-11 \times 5 \div 9 = -6.1$

4. °C = -6.1, so 21 °F = -6.1 °C.

<u>Example 5</u>: Convert 50 Km/sec to cm/hr.

1. Use the conversions 1 Km = 1000 m, 1 m = 100 cm, 1 hr = 60 min and 1 min = 60 sec.

2.

$$\frac{50\ Km}{\text{sec}} \bullet \frac{1000\ m}{1\ Km} \bullet \frac{100\ cm}{1\ m} \bullet \frac{60\ \text{min}}{1\ hr} \bullet \frac{60\ \text{sec}}{1\ \text{min}}$$

3.

$$50 \bullet \frac{1000}{1} \bullet \frac{100\ cm}{1} \bullet \frac{60}{1\ hr} \bullet \frac{60}{1}$$

4. Multiply: 50 × 1000 × 100 × 60 × 60 = 18,000,000,000

5. 50 Km/sec = 18,000,000,000 cm/hr

PRACTICE PROBLEMS:

1. 1325 dm = _____ km
2. 0.4563 Dm = _____ cm
3. 12730 g = _____ hg
4. 72 hg = _____ kg
5. 235 cm = _____ Dm
6. 572 dl = _____ Dl
7. -40 °F = _____ °C
8. -15 °C = _____ °F

ANSWERS:

1. 0.1325 km	2. 456.3 cm	3. 127.30 hg	4. 7.2 kg
5. 0.235 Dm	6. 0.572 Dl	7. -40 °F	8. 5 °C

CONVERSION FACTORS:

1. Length:

1 m = 39.37 in = 3.28 ft
1 in == 2.45 cm
1 km = 0.621 mi
1 mi = 5280 ft = 1.609 km

2. Time:

1 min = 60 s
1 hr = 3600 s
1 day = 8.64×10^4 s
1 year = 365.242 days = 3.156×10^7 s

3. Speed:

1 km/hr = 0.278 m/s = 0.621 mi.hr
1 m/s = 2.237 mi/hr = 3.281 ft/s
1 mi/hr = 1.61 km/hr = 0.44 m/s = 1.467 ft/s

4. Mass:

1 kg = 10^3 g = 6.85×10^{-2} slug
1 slug = 14.59 kg
1 u = 1.66×10^{-27} kg

5. Volume:

1 liter = 1000 cm^3 = 3.531×10^{-2} ft^3
1 ft^3 = 2.832×10^{-2} m^3
1 gallon = 3.786 liter = 231 in^3

6. Angle:

180° = rad
1 rad = 57.30°
1° = 60 min = 1.745×10^{-2} rad

7. Force:

1 N = 0.2248 lb = 10^5 dynes
1 lb = 4.448 N
1 dyne = 10^{-5} N = 2.248×10^{-6} lb

8. Work and Energy:

1 J = 10^7 erg = 0.738 ft·lb = 0.239 cal
1 cal = 4.186 J
1 ft·lb = 1.356 J
1 Btu = 1.054×10^3 J = 252 cal
1 J = 6.24×10^{18} eV
1 eV = 1.602×10^{-19} J
1 kWh = 3.60×10^6 J

9. Pressure:

1 atm = 1.013×10^5 N/m^2 (or Pa) = 14.70 lb/in^2
1 Pa = 1 N/m^2 = 1.45×10^{-4} lb/in^2
1 lb/in^2 = 6.895×10^3 N/m^2

10. Power:

1 hp = 550 ft·lb/s = 0.746 kW
1 W = 1 J/s = 0.738 ft·lb/s
1 Btu/h = 0.293 W

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STUDENT LEARNING ASSISTANCE CENTER (SLAC)
Texas State University-San Marcos