

Conversions:

1. If 1 in equals 2.54 cm, how many miles are in one kilometer?
 $? \frac{mi}{1} = 1 km \times \frac{1000 m}{1 km} \times \frac{100 cm}{1 m} \times \frac{1 in}{2.54 cm} \times \frac{1 ft}{12 in} \times \frac{1 yd}{3 ft} \times \frac{1 mi}{1760 yd} = 6.21 \times 10^{-4} mi$

2. The density of water is 1 g/cm³. What is this value in kilograms per cubic meter?
 $? \frac{kg}{m^3} = \frac{1 g}{1 cm^3} \times \frac{1 kg}{1000 g} \times \frac{100^3 cm^3}{1 m^3} = 1.00 \times 10^3 \frac{kg}{m^3}$

3. The piston displacement of a certain automobile engine is give as 2.5 l. Using only the facts that 1 L = 1000 cm³ and 1 in = 2.54 cm, express the volume in cubic inches.
 $? in^3 = 2.5 L \times \frac{1000 cm^3}{1 L} \times \frac{1 in^3}{254^3 cm^3} = 1.53 \times 10^2 in^3$

4. If one Deutschmark is worth 55 cents and gasoline costs 1.30 Deutschmarks per liter, what is the cost in dollars per gallon?
 $? \frac{\$}{gal} = \frac{1.30 DM}{1 L} \times \frac{55¢}{1 DM} \times \frac{1 \$}{100¢} \times \frac{3.78 L}{1 gal} = 2.70 \frac{\$}{gal}$

5. Compute the number of seconds in a day, in a year.
 $? s = 1 d \times \frac{24 hr}{1 d} \times \frac{60 min}{1 hr} \times \frac{60 s}{1 min} = 8.64 \times 10^4 s$
 $? s = 1 yr \times \frac{365 d}{1 yr} \times \frac{8.64 \times 10^4 s}{1 d} = 3.15 \times 10^7 s$

6. The Concorde is the fastest airliner used for commercial service; it can cruise at 1450 mph:
 a. What is the cruise speed of the Concorde in mi /s?
 $? \frac{mi}{s} = 1450 \frac{mi}{hr} \times \frac{1 hr}{60 min} \times \frac{1 min}{60 s} = 4.03 \times 10^{-1} \frac{mi}{s}$

b. What is the cruise speed of the Concorde in m/s?
 $? \frac{m}{s} = 1450 \frac{mi}{hr} \times \frac{1 hr}{3600 s} \times \frac{1760 yd}{1 mi} \times \frac{36 in}{1 yd} \times \frac{2.54 cm}{1 in} \times \frac{1 m}{100 cm} = 6.48 \times 10^2 \frac{m}{s}$

7. The gasoline consumption of a small car is 15 km/L. How many miles per gallon is this?
 $? \frac{mi}{gal} = \frac{15 km}{1 L} \times \frac{1000 m}{1 km} \times \frac{100 cm}{1 m} \times \frac{1 in}{2.54 cm} \times \frac{1 yd}{36 in} \times \frac{1 mi}{1760 yd} \times \frac{3.78 L}{1 gal} = 3.52 \times 10^1 \frac{mi}{gal}$

8. The speed limit on a highway in Lower Slobbovia was given as 120,000 furlongs per fortnight. How many miles per hour is this? (One furlong is 1/8 mile, and a fortnight is 14 days.)
 $? \frac{mi}{hr} = \frac{120000 f}{1 hr} \times \frac{1 mi}{8 f} \times \frac{1 d}{14 d} \times \frac{1 d}{24 hr} = 4.46 \times 10^1 \frac{mi}{hr}$

9. A gold atom has a diameter of 0.288 nm. How many miles long would a single row of 6.02 x 10²³ gold atoms be?
 $? mi = 0.288 nm \times 6.02 \times 10^{23} \times \frac{1 m}{1 \times 10^9 nm} \times \frac{100 cm}{1 m} \times \frac{1 in}{2.54 cm} \times \frac{1 yd}{36 in} = 1.08 \times 10^4 mi$

10. When the Pharmacopoeia of London was compiled in 1618, the troy system of measure was used to prepare medicine. Among the units used were: 20 grains = 1 scruple; 3 scruples = 1 drachm; 8 drachms = 1 ounce; 12 ounces = 1 pound.
 a. 6.00 pounds = _____ drachms $5.76 \times 10^2 dr$
 b. 12.0 drachms = _____ pounds; = _____ ounces
 $? lb = 12 dr \times \frac{1 oz}{8 dr} \times \frac{1 lb}{12 oz} = 1.25 \times 10^{-1} lb$
 1.502

11. Bill Rodgers won the 1979 Boston Marathon (26.2 mi) in 2 h, 9 min, 27 s. What was Rodgers' speed in kilometers per hour?
 $? \frac{km}{hr} = \frac{26.2 mi}{7767 s} \times \frac{1760 yd}{1 mi} \times \frac{36 in}{1 yd} \times \frac{2.54 cm}{1 in} \times \frac{1 m}{100 cm} \times \frac{1 km}{1000 m} \times \frac{3600 s}{1 hr} = 1.95 \times 10^1 \frac{km}{hr}$

$? s = 2 h \times \frac{3600 s}{1 hr} = 7200 s$

$? s = 9 min \times \frac{60 s}{1 min} = 540 s$