

ChEn 273 - Winter 08
Special Problem 2.1

Name: _____

1. Using the constants in the front of your book, estimate (without using a calculator) the quantities below in the requested units. Also, state how many significant figures should be used.

(a) $600. \text{ J/min} = ??? \text{ hp}$

(b) $3.0 \text{ weeks} = ??? \text{ ms}$

(c) $300 \text{ m}^3 = ??? \text{ ft}^3$

2. The units of moles is a measure of:

(a) mass (b) volume (c) number of molecules (d) weight (e) furry animals

3. Molecular oxygen has a molecular mass of 32 gm/mol (or 32 gm/gmol).

(a) What is the mass (in grams) of 2 gram-moles of oxygen?

A lbmol is a convenient AES unit that is defined by using the molecular mass in lb_m . Thus, the molecular mass of oxygen is also 32 lb_m/lbmol .

(b) How many lbmol are there in 16 lb_m of oxygen?

(c) Finish the conversion: 1 lbmol = ??? gmol.

4. If I weigh 180 lb in the doctor's office in Salt Lake City, what will I weigh (in lb_f) on the moon where the force of gravity is only 1.6 m/s^2 ?

5. (a) What is the weight (force) of a 10 kg object at sea level?

(b) What is the weight (force) of a 10 lb_m object at sea level?

(c) Which is more massive, the 10 kg or 10 lb_m object?

Note that the acceleration due to gravity (on earth) is 9.807 m/s^2 or 32.17 ft/s^2 .

6. I have read the entire course syllabus. yes no

FACTORS FOR UNIT CONVERSIONS

Quantity	Equivalent Values
Mass	$1 \text{ kg} = 1000 \text{ g} = 0.001 \text{ metric ton} = 2.20462 \text{ lb}_m = 35.27392 \text{ oz}$ $1 \text{ lb}_m = 16 \text{ oz} = 5 \times 10^{-4} \text{ ton} = 453.593 \text{ g} = 0.453593 \text{ kg}$
Length	$1 \text{ m} = 100 \text{ cm} = 1000 \text{ mm} = 10^6 \text{ microns } (\mu\text{m}) = 10^{10} \text{ angstroms } (\text{\AA})$ $= 39.37 \text{ in.} = 3.2808 \text{ ft} = 1.0936 \text{ yd} = 0.0006214 \text{ mile}$ $1 \text{ ft} = 12 \text{ in.} = 1/3 \text{ yd} = 0.3048 \text{ m} = 30.48 \text{ cm}$
Volume	$1 \text{ m}^3 = 1000 \text{ L} = 10^6 \text{ cm}^3 = 10^6 \text{ mL}$ $= 35.3145 \text{ ft}^3 = 220.83 \text{ imperial gallons} = 264.17 \text{ gal}$ $= 1056.68 \text{ qt}$ $1 \text{ ft}^3 = 1728 \text{ in.}^3 = 7.4805 \text{ gal} = 0.028317 \text{ m}^3 = 28.317 \text{ L}$ $= 28,317 \text{ cm}^3$
Force	$1 \text{ N} = 1 \text{ kg}\cdot\text{m}/\text{s}^2 = 10^5 \text{ dynes} = 10^5 \text{ g}\cdot\text{cm}/\text{s}^2 = 0.22481 \text{ lb}_f$ $1 \text{ lb}_f = 32.174 \text{ lb}_m\cdot\text{ft}/\text{s}^2 = 4.4482 \text{ N} = 4.4482 \times 10^5 \text{ dynes}$
Pressure	$1 \text{ atm} = 1.01325 \times 10^5 \text{ N}/\text{m}^2 \text{ (Pa)} = 101.325 \text{ kPa} = 1.01325 \text{ bar}$ $= 1.01325 \times 10^6 \text{ dynes}/\text{cm}^2$ $= 760 \text{ mm Hg at } 0^\circ\text{C (torr)} = 10.333 \text{ m H}_2\text{O at } 4^\circ\text{C}$ $= 14.696 \text{ lb}_f/\text{in.}^2 \text{ (psi)} = 33.9 \text{ ft H}_2\text{O at } 4^\circ\text{C}$ $= 29.921 \text{ in. Hg at } 0^\circ\text{C}$
Energy	$1 \text{ J} = 1 \text{ N}\cdot\text{m} = 10^7 \text{ ergs} = 10^7 \text{ dyne}\cdot\text{cm}$ $= 2.778 \times 10^{-7} \text{ kW}\cdot\text{h} = 0.23901 \text{ cal}$ $= 0.7376 \text{ ft}\cdot\text{lb}_f = 9.486 \times 10^{-4} \text{ Btu}$
Power	$1 \text{ W} = 1 \text{ J}/\text{s} = 0.23901 \text{ cal}/\text{s} = 0.7376 \text{ ft}\cdot\text{lb}_f/\text{s} = 9.486 \times 10^{-4} \text{ Btu}/\text{s}$ $= 1.341 \times 10^{-3} \text{ hp}$

Example: The factor to convert grams to lb_m is $\left(\frac{2.20462 \text{ lb}_m}{1000 \text{ g}}\right)$.