CHEM 103
R&R 1
30 May 2024
Adapted from a 24 May 2016 document

Please simplify/solve/express in scientific notation to 3 sig figs. If you can, try to manipulate each one in multiple ways. For instance:

$\left(16 \cdot \frac{1}{4}\right)^{1/2} = 16^{1/2} \cdot \left(\frac{1}{4}\right)^{1/2} = 4 \cdot \frac{1}{2} = 2$ OR $\left(16 \cdot \frac{1}{4}\right)^{1/2} = (4)^{1/2} = 2$

There is often an "easiest" way to simplify a given expression, but it takes practice to develop comfort with different operations.

1) $\sqrt[5]{1.2 \times 10^{19}} = (1.2\times10^{19})^{1/5}$
$= (1.2\times10^{4})^{1/5}(10^{15})^{1/5}$
$= 6.54\times10^{3}$

2) $\log x = 8.73 \Rightarrow x = 10^{8.73}$
$x = 5.37\times10^{8}$

3) $\left(12 \cdot \frac{1}{6}\right)^{7} = 2^{7} = 128$
OR $= \frac{12^7}{6^7} = \frac{3.58\times10^{7}}{2.80\times10^{5}} = 128$

4) $4^5 \cdot 6^5 = 1024 \cdot 7776 = 7.96\times10^{6}$
OR $= (4\cdot6)^5 = 24^5 = 7.96\times10^{6}$

5) $\frac{1}{2} \cdot \ln(50) \cdot \ln(400) =$
$\ln(50) \cdot \frac{1}{2}\ln(400) = \ln(50)\ln(\sqrt{400})$
$= \ln(50)\ln(20) = 11.7 \Rightarrow 1.17\times10^{1}$

6) $\log_x 8 = 3 \Rightarrow 8 = x^3$
$x = 2 \Rightarrow 2.00\times10^{0}$

conversion factors typically considered to have "infinite" sig. figs

7) If Jane and Dan are 1.97×10^{-2} miles apart, how many micrometers apart are they?
Note: 1 mile = 5280 ft; 1 ft = 12 in; 1 in = 0.0254 m; 1 m = 1×10^{6} μm

$1.97\times10^{-2}\ \text{miles} \cdot \frac{5280\ \text{ft}}{\text{mile}} \cdot \frac{12\ \text{in}}{\text{ft}} \cdot \frac{0.0254\ \text{m}}{\text{in}} \cdot \frac{10^{6}\ \mu\text{m}}{\text{m}} = 3.17\times10^{7}\ \mu\text{m}$

8) $\frac{6.626\times10^{-34} \cdot 3.00\times10^{8}}{484\times10^{-9}} =$
$\left(\frac{6.626\cdot3.00}{484}\right)\times10^{-17}$
$= 4.11\times10^{-19}$

9) $(8^6 \cdot 27)^{1/3} = (7.078\times10^{6})^{1/3} = 192$
OR $= (8^6)^{1/3} \cdot (27)^{1/3}$
$= 8^2 \cdot 3 = 192$

10) Pure water has its highest density of 1000. $kg \cdot m^{-3}$ at temperature 4 °C.
You heat water to 90 °C and find that a 15.0 mL sample has mass 14.5 g.
By what percent of its original, highest density has your sample's density decreased?
Note: 1 mL = 1 cm^3 1 m^3 = 1×10^6 cm^3 (does this make sense?) 1 kg = 1000 g

new density = $\frac{14.5\,g}{15.0\,mL} \cdot \frac{kg}{1000\,g} \cdot \frac{mL}{cm^3} \cdot \frac{10^6\,cm^3}{m^3} = 967\ kg \cdot m^{-3}$

% decrease of $\frac{(1000. - 967)}{1000.} = 3.3\%$

11) What is the difference between accuracy and precision? Is it possible for measurements to be precise but not accurate? Accurate but not precise?

Accuracy: how close is average value to the true value?

precision: how close together are my values?

precise but not accurate:  , accurate but not precise: 

12) Given the chemical symbol, provide the name of the following elements:

a. Na sodium
b. F fluorine
c. Cu copper
d. Ag silver
e. Fe iron
f. Pb lead

13) Please connect and fill in the boxes with the terms below, providing brief explanations.

Compounds
Homogeneous mixture
Heterogeneous mixture
Pure substances
Mixtures
Elements
Matter