AP CHEMISTRY

TOPIC 1: CHEMICAL FOUNDATIONS, REVIEW

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1) Perform the indicated calculations on the following measured values, giving the final answer with the correct number of **significant figures**.

a) $12.734 - 3.0$ ***9.7 (1 significant "decimal" place)***

b) 61×0.00745 ***.45 (2 sig figs)***

c) $\dfrac{5\times10^{16}}{(4.78-2.314)}$ ***2×10^{16} (1 sig fig)***

d) $(6.02\times10^{23}+4.14\times10^{17})\times(8.31\times10^{-11}-9.2\times10^{-9})$ ***-5.5×10^{15} (2 sig figs)***

2) The density of mercury is 13.6 g / cm^3. How many pounds (454 g = 1 lbs.) would one liter of mercury weigh?

Answer:

$$\frac{1\ L}{}\times\frac{1000\ mL}{1\ L}\times\frac{1\ cm^3}{1\ mL}\times\frac{13.6\ g}{cm^3}\times\frac{1\ lbs}{454\ g} = 30.0\ lbs$$ ***(use 3 sig figs)***

3) During a recent baseball game, a pitcher threw a fastball that had a velocity of 93.7 mph.

a) calculate the velocity in meters per second.

Answer:

$$\frac{93.7\ miles}{HR}\times\frac{1\ HR}{60\ \text{min}}\times\frac{1\ \text{min}}{60\ \text{sec}}\times\frac{5280\ ft}{1\ mile}\times\frac{12\ in}{1\ ft}\times\frac{2.54\ cm}{1\ in}\times\frac{1\ m}{10^2\ cm} = 41.9\frac{m}{\text{sec}}$$ ***(3 sig figs)***

b) calculate how long it took this pitch to travel from the mound to home plate (60 ft. 6 in.).

Answer:

(6 in = 0.5 ft)

$$\frac{60.5\ ft}{}\times\frac{12\ in}{1\ ft}\times\frac{2.54\ cm}{1\ in}\times\frac{1\ m}{10^2\ cm}\times\frac{\text{sec}}{41.9\ m} = 0.440\ \text{sec}$$ ***(use 3 sig figs)***

4) Identify the following elements:

a) ${}^{91}_{40}X$ ***(Zirconium, Zr)*** b) ${}^{85}_{36}X$ ***(Krypton, Kr)***

c) ${}^{48}_{22}X$ ***(Titanium, Ti)*** d) ${}^{207}_{82}X$ ***(Lead, Pb)***

5) Would you expect the following atoms to gain or lose electrons when forming ions? If so, how many would be gained or lost (and indicate the charge for each)?

a) Be ***(lose 2, +2)*** b) Cl ***(gain 1, -1)*** c) Al ***(lose 3, +3)*** d) Li ***(lose 1, +1)***

e) S ***(gain 2, -2)*** f) Ba ***(lose 2, +2)*** g) Na ***(lose 1, +1)*** h) P ***(gain 3, -3)***

6) Name each of the following compounds:

a) $MgSO_4$ ***(magnesium sulfate)*** b) NH_4Cl ***(ammonium chloride)***

c) $NaC_2H_3O_2$ ***(sodium acetate)*** d) N_2O_3 ***(di-nitrogen tri-oxide)***

e) $KClO_4$ ***(potassium perchlorate)*** f) P_4O_{10} ***(tetra-phosphorus deca-oxide)***

g) NH_3 ***(nitrogen tri-hydride, ammonia)*** h) HBr ***(hydrobromic acid)***

i) HIO_3 ***(iodic acid)*** j) H_2SO_3 ***(sulfurous acid)***

7) Write the formulas for each of the following compounds:

a) sodium sulfate ***(Na_2SO_4)*** b) tin(II) fluoride ***(SnF_2)***

c) iron(III) oxide ***(Fe_2O_3)*** d) calcium phosphate ***($Ca_3(PO_4)_2$)***

e) lead(II) nitrate ***($Pb(NO_3)_2$)*** f) manganese(IV) carbonate ***($Mn(CO_3)_2$)***

g) carbon tetrachloride ***(CCl_4)*** h) hydrosulfuric acid ***(H_2S)***

i) nitrous acid ***(HNO_2)*** j) potassium chlorate ***($KClO_3$)***

8) A sample of sulfur has a mass of 5.37 g. How many atoms are in this sample?

Answer:

$$\frac{5.37\ g}{}\times\frac{1\ mol\ S}{32.06\ g}\times\frac{6.02\times10^{23}\ atoms}{1\ mol\ S}\ =\ 1.01\times10^{23}\ atoms$$ ***(3 sig figs)***

9) How many milligrams of oxygen gas are in a 4.8×10^{20} molecules of oxygen gas?

Answer:

$$\frac{4.8\times10^{20}\ molecules\ O_2}{}\times\frac{1\ mol\ O_2}{6.02\times10^{23}\ molecules}\times\frac{(2)16g}{1\ mol\ O_2}\times\frac{10^3\ mg}{1\ g}\ =\ 26\ mg$$ ***(2 sig figs)***

10) How many kilograms are there in 0.36 moles of cobalt(III) acetate?

Answer:

$$\frac{0.36\ mol\ Co(C_2H_3O_2)_3}{}\times\frac{(58.93g)+(6)(12.011g)+(9)(1.008g)+(6)(16.g)}{1\ mol\ Co(C_2H_3O_2)_3}\times\frac{1\ kg}{10^3\ g}\ =\ 0.085\ kg$$ ***(2 s.f.)***

11) Determine the empirical formula of the compound that contains the following percentages of elements by mass:
C = 38.66%, H = 16.24%, N = 45.10%

Answer:

C: $\frac{38.66\ g}{}\times\frac{1\ mol\ C}{12.01\ g}\ =\ 3.219\ mol$ $\frac{3.219\ mol}{3.219\ mol}\ =\ 1$ ***1 : 5 : 1 ratio***

H: $\frac{16.24\ g}{}\times\frac{1\ mol\ H}{1.008\ g}\ =\ 16.11\ mol$ $\frac{16.11\ mol}{3.219\ mol}\ =\ 5$

CH_5N

N: $\frac{45.1\ g}{}\times\frac{1\ mol\ N}{14.01\ g}\ =\ 3.220\ mol$ $\frac{3.220\ mol}{3.219\ mol}\ =\ 1$

12) Determine the molecular formula for a compound that has a molecular mass of 289.9 g/mol that contains the following percentages of elements by mass:
C = 49.67%, Cl = 48.92%, H = 1.39%

Answer:

C: $\frac{49.67 g}{} \times \frac{1\ mol\ S}{12.01\ g} = 4.135\ mol$ $\qquad \frac{4.135\ mol}{1.380\ mol} = 3$ $\qquad$ ***3 : 1 : 1 ratio***

E.F.: C_3ClH

Cl: $\frac{48.92\ g}{} \times \frac{1\ mol\ Cl}{35.453\ g} = 1.380\ mol$ $\qquad \frac{1.380\ mol}{1.380\ mol} = 1$

H: $\frac{1.39\ g}{} \times \frac{1\ mol\ N}{1.008\ g} = 1.380\ mol$ $\qquad \frac{1.380\ mol}{1.380\ mol} = 1$

E.F.M. = (3) 12.011g + 35.453g + 1.008g = 72.494 g

Molecular Formula = $(C_3ClH)_n$ $\qquad n = \frac{289.9\ g}{72.494\ g} = 4$ $\quad = (C_3ClH)_4 = C_{12}Cl_4H_4$

13) Balance the following equation:

__*4*__ NH_4OH + ____ $KAl(SO_4)_2 \bullet 12\ H_2O \rightarrow$ ____ $Al(OH)_3$ + __*2*__ $(NH_4)_2SO_4$ + ____ KOH + __*12*__ H_2O

NH_4:	~~1~~	4
OH:	~~1~~	4
K:	1	
Al:	1	
SO_4:	2	
H_2O:	12	

NH_4:	~~2~~	4
OH:	4	
K:	1	
Al:	1	
SO_4:	~~1~~	2
H_2O:	~~1~~	12