Chem15, Fall16, SJCC, Test2 N 14

48-0=48 60 (108/114)

KEY

Please read all the questions VERY carefully before answering. If you do not understand any question, please ask. Use the reverse side of the question paper as scratch. Use the periodic table and constant chart in the last page. No outside paper is allowed. Total points = 48+(22x3=)66=114

SHORT ANSWER. Please write the set-up equation first, then insert the raw data with units in the equation before doing your calculations. Points will be deducted if your answer is not clear.

1) Calculate the number of atoms in 39.7 g of naturally occuring bromine (Note the formula of Bromine). (6 pts.)

1) 2.99×10^{23} Br atoms

$$39.7\ g\ Br_2 \times \frac{1\ mol\ Br_2}{159.808\ g\ Br_2} \times \frac{(6.022 \times 10^{23}) \cdot 2\ atoms}{1\ mol\ Br_2}$$

$= 2.99 \times 10^{23}$ Br atoms

2) Calculate the amount (in grams) of phosphorous in a 15.5 gram sample of phosphorous pentachloride. (10 pts.)

2) 2.31 g P

$$15.5\ g\ PCl_5 \times \frac{1\ mol\ PCl_5}{208.239\ g\ PCl_5} \times \frac{1\ mol\ P}{1\ mol\ PCl_5} \times \frac{30.974\ g\ P}{1\ mol\ P}$$

$= 2.31\ g\ P$

3) Write the net-ionic equation for the following reactions: **Include phase labels for both reactants and products. Also classify each reaction, giving its type.** (4 pts/each; 8 pts. tot)

3) _____

a. $2Na(s) + 2H_2O(l) \text{ -----> } 2NaOH(aq) + H_2(g)$

Net Ionic Equation:

Reaction Type:

single displacement

$2Na(s) + 2H_2O(l) \rightarrow 2Na^+(aq) + 2OH^-(aq) + H_2(g)$

b. $3Na_2CO_3(aq) + 2Fe(NO_3)_3(aq) \text{ -----> } Fe_2(CO_3)_3(s) + 6NaNO_3(aq)$

Net Ionic Equation:

Reaction Type:

double-displacement

$6Na^+_{(aq)} + 3CO_3^{2-}{}_{(aq)} + 2Fe^{3+}_{(aq)} + 6NO_3^-{}_{(aq)} \rightarrow Fe_2(CO_3)_3(s) + 6Na^+_{(aq)} + 6NO_3^-{}_{(aq)}$

$= 3CO_3^{2-}{}_{(aq)} + 2Fe^{3+}_{(aq)} \rightarrow Fe_2(CO_3)_3(s)$

$3CO_3^{2-}{}_{(aq)} + 2Fe^{3+}_{(aq)} \rightarrow Fe_2(CO_3)_3(s)$

4) An acid has 40% C, 6.7% H, 53.3% O and its molar mass is 60.05 g/mol. Show your calculation to find the molecular formula of the acid? (10 pts.)

4) $C_2H_4O_2$

(a) assume a 100 g sample

C = 40 g
H = 6.7 g
O = 53.3 g

(b) g → mol

C → $\frac{40\ g}{12.011\ g/mol} = 3.33\ mol\ C$

H → $\frac{6.7\ g}{1.0079\ g/mol} = 6.65\ mol\ H$

O → $\frac{53.3\ g}{15.999\ g/mol} = 3.33\ mol\ O$

(c) divide by smallest amt. of mol

$\frac{3.33\ mol\ C}{3.33\ mol} = 1\ mol\ C$

$\frac{6.65\ mol\ H}{3.33\ mol} = 2\ mol\ H$

$\frac{3.33\ mol\ O}{3.33\ mol} = 1\ mol\ O$

EF = CH_2O

$m_{EF} = 30.0258\ g/mol$

(d) $n = \frac{m_{MF}}{m_{EF}} = \frac{60.05\ g/mol}{30.0258\ g/mol} = 2$

MF = $C_2H_4O_2$

5) (a) Calculate how many grams of anhydrous magnesium sulfate is in 63.6 grams of its hydrate salt . The hydrate salt contains 51.1% water by weight. (3 pts.)

5) 31.1 g $MgSO_4$ & 32.5 g H_2O

63.6 g $MgSO_4 \cdot H_2O$

63.6 × 0.511 = 32.4996 g H_2O

63.6 g $MgSO_4 \cdot H_2O$ − 32.4996 g H_2O = 31.1004 g $MgSO_4$

= 31.1 g $MgSO_4$

(b) Calculate how many grams of water is in the 63.6 grams of the magnesium sulfate hydrate salt (3 pts.)

63.6 g $MgSO_4 \cdot H_2O$ × 0.511 = 32.4996 g H_2O = 32.5 g H_2O

6) Iron, Fe(s) reacts with oxygen gas, O_2(g) to produce Fe_2O_3 (s). Calculate how many grams of (a) Fe and (b) O are necessary to make 23.7 g of Fe_2O_3 (4 pts. each, total 8 pts)

6) 16.6 g Fe & 7.1 g O_2

$4Fe + 3O_2 \rightarrow 2Fe_2O_3$

(a) $23.7\ g\ Fe_2O_3 \times \frac{1\ mol\ Fe_2O_3}{159.687\ g\ Fe_2O_3} \times \frac{4\ mol\ Fe}{2\ mol\ Fe_2O_3} \times \frac{55.845\ g\ Fe}{1\ mol\ Fe}$

$= 16.6\ g\ Fe$

(b) $23.7\ g\ Fe_2O_3 \times \frac{1\ mol\ Fe_2O_3}{159.687\ g\ Fe_2O_3} \times \frac{3\ mol\ O_2}{2\ mol\ Fe_2O_3} \times \frac{31.998\ g\ O_2}{1\ mol\ O_2} =$

$= 7.1\ g\ O_2$