Homework answers Parts 8 & 9

CHM 1020

① The trick here is to go from grams to moles then moles to molecules

$$1.00\,g \times \frac{mole}{18.0\,g} \times \frac{6.02\times10^{23}\ molecules}{mole} = 3.34\times10^{22}\ molecules$$

② 6.02×10^{23} atoms

③ 1 mole = 12 grams (for carbon-12)

④ NO_2 $(1\times14.0)+(2\times16.0)=\boxed{\frac{46.0\,g}{mole}}$

⑤ CO_2 $(1\times12.0)+(2\times16.0)=\boxed{\frac{44.0\,g}{mole}}$

⑥ This is tricky. An oxygen molecule is O_2. (It is one of seven elements that exist as a diatomic molecule in the elemental state)

O_2 $(2\times16.0)=\frac{32.0\,g}{mole}$

7&8: see 4&5

9 $(1\times40.1)+(2\times16.0)+(2\times1.0)=\frac{74.1\,g}{mole}$

10. $\frac{2}{1}C_8H_{18}+\frac{25}{2}O_2 \longrightarrow \frac{16}{8}CO_2+\frac{18}{9}H_2O$

11. $N_2 + 3H_2 \longrightarrow 2NH_3$

moles / grams: $\uparrow$ 5.40 g H_2

step 1: $5.40\,g\,H_2 \times \frac{mole}{2.00g} = 2.70$ moles H_2

step 2: 2.70 moles $H_2 \times \frac{2\,NH_3}{3\,H_2} = 1.80$ moles NH_3

step 3: 1.80 moles $NH_3 \times \frac{17.0\,g}{mole} = 30.6\,g\,NH_3$

#12

$2AgNO_3 + NiCl_2 \rightarrow 2AgCl + Ni(NO_3)_2$

moles / grams: ? ← 800.

$FW_{AgCl} = 107.9 + 35.5 = \frac{143.4\ g}{mole}$

$FW_{NiCl_2} = 58.7 + (2 \times 35.5) = \frac{129.7\ g}{mole}$

step 1: $800.\ g\ AgCl \times \frac{mole}{143.4\ g} = 5.58\ moles\ AgCl$

step 2: $5.58\ moles\ AgCl \times \frac{1\ NiCl_2}{2\ AgCl} = 2.79\ moles\ NiCl_2$

step 3: $2.79\ moles\ NiCl_2 \times \frac{129.7\ g}{mole} = \boxed{362\ g\ NiCl_2}$

#13 $Ba(NO_3)_2 + Na_2SO_4 \rightarrow BaSO_4 + 2NaNO_3$

moles / grams: ↑ 4.00 g → ?

$Ba(NO_3)_2 = 137.3 + (2 \times 14.0) + (6 \times 16.0) = \frac{261.3\ g}{mole}$

$BaSO_4 = 137.3 + (32.0) + (4 \times 16.0) = \frac{233.4\ g}{mole}$

Notice I am assuming I meant 4.00 g.

step 1: $4.00\ g\ Ba(NO_3)_2 \times \frac{mole}{261.3\ g} = 1.53 \times 10^{-2}\ moles\ Ba(NO_3)_2$ (.0153 moles)

step 2: $1.53 \times 10^{-2}\ moles\ Ba(NO_3)_2 \times \frac{1\ BaSO_4}{1\ Ba(NO_3)_2} = 1.53 \times 10^{-2}\ moles\ BaSO_4$

step 3: $1.53 \times 10^{-2}\ moles\ BaSO_4 \times \frac{233.4\ g}{mole} = \boxed{3.57\ g\ BaSO_4}$

#14 $2Sb + 3Cl_2 \rightarrow 2SbCl_3$

moles / grams: ↑ 129 g → ?

$FW_{Sb} = \frac{121.8\ g}{mole}$

$FW_{SbCl_3} = 121.8 + (3 \times 35.5) = \frac{228.3\ g}{mole}$

step 1: $129\ g\ Sb \times \frac{mole}{121.8\ g} = 1.06\ moles\ Sb$

step 2: $1.06\ moles\ Sb \times \frac{2\ SbCl_3}{2\ Sb} = 1.06\ moles\ SbCl_3$

step 3: $1.06\ moles\ SbCl_3 \times \frac{228.3\ g}{mole} = \boxed{242\ g\ SbCl_3}$

15.1 Zn is going from Zn^0 to Zn^{2+}, it is being oxidized.
It is the reducing agent

Cu is going from Cu^{2+} to Cu^0. It is being reduced.
It is the oxidizing agent.

15.2 Cobalt is going from Co^{2+} to Co^0. It is being reduced.
It is the oxidizing agent

Tin (Sn) is going from Sn^0 to Sn^{2+}. It is being oxidized.
It is the reducing agent.

15.3 Carbon is being oxidized, it is the reducing agent.
Oxygen is being reduced, it is the oxidizing agent.

15.4 Same as 15.3.

16.1 d, redox. Mg & H are changing charges
16.2 a. formation of a solid.
16.3 c. formation of water, acid/base
16.4 d redox there are changing charges.
16.5 d redox there are changing charges.
16.6 a formation of a solid.
16.7 a formation of a solid

17.1 c single replacement
17.2 d double replacement
17.3 d double replacement
17.4 c ~~combination~~ single replacement
17.5 a combination
17.6 d double replacement
17.7 d double replacement

18. The trick here is to identify that this is a double replacement reaction & to identify A, B, C, D

$A = Cu^{2+}$ $B = Cl^{\ominus}$ $C = Na^{\oplus}$ $D = OH^{\ominus}$ $Cu^{2+}\ OH^{1-}$ $Na^{\oplus}\ Cl^{\ominus}$

$$CuCl_{2(aq)} + 2NaOH_{(aq)} \rightarrow Cu(OH)_{2(s)} + 2NaCl_{(aq)}$$

1) Use the switcheroo rule to find the correct products
2) Balance the equation.
3) Use solubility rules to determine (aq) or (s)

19 a $CuSO_{4(aq)} + 2NaOH_{(aq)} \rightarrow Cu(OH)_{2(s)} + Na_2SO_{4(aq)}$

b $HNO_{3(aq)} + NaOH_{(aq)} \rightarrow H_2O_{(l)} + NaCl_{(aq)}$

c $Na_2SO_{4(aq)} + BaCl_{2(aq)} \rightarrow BaSO_{4(s)} + 2NaCl_{(aq)}$

d. $2KOH_{(aq)} + MgCl_{2(aq)} \rightarrow Mg(OH)_{2(s)} + 2KCl_{(aq)}$