

# ch 1 Quantitative Chemistry Key

1.) C



$$\text{molar mass} = 2(12.01) + 2(16.00) + 4(1.01) = 60.06 \text{ g}$$

$$\frac{60.06 \text{ g}}{\text{mol}} \times \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ molecules}} = 9.977 \times 10^{-23} \frac{\text{g}}{\text{molec.}}$$

( $\approx 1 \times 10^{-22}$ )

2.) C

Hydrogen is diatomic,  $\text{H}_2$ !

$$\text{so, } 2(6.02 \times 10^{23} \text{ atoms}) = 1.204 \times 10^{24} \text{ atoms H}$$

3.) B

$$24 \text{ g C} \times \frac{1 \text{ mol}}{12.01} = 2.0 \text{ mol C}$$

$$4 \text{ g H} \times \frac{1 \text{ mol}}{1.01} = 4 \text{ mol H}$$

$$32 \text{ g O} \times \frac{1 \text{ mol}}{16.00} = 2 \text{ mol O}$$



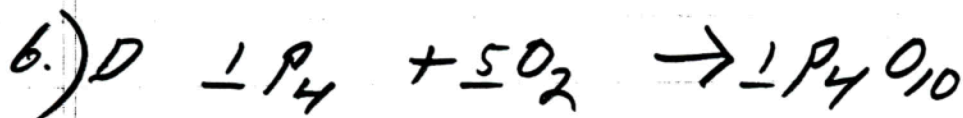
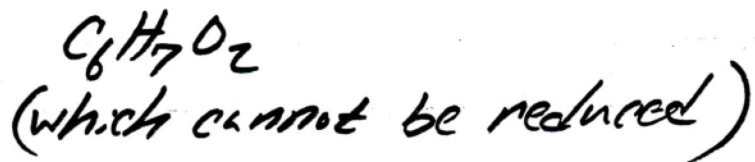
4.) A

i)  $3(6.02 \times 10^{23}) = 1.8 \times 10^{24} \text{ atoms True!}$

ii)  $(32.06 \text{ g}) + 2(16.00 \text{ g}) = 64 \text{ g True!}$

5.) D

rewrite  $C_6H_5(OH)_2$  as



$$1 + 5 + 1 = \boxed{7}$$

7.) A

$$4.86g Mg \times \frac{1 mol}{24.31g} \times \frac{1 mol H_2}{1 mol Mg} \times \frac{2.02g H_2}{1 mol} = 0.403g H_2$$

$$(0.100L HCl) \left( 2.00 \frac{mol}{L} \right) \times \frac{1 mol H_2}{2 mol HCl} \times \frac{2.02g}{1 mol} = \boxed{0.202g H_2}$$

$$\left[ \text{recall } \frac{mol}{mol} = \frac{mol}{L} \right]$$

↑  
Least amount

8.) B

Note: only need to determine the L.R.

$$11.6g C_4H_{10} \times \frac{1 mol}{58.14g} \times \frac{13 mol O_2}{2 mol C_4H_{10}} \times \frac{32.00g}{1 mol O_2}$$

$$= 41.5g O_2 \text{ needed.}$$

But you only have 11.6g  $O_2$ ,  $\therefore O_2$  is L.R.

9.) A

First, determine the number of moles HCl present in each solution.

$$(0.250\text{L})(3.00\text{M}) = 0.750\text{mol}$$

$$(0.350\text{L})(2.00\text{M}) = 0.700\text{mol}$$

Then determine concentration

$$[\text{HCl}]_{\text{final}} = \frac{(0.750 + 0.700)\text{mol}}{(0.250 + 0.350)\text{L}} = 2.42\text{M}$$

10.) A

$$(0.025\text{L})\left(0.125 \frac{\text{mol H}_2\text{SO}_4}{\text{L}}\right) \times \frac{2\text{mol NaOH}}{1\text{mol H}_2\text{SO}_4} = 0.00625\text{mol NaOH}$$

$$M = \frac{\text{mol}}{\text{L}} \rightarrow L = \frac{\text{mol}}{M}$$

$$L = \frac{0.00625\text{mol}}{0.250\text{M}} = 0.0250\text{L} \\ = 25.0\text{mL} \\ (25\text{cm}^3)$$

11.) B

(see #12 Below first!)

$$d_1 = d_2$$

$$P_1 = P_2$$

$$T_1 = T_2$$

( $M = \text{molecular mass}$ )

$$\therefore \frac{P_1 M_1}{RT_1} = \frac{P_2 M_2}{RT_2}$$

$$M_1 = M_2$$

12.) C

$$n = \frac{\text{mass}}{M}$$

$$PV = nRT$$

or

$$PV = \left(\frac{m}{M}\right) RT$$

$$\text{density} = \frac{m}{V} = \left[ \frac{PM}{RT} \right]$$

13.) D From problem 12,

$$PV = \frac{nRT}{M}$$

$$M = \frac{nRT}{VP} = \frac{(1.42)(82.05)(308)}{(250)(0.85)}$$

$T = 35 + 273$   
↓  
(308)

14.) a.)  $15.0g C_7H_6O_3 \times \frac{1mol}{138.13g} \times \frac{1mol C_4H_6O_3}{2mol C_7H_6O} \times \frac{102.10g}{1mol} =$

5.54g  $C_4H_6O_3$   
Required

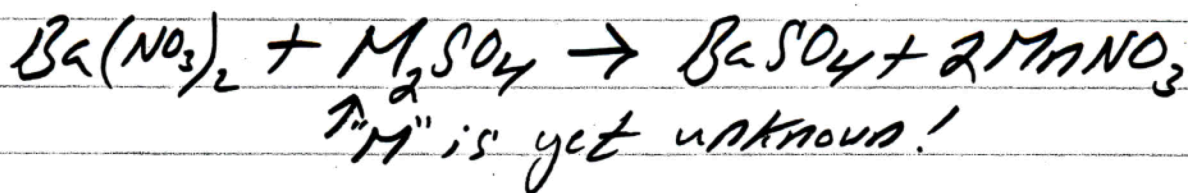
$\therefore C_7H_6O_3$  is  $< 12$ .  
(2-hydroxybenzoic acid)

b.)  $15.0g C_7H_6O_3 \times \frac{1mol}{138.13g} \times \frac{2mol C_9H_8O_4}{2mol C_7H_6O} \times \frac{180.17g}{1mol}$   
L.R.  $\rightarrow$

$= 19.6g C_9H_8O_4$

c.)  $\frac{13.7g}{19.6g} \times 100 = 69.9\%$

15.) Need a balanced chemical equation -



a.) By "amount", they mean moles.

$$9.336 \text{ g BaSO}_4 \times \frac{1 \text{ mol}}{233.40 \text{ g}} = \boxed{0.04000 \text{ mol BaSO}_4}$$

b.) Since "excess"  $\text{Ba}(\text{NO}_3)_2$  was added, you can assume  $\text{SO}_4^{2-}$  is L.R.

$$0.04000 \text{ mol BaSO}_4 \times \frac{1 \text{ mol SO}_4^{2-}}{1 \text{ mol BaSO}_4} = \boxed{0.04000 \text{ mol SO}_4^{2-}}$$

$$c.) M_r = \frac{\text{mass}}{\text{moles}} = \frac{14.48}{0.04000} = \boxed{362}$$

recall  $M_r$  has no units

d.)  $\text{M}_2\text{SO}_4$  molar mass = 362 (from above)

$$2(\text{atomic mass of M}) + (32.06) + 4(16.00) = 362$$

$$\text{atomic mass of M} = \frac{362 - (32.06) - 4(16.00)}{2} = 133$$

$\therefore \boxed{\text{Cs}}$