

CHEM 024b 2008
Tutorial Quiz #1 – Group A
Friday, January 25th 2008

YOUR NAME: JONES

TA'S NAME: _____

- (1) Chalcopyrite is a mineral that contains 34.62 % copper (Cu), 30.43 % iron (Fe), and 34.95 % sulfur (S) by mass. What is the chemical formula for chalcopyrite? [6 marks]

Imagine you have 100 g chalcopyrite

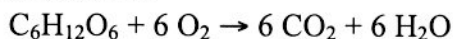
$$\Rightarrow 34.62 \text{ g Cu} = \frac{34.62 \text{ g}}{63.55 \text{ g mol}^{-1}} = 0.545 \text{ mol}$$

$$30.43 \text{ g Fe} = \frac{30.43 \text{ g}}{55.85 \text{ g mol}^{-1}} = 0.545 \text{ mol}$$

$$34.95 \text{ g S} = \frac{34.95 \text{ g}}{32.07 \text{ g mol}^{-1}} = 1.09 \text{ mol}$$

\Rightarrow chalcopyrite has the formula: CuFeS_2 .

- (2) [5 marks] In an experiment, 1.00 g of CO_2 gas was isolated from the combustion of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) in excess oxygen (O_2). What mass of glucose was burned if the experimental yield was 90%. The combustion reaction is:



100% yield would be $\frac{100}{90} \times 1.00 \text{ g} = 1.11 \text{ g } \text{CO}_2$
 $\equiv \frac{1.11 \text{ g}}{(12.01 + 2 \times 16.00) \text{ g mol}^{-1}} = 0.025 \text{ mol } \text{CO}_2$

mol. ratio CO_2 : glucose
 $6 : 1$

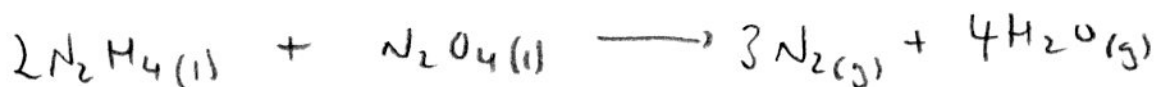
\therefore # moles glucose burned = $\frac{1}{6} \times 0.025 \text{ mol}$
 $= 4.21 \times 10^{-3} \text{ mol}$

$\text{mw}(\text{glucose}) = 6 \times 12.01 + 12 \times 1.008 + 6 \times 16.00 \text{ g mol}^{-1}$
 $= 180.16 \text{ g mol}^{-1}$

\Rightarrow mass of glucose burned = $180.16 \text{ g mol}^{-1} \times 4.21 \times 10^{-3} \text{ mol}$
 $= \underline{\underline{0.76 \text{ g}}}$

- (3) Write balanced equations for the following reactions [2 marks each]:

- (a) The "rocket reaction" between N_2H_4 and N_2O_4 .



- (b) The precipitation of silver chloride (AgCl) from mixing of aqueous silver nitrate (AgNO_3) and iron(III) chloride solutions.



- (4) Silver (Ag) has two naturally occurring isotopes. The first, ^{107}Ag , has a mass of 106.9 amu and an abundance of 51.8%. Calculate the mass of the other isotope of silver. [5 marks]

$$\frac{51.8}{100} \times 106.9 + \frac{100-51.8}{100} \times x = 107.9 \text{ amu}$$

↑
from the periodic table.

$$55.37 + 0.482x = 107.9$$

$$\Rightarrow x = \frac{107.9 - 55.37}{0.482}$$

$$= \underline{\underline{108.97 \text{ amu.}}}$$

(5) (a) In the following reaction, identify two acid and base pairs [2 marks]:



(b) Say whether the following statements are true or false [1 mark each]:

(i) CH_3COOH is a stronger acid than H_3O^+ . *False*

(ii) The equilibrium lies completely on the right hand side. *False*

(6) For each of the following elements

Bismuth (Bi)
Selenium (Se)
Barium (Ba)

State [1 mark each]:

- The name of the group into which the element falls
- The nearest noble gas element
- The charge borne by ions of the element

Answers:

Bi (a) Main group
(b) Radon (Rn)
(c) Bi^{3-}

Se (a) Main group
(b) Krypton (Kr)
(c) Se^{2-}

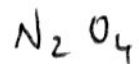
Ba (a) Alkaline earth metal
(b) Xenon (Xe)
(c) Ba^{2+}

(7) How many hydrogen atoms are there in 2 mol of cyclobutane (C_4H_8) [1 mark]?

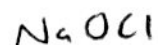
$$2 \times 8 \times 6.02 \times 10^{23} = 9.63 \times 10^{24} \text{ H-atoms}$$

(8) Give the formulae of the following compounds [1 mark each]:

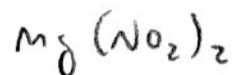
(a) dinitrogen tetroxide



(b) sodium hypochlorite



(c) magnesium nitrite



(9) Give the names of the following compounds [1 mark each]:

(a) P_4O_6

tetraphosphorus hexaoxide

(b) NaSO_3

sodium sulfite

(c) FeCl_2

iron(II) chloride (or, ferrous chloride).