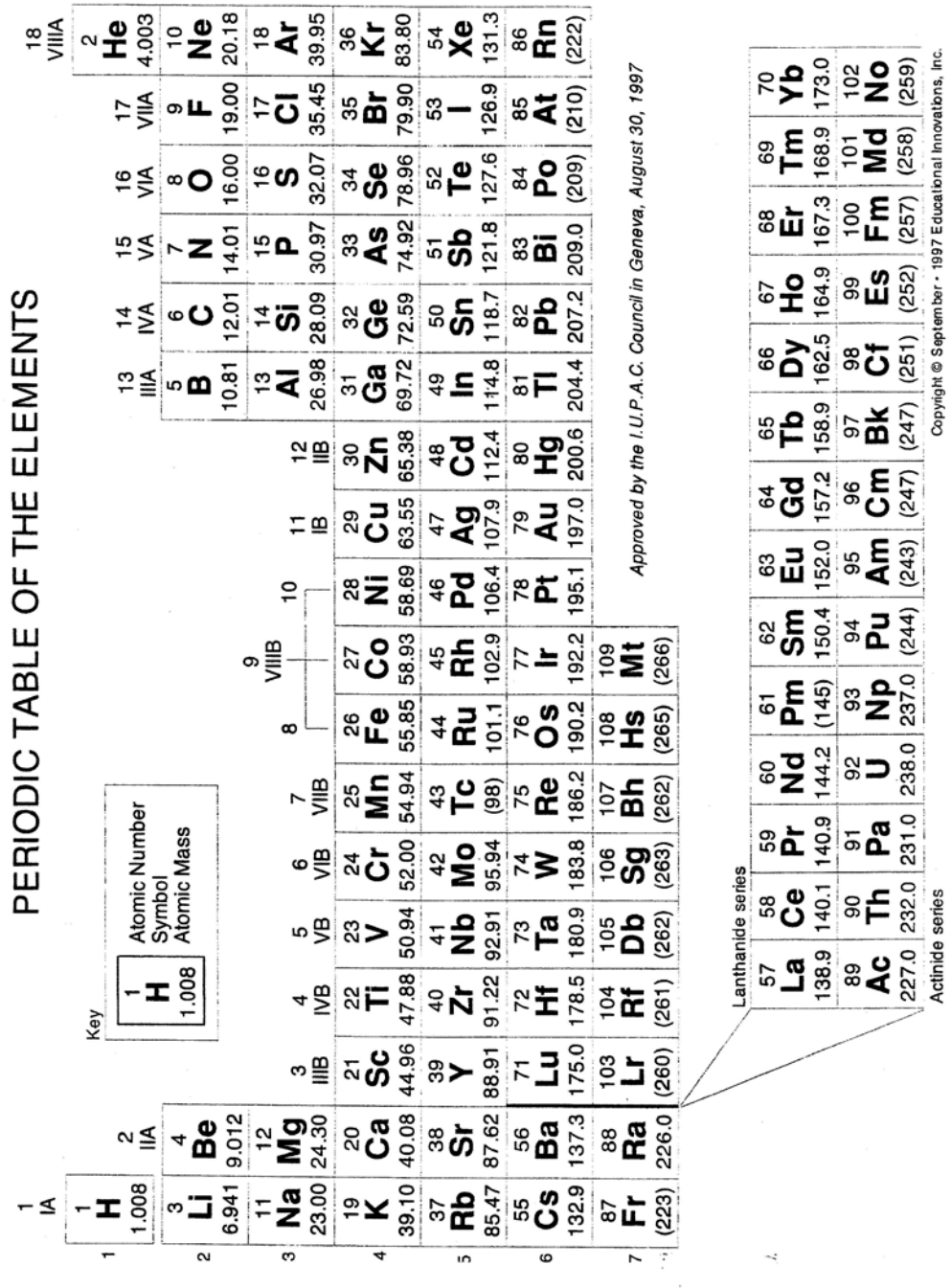
CHEM 1413.001 - Exam 2 – October 11, 2017

Constants and Conversion Factors

Avogadro's Number: $N_A = 6.02 \times 10^{23}\ mol^{-1}$

Molar Masses:

B – 10.8	O_2 – 32.	B_2O_3 – 69.6	Br_2 – 159.8
$FeBr_3$ – 295.5	KBr – 119.	W – 183.8	K_2SO_4 – 174.3
Ag_2SO_4 – 311.9	$Al_2(CO_3)_3$ – 234.		



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Name_____

(76) **MULTIPLE CHOICE (Circle the ONE correct answer)**

NOTE: Required Molar Masses and non-metric conversion factors are given on the cover sheet.

For #1 - #4: Consider the reaction: $4\ B + 3\ O_2 \rightarrow 2\ B_2O_3$

1. What is the approximate theoretical yield of B_2O_3 when 120. grams of O_2 are reacted with an excess of B?

   (A) 96 g (B) 170 g (C) 260.g ; (D) 390 g

2. When 120 g of B are reacted with 225 g of O_2, what is the approximate theoretical yield of B_2O_3?

   (A) 200 g (B) 390 g (C) 250 g (D) 330 g

3. When 120 g of B are reacted with 225. g of O_2, _____ is the excess reactant and approximately _____ of this reactant remain after the reaction is complete.

   (A) O_2 , 130 g (B) O_2 , 77 g (C) B , 19 g (D) B , 100 g

4. When 108 g of B are reacted with an excess of O_2, the percent yield for the reaction is 65%. Approximately how many grams of B_2O_3 are produced?

   (A) 230 g (B) 170 g (C) 350 g (D) 450 g

5. Consider the reaction of Fe(s) and Br_2(l) to form $FeBr_3$(s): __Fe(s) + __Br_2(l) $\rightarrow$ __$FeBr_3$(s). Approximately how many grams of Br_2, reacting with excess Fe, are required to obtain 200 grams of $FeBr_3$ if the percent yield is 70%?

   (A) 160 g (B) 290 g (C) 100 g (D) 230 g

6. For the reaction, ___P_2O_5 + ___H_2O $\rightarrow$ ___H_3PO_4, when 4.0 moles of P_2O_5 are reacted with 8.0 moles of H_2O, 2.5 moles of H_3PO_4 are formed. What is the approximate percent yield for this reaction?

   (A) 11% (B) 31% (C) 47% (D) 63%

7. Transition metals for metal carbonyl complexes of the form $M(CO)_x$. When 175.9 grams of $W(CO)_x$ is heated to drive off the CO [M(CO) = 28], 91.9 grams of pure W remains. The empirical formula is:

   (A) $W(CO)_4$ (B) $W(CO)_6$ (C) $W(CO)_3$

   (D) None of the above.

8. Consider the thermal decomposition of an unknown metal carbonate, $XCO_3(s)$:

$$X_2CO_3(s) \xrightarrow{Heat} X_2O(s) + CO_2(g)$$

When 105. grams of X_2CO_3 is decomposed, 22. grams of CO_2 (M=44) are produced. What is the Molar Mass of the unknown metal; **i.e. what is M(X)**?

(A) 210. g/mol (B) 75 g/mol (C) 150. g/mol

(D) Cannot be determined without knowing the mass of XO produced

9. For this questionc, the relevant solubility rules are: (a) All compounds containing Cl^- are soluble except AgCl, Hg_2Cl_2, $PbCl_2$, (b) All compounds containing PO_4^{3-} are insoluble except those with NH_4^+ or Group 1A metal ions.

The **Net Ionic Equation** (NIE) for the reaction of $SrCl_2$(aq) and K_3PO_4(aq) is:

(A) $6K^+ + 6Cl^- \rightarrow 6KCl$ (B) $2Sr^{2+} + 3PO_4^{3-} \rightarrow Sr_2(PO_4)_3$

(C) $3Sr^{2+} + 2PO_4^{3-} \rightarrow Sr_3(PO_4)_2$ (D) there is NO reaction

10. Which of the following solutions has the **lowest** concentration of ions?

(A) 0.30 M $Al(NO_3)_3$ (B) 0.45 M K_2SO_4

(C) 0.75 M NaCl (D) 0.30 M $Mg_3(PO_4)_2$

11. How many grams of KBr are contained in 300 mL of 0.85 M KBr?

(A) 18.7 g (B) 340 g (C) 42.0 g (D) 30.3 g

12. If one wishes to prepare 800 mL of 0.20 M NaOH from a stock solution with a concentration of 1.20 M, approximately how many mL of the stock solution are required?

(A) 130 mL (B) 75 mL (C) 320 mL (D) 60 mL

13. If one mixes 400 mL of 0.40 M Ethanol with 500 mL of 0.60 M Ethanol approximately how many additional mL of pure water must be added to the solution to have a final concentration of 0.30 M Ethanol?

(A) 480 mL (B) 630 mL (C) 1530 mL

(D) None of the above

14. If one mixes the following 3 aqueous samples together, what is the **total concentration of all ions** in the resulting solution: (1) 400 mL containing 20 grams of K_2SO_4(aq), (2) 500 mL containing 15 grams of K_2SO_4(aq), (3) 300 mL of water:

(A) 0.60 M (B) 0.20 M (C) 0.50 M (D) 0.17 M

15. Silver Sulfate Ag_2SO_4, is a sparingly soluble salt with a solubility of 0.85 g/100 mL of H_2O at 25 ^oC. If you stir 18.0 grams of Ag_2SO_4 into 3.0 L of water at 25 ^oC, what will be the approximate Molar concentration of **Silver ions**, **[Ag^+],** in the solution after it has come to equilibrium?

    (A) 0.038 M (B) 0.055 M (C) 0.027 M (D) 0.019 M

16. 140 mL of 0.20 M H_3PO_4(aq) is needed to completely neutralize 50 mL of an aqueous KOH(aq) solution? What is the Molarity of the KOH(aq) solution?

    (A) 0.56 M (B) 1.68 M (C) 0.37 M (D) 0.19 M

17. Consider the reaction of aqueous Barium Chloride, $BaCl_2$(aq) with aqueous potassium phosphate, K_3PO_4(aq) to form solid Barium Phosphate, $Ba_3(PO_4)_2$(s). Approximately how many mL of 0.45 M $BaCl_2$(aq) are required to react completely with 300 mL of 0.35 M K_3PO_4(aq)?

    (A) 350 mL (B) 700 mL (C) 230 mL (D) 160 mL

18. You are given 34. grams of an unknown base, $X(OH)_2$, which is completely neutralized by reaction with 460 mL of 0.70 M HNO_3. The Molar Mass of the base is approximately:

    (A) 105 g/mol (B) 53 g/mol (C) 210 g/mol (D) 174 g/mol

19. Regarding the following reaction, which of the statements below is/are true?

    $Fe_2O_3(s) + 3\ CO(g) \rightarrow 2\ Fe + 3\ CO_2(g)$

    (1) Fe_2O_3 is the oxidizing agent (2) Fe_2O_3 is oxidized

    (3) 3 electrons are transfered (4) CO is reduced

    (A) 1 only (B) 2 & 4 (C) 2 & 3 & 4 (D) 1 & 3

Two (2) Problems follow (You MUST show your work to receive credit)

(12) 1. Consider the hypothetical, metal "Spookium (Sp), with Molar Mass: M(Sp) = 60 g/mol.

When 30. grams of Sp are reacted with aqueous HCl(aq), 1.25 grams of $H_2(g)$ are formed, as well as the Metal Chloride , Sp_xCl_y . Determine the empirical formula of the metal chloride; i.e. what are "x" and "y" in Sp_xCl_y

(12) 2. When aluminum nitrate, $Al(NO_3)_3(aq)$, reacts with sodium carbonate, $Na_2CO_3(aq)$ in solution, solid aluminum carbonate, $Al_2(CO_3)_3(s)$, precipitates from solution.

When 750. mL of 0.40 M $Al(NO_3)_3(aq)$is mixed with 1200 mL of 0.30 M $Na_2CO_3(aq)$, then, at the completion of the reaction, calculate:

(6) (a) the number of grams of $Al_2(CO_3)_3(s)$) which will be produced (i.e. the theoretIcal yield).

(6) (b) which reactant, $Al(NO_3)_3(aq)$ or $Na_2CO_3(aq)$, is in excess (and remains in solution), and what will be it's Molar concentration at the conclusion of the reaction.

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