CHEM 11 Exam 1 Fall 2007 Section D01BG Lloyd

You have 120 minutes to complete this exam. Answer all questions. To receive credit you must show your reasoning and all calculations in the bluebook. Report numerical answers with the correct number of significant figures and with correct units. No speaking is allowed during the exam. You must use the calculator you have. Once you complete the exam you may leave the room. Each question is valued at 5 points for a total of 100 points.

1. How many protons, electrons, and neutrons are in an atom of the isotope ^{63}Cu?

2. Write the chemical formula for the compound formed from Cr^{3+} and SO_4^{2-} ions.

3. Name the following compounds: PbO Li_2SO_3 Cl_2O_7

4. The atomic masses of the two stable isotopes of boron are ^{10}B (19.78% abundance and mass = 10.0129 amu) and ^{11}B (80.22% abundance and mass = 11.0093 amu). Calculate the average atomic mass of boron.

5. How many moles of magnesium (Mg) are there in 87.3 g of Mg?

6. Calculate the number of atoms in 0.551 g of potassium (K).

7. What is the molar mass of sucrose ($C_{12}H_{22}O_{11}$)?

8. Calculate the moles of chloroform ($CHCl_3$) in 198 g of chloroform.

9. Calculate the percentage mass composition of each element in ammonia (NH_3).

10. A compound containing boron and hydrogen contains 6.444 g of boron and 1.803 g of hydrogen. The molar mass of the compound is about 28 g/mol. What is (a) the empirical formula of the compound and (b) the molecular formula of the compound?

11. Write and balance the following equation using the smallest whole numbers possible: Solid iron (Fe) reacts with oxygen gas (O_2) to form solid iron (III) oxide (Fe_2O_3).

12. Consider the following chemical reaction: $2CH_3OH + 3O_2 \rightarrow 2CO_2 + 4H_2O$
If 4.5 mol of methanol (CH_3OH) react with excess oxygen (O_2) how many moles of water (H_2O) are produced?

13. Consider the following chemical reaction: $2NO + O_2 \rightarrow 2NO_2$
If 1.25 moles of nitric oxide (NO) react with 0.55 moles of oxygen (O_2) how many moles of NO_2 are produced?

14. Consider the following chemical reaction: $3H_2 + N_2 \rightarrow 2NH_3$
If 3.30 mol of H_2 react with excess nitrogen (N_2) how many grams of ammonia (NH_3) should be produced? Suppose the actual amount of nitrogen produced is 21.50 g. Calculate the reaction yield.

15. Write in your blucbook the compound(s) that is/are soluble in water (more than one compound may be soluble).
CuS $Ca(OH)_2$ $Zn(NO_3)_2$ Ag_2SO_4 $CaCO_3$

16. Write the ionic equation and the net ionic equation for the reaction shown:
$Al(NO_3)_3$ (aq) + 3NaOH (aq) → $Al(OH)_3$ (s) + $3NaNO_3$ (aq)

17. Complete the (a) balanced molecular, (b) ionic, and (c) net ionic equations for the following acid-base reaction:

Incomplete Molecular Equation: HBr (aq) + LiOH (aq) →

18. Assign an oxidation number to each element in PF_3 and in MnO_4^-.

19. What is the molarity of a 1.18 L ethanol (C_2H_6O) solution containing 1.77 g of ethanol?

20. A 5.00 M stock solution of NaOH is diluted to 0.500 M with a volume of 250.0 mL. What volume of stock solution is needed?

EXAM 1 REFERENCE MATERIALS

SOLUBILITY RULES

1. Salts containing Group I elements are soluble (Li^+, Na^+, K^+, Cs^+, Rb^+). Exceptions to this rule are rare. Salts containing the ammonium ion (NH_4^+) are also soluble.
2. Salts containing nitrate ion (NO_3^-) are generally soluble.
3. Salts containing Cl^-, Br^-, I^- are generally soluble. Important exceptions to this rule are halide salts of Ag^+, Pb^{2+}, and $(Hg_2)^{2+}$.
4. Most silver salts are insoluble. $AgNO_3$ and $Ag(C_2H_3O_2)$ are common soluble salts of silver; virtually anything else is insoluble.
5. Most sulfate salts are soluble. Important exceptions to this rule include $BaSO_4$, $PbSO_4$, Ag_2SO_4 and $SrSO_4$.
6. Most hydroxide salts are only slightly soluble. Hydroxide salts of Group II elements (Ca, Sr, and Ba) are slightly soluble.
7. Most sulfides of transition metals are highly insoluble.
8. Carbonates are frequently insoluble.
9. Chromates are frequently insoluble.
10. Phosphates are frequently insoluble.
11. Fluorides are frequently insoluble.

POLYATOMIC IONS

nitrite	NO_2^-	ammonium	NH_4^+
nitrate	NO_3^-	hydronium	H_3O^+
hydrogen phosphate	HPO_4^{2-}	perchlorate	ClO_4^-
phosphate	PO_4^{3-}	chlorate	ClO_3^-
chromate	CrO_4^{2-}	chlorite	ClO_2^-
dichromate	$Cr_2O_7^{2-}$	hypochlorite	ClO^-
cyanide	CN^-	permanganate	MnO_4^-
hydroxide	OH^-	carbonate	CO_3^{2-}
sulfate	SO_4^{2-}	hydrogen carbonate	HCO_3-
sulfite	SO_3^{2-}	mercury (I)	Hg_2^{2+}

$d = m/V$ $M = n/V$ $N_A = 6.022 \times 10^{23}/mol$ $e = -1.602 \times 10^{-19}$ C

Reaction yield = [(actual yield)/(theoretical yield)] x 100 %

OXIDATION NUMBERS

1. The alkali metals (Li, Na, K, Rb, and Cs) in compounds are always assigned an oxidation state of +1.
2. Fluorine in compounds is always assigned an oxidation state of -1.
3. The alkaline earth metals (Be, Mg, Ca, Sr, Ba, and Ra) and also Zn and Cd in compounds are always assigned an oxidation state of +2.
4. Hydrogen in compounds is assigned an oxidation state of +1.
5. Oxygen in compounds is assigned an oxidation state of -2.
6. Halogens in compounds are assigned an oxidation state of -1.