Chem 1210

Midterm 2

100 points

Dr. Luther Giddings

Name_____

Instructions:
This is a closed book, closed notebook test. You may not discuss this exam with anyone, either during or after the exam, until it has been graded and returned to you in class. You may not use any outside materials - including Periodic Tables - on this exam, <u>except</u> a single 3" x 5" index card and an English-foreign language dictionary if necessary. You may use a calculator to help you compute the correct answer but may not retrieve or view any reference materials that may be stored in your calculator. <u>Please be honest!</u>

Each question is worth 5 points. All questions are of equal value.

Potentially Useful Information (?)

Solubility Rules			
Rule	**Substances**		**Exceptions**
1	Group 1 cations and ammonium ion	always soluble	none
2	acetates, nitrates, and citrates	always soluble	none
3	halogens (as anions)	always soluble	Ag^{+}, Hg_2^{2+}, Hg^{2+}, or Pb^{2+}
4	sulfates	always soluble	Ag^{+}, Hg_2^{2+}, Hg^{2+}, Pb^{2+}, Ca^{2+}, Sr^{2+}, or Ba^{2+}
5	carbonates, phosphates, sulfides, and hydroxides	always insoluble	Group 1 and Group II hydroxides are strong bases

Rules for Determining Oxidation Numbers	
Rule 1	the oxidation number of atoms in their elemental state is zero
Rule 2	the oxidation number of a monatomic ion is equal to its charge
Rule 3	the oxidation number of oxygen is always equal to -2 unless in a peroxide (then -1)
Rule 4	the oxidation number of hydrogen is always +1 unless in a hydride (then -1)
Rule 5	Fluorine always has an oxidation number of -1. The other halogens always have an oxidation of -1 as anions in binary compounds. Halogens listed as the first member of a binary molecular compound or involved in oxyanions have positive oxidation numbers.
Rule 6	for either a neutral compound or for any polyatomic ion, the sum of the oxidation numbers of the atoms in the molecule is equal to the net charge on the specie
note	it <u>is</u> possible for atoms to have fractional oxidation numbers

$PV = nRT$
$P_1V_1/n_1T_1 = P_2V_2/n_2T_2$
$R = 0.0821\ L \cdot atm \cdot mol^{-1} \cdot K^{-1}$

1. The conversion of elemental phosphorus to phosphoric acid is described by the equation

$$P_4 + 5\ O_2 + 6\ H_2O \rightarrow 4\ H_3PO_4$$

What is the minimum mass of phosphorus needed to prepare 125 grams of H_3PO_4?

A. 9.88 g
B. 24.3 g
C. 39.5 g
D. 97.2 g
E. 123.9 g

2. Nitric oxide (or nitrogen monoxide, NO) is made by the oxidation of ammonia (NH_3) and the reaction is represented by the equation

$$4\ NH_3 + 5\ O_2 \rightarrow 4\ NO + 6\ H_2O$$

An 8.50 g sample of ammonia yields 12.0 g of nitric oxide. The percent yield of NO is

A. 10%
B. 40%
C. 60%
D. 80%
E. 100%

3. If 50.0 grams of oxygen gas are mixed with 50.0 grams of hydrogen gas and ignited, what mass of water is produced?

A. 50.0 g
B. 56.3 g
C. 65.7 g
D. 71.4 g
E. 100.0 g

4. Which of the following is a weak base?

A. $HClO_4$
B. LiOH
C. $Ba(OH)_2$
D. KOH
E. NH_3

5. All of the following are strong electrolytes in aqueous solution <u>except</u>

A. HBr
B. $HC_2H_3O_2$
C. $NaC_2H_3O_2$
D. NaCl
E. $NH_4C_2H_3O_2$

6. When aqueous solutions of lithium chloride and ammonium sulfate are mixed

A. A precipitate forms
B. A new salt is formed
C. A gas is created
D. An acid and a base are formed
E. No reaction occurs

7. When aqueous solutions of barium chloride and sodium sulfate are mixed the spectator ions in the resulting reaction are

A. Both sodium and chloride ions
B. Both barium and chloride ions
C. Both barium and sulfate ions
D. Both sodium and sulfate ions
E. None of the above

8. A precipitate is expected when an aqueous solution of potassium iodide is added to an aqueous solution of

A. Sodium sulfate
B. Iron (II) chloride
C. Calcium acetate
D. Barium hydroxide
E. Lead nitrate

9. The balanced net ionic equation for the reaction of calcium carbonate with nitric acid is

A. $CaCO_{3\,(s)} + 2\ H^+_{(aq)} \rightarrow Ca^{2+}_{(aq)} + CO_{2\,(g)} + H_2O_{(l)}$
B. $CaCO_{3\,(s)} + 2\ HNO_{2\,(aq)} \rightarrow Ca^{2+}_{(aq)} + 2\ NO_2^{2-}{}_{(aq)} + CO_{2\,(g)} + H_2O_{(l)}$
C. $CaCO_{3\,(s)} + 2\ HNO_{3\,(aq)} \rightarrow Ca^{2+}_{(aq)} + 2\ NO_3^{2-}{}_{(aq)} + CO_{2\,(g)} + H_2O_{(l)}$
D. $Ca^{2+}_{(aq)} + CO_3^{2-}{}_{(aq)} + 2\ H^+_{(aq)} + 2\ NO_3^{2-}{}_{(aq)} \rightarrow Ca^{2+}_{(aq)} + 2\ NO_3^{2-}{}_{(aq)} + CO_{2\,(g)} + H_2O_{(l)}$
E. $Ca^{2+}_{(aq)} + CO_3^{2-}{}_{(aq)} + 2\ H^+_{(aq)} + 2\ NO_3^{2-}{}_{(aq)} \rightarrow Ca(NO_3)_{2\,(aq)} + CO_{2\,(g)} + H_2O_{(l)}$

10. Which net ionic equation best represents the reaction that occurs when an aqueous solution of barium chloride is mixed with an aqueous solution of sulfuric acid?

A. $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2\ HCl$
B. $2\ H^+_{(aq)} + 2\ Cl^-_{(aq)} \rightarrow HCl_{(aq)}$
C. $Ba^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)} \rightarrow BaSO_{4\ (s)}$
D. $Ba^{2+}_{(aq)} + 2\ Cl^-_{(aq)} + 2\ H^+_{(aq)} + SO_4^{2-}{}_{(aq)} \rightarrow BaSO_{4\ (s)} + 2\ HCl_{(aq)}$
E. No net reaction occurs

11. The oxidation numbers of nitrogen in dinitrogen monoxide and nitrogen tetrafluoride are, respectively

A. -2 and -3
B. -2 and +2
C. +1 and -1
D. +1 and +2
E. +1 and -3

12. Which of the following reactions is a redox reaction?

A. $CaCO_3 + 2\ HCl \rightarrow CaCl_2 + H_2O + CO_2$
B. $Mg + CO_2 \rightarrow MgO + CO$
C. $AgNO_3 + KI \rightarrow AgI + KNO_3$
D. $H_2SO_4 + 2\ NaOH \rightarrow Na_2SO_4 + 2\ H_2O$
E. $CaO + SO_3 \rightarrow CaSO_4$

13. Xylene (C_8H_{10}) can be oxidized in acid solution to phthalic acid ($C_8H_6O_4$). In the balanced half-reaction one mole of xylene loses how many moles of electrons?

$$\_\_\_C_8H_{10} + \_\_\_H_2O \rightarrow \_\_\_C_8H_6O_4 + \_\_\_H^+ + \_\_\_e^-$$

A. 3
B. 4
C. 6
D. 8
E. 12

14. How much physiological saline (0.54 M NaCl) can be prepared by the dilution of 100 mL of a 6.0 M NaCl solution?

A. 1100 mL
B. 910 mL
C. 540 mL
D. 90 mL
E. 1900 mL

15. How many moles of KOH are contained in 27.5 mL of 0.250 M KOH?

A. 0.00431
B. 0.00688
C. 0.00724
D. 0.00813
E. 0.00921

16. How many grams of lithium nitrate are required to prepare 300.0 mL of 0.200 M solution?

A. 1.04 g
B. 2.08 g
C. 3.62 g
D. 4.14 g
E. 6.32 g

17. A 1.25 g sample of carbon dioxide is contained in a 750.0 mL flask at 22.5°C. What is the pressure of the gas in atmospheres?

Answer = _____

18. A 1.007 g sample of an unknown gas exerts a pressure of 715 mm Hg in a 452 mL container at 23°C. What is the molar mass of the gas? Remember your units.

Answer = _____

19. Sodium azide (NaN_3), the explosive compound in automobile air bags, decomposes according to the equation

$$2\ NaN_{3\ (s)} \rightarrow 2\ Na_{(s)} + 3\ N_{2\ (g)}$$

What mass of sodium azide (in grams) is required to provide the nitrogen needed to inflate a 25.0 L bag to a pressure of 1.3 atm at 25°C?

Answer = _____

20. A helium-filled balloon of the type used in long-distance flying contains 420,000 ft^3 (1.200×10^7 L) of helium. The balloon is filled with helium on the ground to a pressure of 737.0 mm Hg at a temperature of 16.00°C. When the balloon ascends to an altitude of 2 miles (1.2 km) where the temperature is -33.00°C the pressure inside the balloon has fallen to 600.0 mm Hg. At this elevation, what is the <u>change</u> in the volume occupied by the helium gas? State your answer in liters.

Answer = _____

Answers Chem 1210 MT2

1. C
2. D
3. B
4. E
5. B
6. E
7. A
8. E
9. A
10. C
11. D
12. B
13. E
14. A
15. B
16. D
17. 0.919 atm
18. 57.5 g/mol
19. 58 g
20. 2.4×10^5 L