Chemistry 201 – Practice Final **Name**_____

Part One: Multiple Choice (60 points)

Select the best answer to each question. There is only one correct answer.

1. How many significant figures are in the value: 0.003050?
   a. 7 b. 6 c. 5 d. 4 e. 3

2. The correct formula for Chromium (IV) Phosphite is:
   a. $CrPO_3$
   b. Cr_3PO_3
   c. $Cr_2(PO_3)_3$
   d. $Cr_3(PO_3)_4$
   e. $Cr_3(PO_4)_4$

3. Ammonia reacts with oxygen gas to produce nitric oxide (NO) and water. In the balanced chemical reaction the coefficient in front of ammonia is:
   a. 2 b. 3 c. 4 d. 5 e. 6

4. What is the oxidation number of phosphorus in $NH_4H_2PO_4$?
   a. -3 b. 0 c. +1 d. +3 e. +5

5. What volume of 0.2M Na_2CO_3 solution contains 53.0 g of Na_2CO_3?
   a. 0.200 L b. 0.400 L c. 0.500 L d. 1.60 L e. 2.50 L

6. A molecular compound contains 92.3% carbon and 7.7% hydrogen by weight. If 0.125 mol of the compound weights 3.25 g, what is its molecular formula?
   a. CH b. C_2H_2 c. C_5H_6 d. C_6H_6 e. C_6H_7

7. The formula for perbromic acid is:
   a. HBrO b. $HBrO_2$ c. $HBrO_3$ d. $HBrO_4$ e. HBr

8. At STP it was found that 1.17 L of a gas weighed 5.45 g. The gas could be:
   a. NH_3 b. HNF_2 c. N_2F_4 d. NH_3 e. NO_2

9. The following equation represents the complete combustion of ethane:
   $2C_2H_{6(g)} + 7O_{2(g)} \rightarrow 4CO_{2(g)} + 6H_2O_{(g)}$
   What is the maximum volume of carbon dioxide that can be obtained from 50.0 L of ethane and 250. L of oxygen assuming constant temperature and pressure?
   a. 25.0 L b. 50.0 L c. 100. L d. 150. L e. 200. L

10. If 250 mL of methane, CH_4, effuses through a small hole in 48 s, the time required for the same volume of helium to pass through the hole will be:
    a. 12 s b. 24 s c. 48 s d. 96 s e.192 s

11. Calculate the change in enthalpy when 52.0 g of Cr at 25°C and 1 atm pressure is oxidized. The standard heat of formation of $Cr_2O_{3(s)}$ is -1140 kJ/mol. $4Cr_{(s)} + 3O_{2(g)} \rightarrow 2Cr_2O_{3(s)}$
    a. -1140 kJ b. +1140 kJ c. -570 kJ d. +570 kJ e. -285 kJ

12. Given the following data:
    $S_{(s)} + O_{2(g)} \rightarrow SO_{2(g)}$ ΔH^o(kJ/mol) = -395
    $S_{(g)} + O_{2(g)} \rightarrow SO_{2(g)}$ ΔH^o(kJ/mol) = -618

    find the heat required for the reaction converting solid sulfur to gaseous sulfur.
    a. +223 kJ/mol b. -223 kJ/mol c. -618 kJ/mol d. +618 kJ/mol e. -1013 kJ/mole

13. All of the following salts are soluble EXCEPT:
    a. NaCl b. AgCl c. LiCl d. $MgCl_2$ e. $AlCl_3$

14. For the reaction that occurs in a lead storage battery:
$Pb_{(s)} + PbO_{2\,(s)} + 2H_3O^{+}_{(aq)} + 2HSO_4^{1-}{}_{(aq)} \rightarrow 2PbSO_{4(s)} + 4H_2O_{(l)}$ the oxidizing agent is:

a. Pb b. PbO_2 c. H_3O^+ d. HSO_4^{1-} e. $PbSO_4$

15. When the equation $HBrO_3 + SO_2 + H_2O \rightarrow Br_2 + H_2SO_4$ is balanced the coefficient for sulfur dioxide is:
a. 5 b. 4 c. 8 d. 10 e. 17

16. Which group forms oxides of the formula RO where R means a single atom of certain elements?
a. alkaline earth metals b. chalcogens c. noble gases d. alkali metals e. halogens

17. Which hybridization occurs around the carbons in CHCH (acetylene)?
a. sp^3 b. sp^2 c. sp d. no hybridization

18. Which of the following molecules is a notable exception to the octet rule?
a. ammonia b. phosphorus pentachloride c. nitrogen trifluoride d. water

19. Which of the following molecules is polar?
a. xenon tetrafluoride b. selenium hexachloride c. carbon tetrachloride d.iodine trifluoride

20. All of the following have noble gas electronic configurations except:
a. As^{3+} b. P^{3-} c. Ca^{2+} d. Br^{1-} e. Kr

Part Two: Short Answer (10 points)

Write your answer in the space provided

1. What is the Pauli Exclusion Principle? Explain.

2. What is a redox reaction?

3. What conditions are NOT favorable for ideal gas behavior?

4. What causes emission line spectra?

5. What is enthalpy?

Part Three: Problem Solving (30 points)

Solve the following problems. Show your work and circle your final answer.

1. Determine the freezing point of a 0.25 m solution of glucose in water. (K_f for water is 1.86°C/m

2. A 1.0 g sample of a small protein having a molecular weight of 50,200 g/mol is dissolved in 50.0 mL of water. Calculate the osmotic pressure of the solution in millimeters of mercury at a temperature of 25°C.

3. Solid calcium nitrate will react with solid ammonium chloride at slightly elevated temperatures to produce nitrous oxide (N_2O) gas and calcium chloride solid and steam (water in gaseous form).

    a. Write the balanced chemical reaction.

    b. What volume of nitrous oxide will be produced at 298K and 1.00 atm if 5.0 grams of solid calcium nitrate are combined with 5.0 grams of solid ammonium chloride?

Some useful constants

$N_A = 6.022 \times 10^{23}$
R = 0.0821 L-atm/mol-K