**Day 1 – 25 Multiple Choice Qs**

**Start:** Answer all questions on this day before stopping.

**Note: NO CALCULATORS MAY BE USED FOR QUESTIONS ON   
 THIS DAY. YOU MAY ONLY USE THE APPROVED AP   
 CHEM PERIODIC TABLE AND EQUATION SHEET.**

**Note:** For all questions, assume that the temperature is  
 298 K, the pressure is 1.00 atmosphere and  
 solutions are aqueous, unless otherwise noted.

**Questions l through 3 refer to the following gases:**

1. HCI
2. O2
3. NO
4. NO2
5. CO
6. This gas diffuses at the slowest rate.
7. This gas has the most weakly interacting molecules.
8. At any given temperature and pressure, this gas has particles with the highest average velocity.

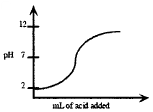
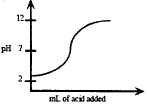
**Questions 4 through 7 refer to the following hybridizations:**

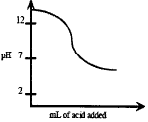
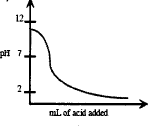
1. sp
2. sp2
3. sp3
4. sp3d
5. sp3d2
6. SO2
7. I3-
8. IF5
9. CH3OH
10. Zn(s) + 2AgNO3(aq) 🡪 2Ag(s) + Zn(NO3)2(aq)  
    About how many grams of zinc must go into this reaction to produce 1.0 mol of silver?
11. 17g
12. 25g
13. 33 g
14. 65g
15. 130 g
16. When a gas expands from 5.00 to 6.00 liters at a constant pressure of 2.00 atm, it absorbs 505.64 joules of energy. What is the change in energy, ∆E, for the gas?   
    (101.32 joules = 1 liter• atm)
17. 50.66 J
18. 101.32 J
19. 303.00 J
20. 505.64 J
21. 606.00 J
22. According to Raoult's Law, which statement is incorrect?
23. The vapor pressure of a solvent decreases as its mole fraction increases.
24. Ionic solids ionize in water, increasing the effects of all colligative properties.
25. The vapor pressure of a solvent over a solution is less than that of the pure solvent
26. The solubility of a gas increases as the temperature decreases.
27. The solubility of a gas in solution increases as the pressure of the gas increases.
28. A molecule of H-Cl contains how many lone electron pairs?
29. one
30. two
31. three
32. four
33. six
34. MgO(s) + H2(g) ↔ Mg(s) + H2O(g) ∆H = -14.0 kJ  
    When the substances in the equation above are at equilibrium at pressure (P) and temperature (T), the equilibrium can be shifted to favor the products by
35. increasing the pressure in the reaction vessel while keeping the temperature constant.
36. increasing the pressure by adding an inert gas like Ar.
37. allowing some H2 gas to escape at constant P and T
38. decreasing the temperature.
39. adding a catalyst.
40. Which solution has the highest boiling point?
41. 0.10 m oxalic acid, H2C2O4
42. 0.10 m potassium chloride, KCI
43. 0.10 m ammonium nitrate, NH4NO3
44. 0.10 m sucrose, C12H22O11
45. 0.10 m calcium nitrate, Ca(NO3)2
46. 100 grams of O2(g) and 100 grams of He(g) are in separate containers of equal volume. Both gases are at l00°C. Which one of the following statements is true?
47. Both gases would have the same pressure.
48. The average kinetic energy of the O2 molecules is greater than that of the He molecules.
49. The average kinetic energy of the He molecules is greater than that of the O2 molecules.
50. There are equal numbers of He molecules and O2 molecules.
51. The pressure of the He(g) would be greater than that of the O2(g).
52. Which of the following is not isoelectronic with the others?
53. S2-
54. Cl-
55. Ar
56. K+
57. Mg2+
58. A 1 molar solution of a very weak monoprotic acid has a pH of 5. What is the value of Ka for the acid?
    1. Ka = 1 x 10-10
    2. Ka = 1 x 10-7
    3. Ka = 1 x 10-5
    4. Ka = 1 x 10-2
    5. Ka = 1 x 10-1
59. Carbon-14 has a half life of 5730 years. Approximately what percent of the original radioactivity would be present after 34,480 years?
    1. 1.56%
    2. 3.13%
    3. 6.26%
    4. 12.5%
    5. 25.0%
60. Which of the following statements is true regarding magnesium and calcium?
    1. Mg has a larger 1st IE and a larger atomic radius
    2. Mg has a larger 1st IE and a smaller atomic radius
    3. Mg has a smaller 1st IE and a larger atomic radius.
    4. Mg has a smaller 1st IE and a smaller atomic radius
    5. Mg and calcium have identical 1st IE and atomic radii
61. What are the oxidation numbers of chromium in chromate and dichromate anions, respectively?
    1. +8, +14
    2. +8, +7
    3. +7, +7
    4. +6, +6
    5. +4, +7
62. For which of the following processes would ∆S have a positive value?

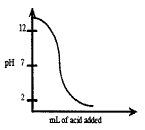
I. MgCO3(s) 🡪 MgO(s) + CO2(g)

II. Ba2+(aq) + SO42- (aq) 🡪 BaSO4(s)

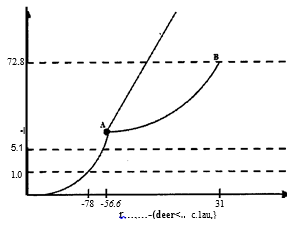
III. Cl2(g) + C3H5(g) 🡪 C3H5Cl2(g)

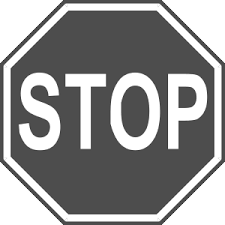
1. I only
2. I and II only
3. I and III only
4. II and III only
5. I, II, and III
6. At 37°C and 1.00 atm of pressure, N2 dissolves in the blood at a solubility of 6.0 x 10-4 M. If a diver breathes compressed air where N2 constitutes 80. mole% of the gas mixture, and the total pressure at this depth is 3.0 atm, what is the concentration of N2 gas in her blood?
7. 1.4 x 10-4 M
8. 6.0 x 10-4 M
9. 1.0 x 10-3 M
10. 1.4 x 10-3 M
11. 6.0 x 10-3 M
12. The rate law for a chemical reaction between substances A and B is rate = k [A]2[B]  
    where k is constant. The concentration of A is reduced to half its original. To make the reaction proceed at 50% of its original rate, the concentration of B should be
13. decreased by ¼
14. halved
15. kept constant
16. doubled
17. increased by a factor of 4
18. In the titration of a weak base of unknown concentration with a solution of a strong acid, a pH meter was used to follow the progress of the titration. Which of the following graphs best represents the data collected for this experiment?
    1.  (B)

 (C) (D)



(E)

1. Which correctly represents the electron configuration of an oxide ion?
2. ls2 2s2 2p2
3. ls2 2s2 2p4
4. ls2 2s2 2p6
5. ls22s22p63s2
6. ls2 2s2 2p6 3s2 3p6
7. The normal boiling point  
   of the substance represented  
   by the phase diagram is:
   1. -78 C
   2. -56.6 C
   3. 31 C
   4. Greater than 31 C
   5. Not determinable   
      from the diagram



**Correct your answers and note how many correct   
 points you earned. Review any topics you missed.**

**Day 2 – 2 Free Response Qs**

**Start:** Answer all questions on this day before stopping.

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**Note:** Clearly show the method used and the steps involved in arriving at your answers. It is to your advantage to do this, since you may obtain partial credit if you do and you will receive little or no credit if you do not. Pay attention to significant figures.

1. 10 points.   
   Formic acid is a significant component of bee venom. Also known as methanoic acid, formic acid has an acid dissociation constant, Ka, of 1.80 x 10-4
   1. If a bottle contains 0.25M solution of formic acid.
      1. Write the equilibrium expression for the dissociation of the acid.
      2. Calculate the pOH of the solution.
   2. Calculate the percent dissociation of the solution in part (A)
   3. Calculate the pH of a solution prepared by mixing equal 1.00L volumes of 0.25M formic acid and 0.20M sodium methanoate.
   4. Using only compounds already mentioned, what should be added to the solution in part (C) to produce a solution with maximum capacity to resist change in pH?

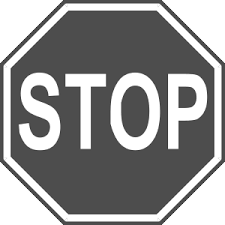
Mention

* + 1. The compound to be added.
    2. The mass of the compound to be added.

1. 10 points.   
   Refer to the following equation.

2Mg(s) + 2CuSO4(aq) + H2O(1) 🡪 2MgSO4(aq) + Cu2O(s) + H2(g)

1. If 1.46 g of Mg(s) are added to 500 ml of a 0.200 M solution of CuSO4, what is the maximum molar yield of H2(g)
2. When all the limiting reagent has been consumed in (A), how many grams of the other reactant (not water) remain?
3. What is the mass of the Cu2O produced in (A)
4. What is the concentration of Mg2+ in the solution at the end of the experiment? Assume that the volume of the solution remains unchanged.



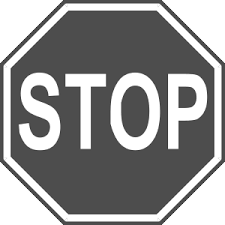
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**Day 3 – 2 Free Response Qs**

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1. 15 points.   
   *For each of the following three reactions, write a balanced equation for the reaction in part (i) and answer the question about the reaction in part (ii). In part (i), coefficients should be in terms of lowest whole numbers. Assume that solutions are aqueous unless otherwise indicated. Represent substances in solutions as ions if the substances are extensively ionized. Omit formulas for any ions or molecules that are unchanged by the reaction.*
   1. A piece of solid tin is heated in the presence of chlorine gas.
      1. Balanced equation.
      2. What is the oxidation number of the tin before and after the reaction?
   2. Ethane is burned completely in air.
      1. Balanced equation.
      2. How many liters of carbon dioxide will be produced from completely burning 3.4 moles of ethane at STP?
   3. A pellet of zinc is dropped into a test tube containing 30mL of 6M HCl
      1. Balanced equation
      2. Indicate two observable changes that will be noted as the reaction proceeds in the test tube.
2. 8 points.   
   *Your response to question 2 will be scored on the basis of the accuracy and relevance of the information cited. Explanations should be clear and well organized. Examples and equations may be included in your responses where appropriate. Specific answers are preferable to broad, diffuse responses.*  
     
   A set of three vials contains three different organic compounds. Each compound contains only one kind of functional group, and each functional group is different from the others. None of the compounds has an ester or amide linkage, and none is an alkene or alkyne.
   1. All of the compounds possess a carbonyl group. What kinds of compounds are these three?
   2. Assuming that each of the three compounds contains four carbon atoms, and is linear (not branched), draw Lewis structures for the three compounds.
   3. Ethanol is added to each of the three vials. With which of the three compounds is ethanol most likely to react to produce an ester?
   4. Draw the Lewis structure and name the ester that would be produced in the reaction described in part (c).



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**Questions l through 4 refer to the following elements:**

1. K
2. Mn
3. Cr
4. Zn
5. Ag
6. Which element reacts exothermically with cold water to form basic solutions?
7. Which element exhibits the greatest number of different oxidation states?
8. Which element has the lowest electronegativity?
9. Which element has no unpaired electrons in its ground state?

**Questions 5 through 8** refer to the following change in entropy.

* 1. Entropy change will be positive.
  2. Entropy change will be zero.
  3. Entropy change will be negative.
  4. Entropy change can be either positive or negative.
  5. Entropy change cannot be determined from the information given.

1. F2 (g) 🡪 2F (g)
2. H2 (g) at 5.0 atm 🡪 H2 (g) at 1.0 atm
3. 2H2 (g) + O2(g) 🡪 2H2O(g)
4. PCl5 (g) ↔ PCl3 (g) + Cl2 (g)
5. Which of the following substances would be the least soluble in water?
   1. Zn(NO3)2
   2. Na2[Zn(OH)4]
   3. ZnCl2 x H2O
   4. Zn(OH)2
   5. ZnCl2
6. When a solid melts, which of the following is true?