

**AP Chemistry Final Exam
Version Q
Fall 2006**

50 Multiple Choice questions, 60 minutes

NO CALCULATORS MAY BE USED. You will have a periodic table.

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

Guessing: One-fourth of the number of questions you answer incorrectly will be subtracted from the number of questions you answer correctly.

You may write on this exam; however, you will only be given credit for answers recorded on the Scantron sheet.

NAME:

PERIOD: 1 2 3 4

December 12-14, 2006

Directions: Each set of lettered choices below refers to the numbered statements immediately following it. Select the option that best fits each statement. A choice may be used once, more than once, or not at all in each set.

Questions 1-3

- A. Chlorine
- B. Helium
- C. Mercury
- D. Phosphorus

1. Solid at room temperature
2. Has a common oxidation state of +7
3. Colorless

Questions 4-6

- A. Has covalent bond(s)
- B. Has ionic bond(s)
- C. Has unpaired electrons
- D. Has a positive electron affinity

4. CH₄
5. NaH
6. Cr

Directions: Choose the best option for each question or statement.

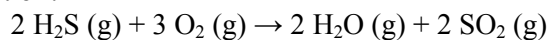
7. A 5 L scuba tank sits in the sun, warming to 50 °C with a pressure of 20 atm. What will be the pressure when the temperature drops to 10 °C when the tank is under water?

- A. $20 \times \frac{50}{10}$ B. $20 \times \frac{10}{50}$ C. $5 \times 20 \times \frac{283}{323}$ D. $\frac{20}{5} \times \frac{283}{323}$ E. $20 \times \frac{283}{323}$

8. How many oxygen atoms are present in one formula unit of cupric sulfate pentahydrate?

- A. 20
- B. 13
- C. 9
- D. 5
- E. 4

9. How many liters of oxygen measured at STP will be needed to completely react with 1 mole of H₂S (g) in the following already balanced reaction?



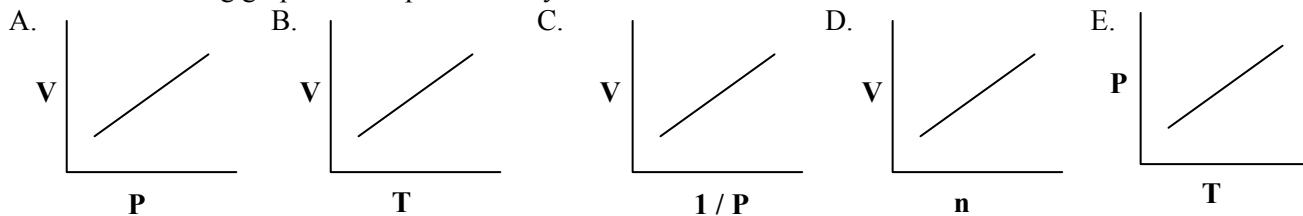
- A. 44.8 L
- B. 33.6 L
- C. 22.4 L
- D. 11.2 L
- E. 1.50 L

10. Which of the following is associated with an emission line in the Balmer series?

- A. Far-infrared
- B. Infrared
- C. Ultraviolet
- D. Visible
- E. X-ray

11. Which series of elements represents increasing electronegativity?
- As, P, N
 - Cl, S, P
 - F, B, Li
 - O, S, Se
 - O, F, Ne
12. Which of the following is a nonpolar molecule?
- H₂S
 - NH₃
 - SF₄
 - SO₂
 - SO₃
13. What is the approximate molecular geometry of the central carbon in a molecule of propene?
- Bent
 - Linear
 - Tetrahedral
 - Trigonal pyramidal
 - Trigonal planar
14. The functional group in the molecule "CH₃CHO" represents a/an:
- Alcohol
 - Aldehyde
 - Carboxylic acid
 - Ether
 - Ketone
15. How many milliliters of a 10-M solution of sulfuric acid should be added to distilled water to prepare a 1 L of a 1-M solution?
- 0.1
 - 1
 - 10
 - 100
 - 1000
16. How many hydrogen atoms are in 0.5 moles of hydrogen gas at STP?
- 0.5039
 - 1.0079
 - 3.011×10^{23}
 - 6.022×10^{23}
 - 1.204×10^{24}
17. The name for V₂O₅ is:
- Divanadium pentoxide
 - Vanadium oxide
 - Vanadium (II) oxide (V)
 - Vanadium (II) pentoxide
 - Vanadium (V) oxide
18. What are the products when a solution of lead (II) nitrate is mixed with a solution of potassium chloride?
- PbCl₂ (s) and KNO₃ (aq)
 - PbCl₂ (aq) and KNO₃ (aq)
 - PbCl₂ (s) and KNO₃ (s)
 - PbCl₂ (aq) and KNO₃ (s)
 - PbK (s) and NO₃Cl (s)

19. Which of the following graphs best represents Boyle's law?



20. The empirical formula for a compound is CH_2O . If the molar mass is approximately 90 g/mol, what is the molecular formula of the compound?

- A. CH_2O
- B. $\text{C}_2\text{H}_4\text{O}_2$
- C. $\text{C}_3\text{H}_6\text{O}_3$
- D. $\text{C}_4\text{H}_8\text{O}_4$
- E. $\text{C}_6\text{H}_{12}\text{O}_6$

21. Which arrangement of elements demonstrates the trend of increasing atomic radius?

- A. B, N, F
- B. I, Br, Cl
- C. Ge, P, O
- D. S, Al, Na
- E. H, He, Li

22. Which of the following atoms or ions are paramagnetic?

- I. Ar
- II. P
- III. Zn^{2+}

- A. I only
- B. II only
- C. III only
- D. I and II
- E. I and III

23. A sample of barium chloride dihydrate is heated. Which error would cause the experimental number of moles of water determined to be higher than the actual amount of moles of water?

- A. All of the water is not driven (by heating) from the hydrate.
- B. An inert, anhydrous impurity was in the hydrated sample.
- C. Some of the hydrate is lost due to splattering out of the crucible.
- D. The hydrated sample is not heated to a constant mass.
- E. The flame color is yellow-orange.

24. The following compounds are correctly matched to the statement at right EXCEPT:

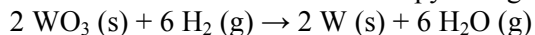
<u>Compound</u>	<u>Statement</u>
A. $\text{Ba}(\text{C}_2\text{H}_3\text{O}_2)_2$	flame test is green
B. $\text{Cu}(\text{NO}_3)_2$	solution is blue
C. $\text{Na}_2\text{Cr}_2\text{O}_7$	solution is orange
D. KCl	solution is lilac
E. LiBr	flame test is red

25. Which of the following will result in the production of H_2 (g)?
- I. Magnesium is added to a hydrochloric acid.
 - II. Silver nitrate is added to sodium hydroxide.
 - III. Sodium is added to water.
- A. I only
 - B. II only
 - C. III only
 - D. I and II only
 - E. I and III only
26. A student performs an experiment that involves burning a metal to form its oxide, and records the following data:
- | | |
|--|---------|
| Mass of weighing paper only | 1.120 g |
| Mass of weighing paper and metal | 1.170 g |
| Mass of weighing paper and metal oxide | 1.20 g |

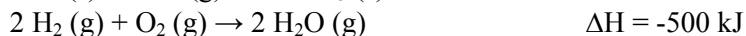
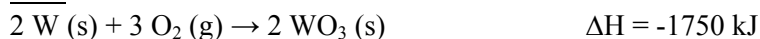
How many significant figures should be used to report the mass ratio of oxygen to metal in the final product?

- A. 1
 - B. 2
 - C. 3
 - D. 4
 - E. 5
27. Addition of which of the following solutions will allow you to differentiate between solutions of AgNO_3 and Ag_2SO_4 ?
- A. KCl
 - B. NH_4NO_3
 - C. Na_2CO_3
 - D. $\text{Ba}(\text{NO}_3)_2$
 - E. $\text{Zn}(\text{C}_2\text{H}_3\text{O}_2)_2$
28. What is the concentration of sodium ion when 500 mL of 0.5 M NaNO_3 is mixed with 1000 mL of 0.25 M Na_2CrO_4 solution?
- A. 0.25 M
 - B. 0.5 M
 - C. 0.75 M
 - D. 1 M
 - E. 1.25 M

29. Use the data below to determine the enthalpy change of the following already balanced reaction:



Data:



- A. -3250 kJ
 - B. -2250 kJ
 - C. -1000 kJ
 - D. 250 kJ
 - E. 2250 kJ
30. Which gas deviates the most from the behavior of an ideal gas at STP?
- A. Ar
 - B. CO
 - C. I_2
 - D. O_2
 - E. CH_4

31. At STP, equimolar amounts of N_2 , CO_2 , and O_2 occupy a balloon that slowly deflates. Which of the following lists these gases in order of decreasing rate of effusion?
- N_2 , CO_2 , O_2
 - N_2 , O_2 , CO_2
 - O_2 , CO_2 , N_2
 - CO_2 , N_2 , O_2
 - CO_2 , O_2 , N_2
32. Which of the following is/are physical process(es) for separating a mixture?
- Chromatography
 - Distillation
 - Precipitation
- I only
 - II only
 - III only
 - I and II only
 - I and III only
33. J.J. Thomson discovered the _____ using a _____ apparatus.
- Charge of the electron, "oil drop"
 - Electron, cathode ray tube
 - Neutron, radioisotope
 - Nucleus, "gold foil"
 - Quark, linear accelerator
34. The atom or ion that has the greatest number of unpaired electrons in the ground state is:
- Co^{2+}
 - Cr^{3+}
 - Fe^{3+}
 - Ni^{2+}
 - Ti^{2+}
35. Which set of quantum numbers is not possible?
- 1, 0, 0, $\frac{1}{2}$
 - 2, 1, 1, $-\frac{1}{2}$
 - 3, 2, -1, $-\frac{1}{2}$
 - 3, 0, -1, $\frac{1}{2}$
 - 4, 2, 1, $\frac{1}{2}$
36. How many moles of H_2O are produced in the combustion of 1 mole of butyne?
- 3
 - 4
 - 5
 - 6
 - $11/2$
37. What do O_3 , Cl_2O , and NO_2^- have in common?
- Bent shape
 - Resonance
 - Double bond
- I only
 - III only
 - I and II only
 - I and III only
 - I, II and III

38. Phosphorus can form PH_3 and PH_5 , whereas nitrogen forms NH_3 but not NH_5 . What is the primary reason for this?
- Nitrogen can only form nonpolar covalent bonds.
 - Nitrogen does not use the 3d sublevel to hybridize.
 - Nitrogen has only 3 electrons in the valence shell.
 - Nitrogen has a higher electronegativity than phosphorus.
 - Nitrogen has 5 unpaired electrons.
39. Which of the following does not have lone electron pairs on the central atom?
- SF_4
 - H_2O
 - NCl_3
 - XeF_2
 - CH_2Br_2
40. What is the total number of isomers for C_4H_8 ?
- 2
 - 3
 - 4
 - 5
 - 6
41. Which series is ranked in order from smallest to largest (becoming more negative) electron affinity?
- B, C, N
 - B, N, C
 - C, B, N
 - N, C, B
 - N, B, C
42. What is the formal charge of nitrogen in nitrite?
- 2
 - 1
 - 0
 - +1
 - +5
43. As the wavelength of electromagnetic radiation decreases, the energy
- Becomes undefined
 - Decreases
 - Increases
 - Remains constant
 - Varies exponentially
44. A central atom that has a trigonal bipyramidal electronic geometry is most likely to feature _____ hybrid orbitals.
- sp
 - sp^2
 - sp^3
 - sp^3d
 - sp^3d^2
45. Which of the following atoms or ions is smallest in size?
- F^{1-}
 - K^{1+}
 - Mg^{2+}
 - O^{2-}
 - Ar

46. The product of the reaction between a nonmetal oxide and water is:
- A. An acid
 - B. A base
 - C. A salt
 - D. Hydrogen gas
 - E. Oxygen gas
47. Meta-dichlorobenzene can also be named:
- A. 1,2-dichlorobenzene
 - B. 1,3-dichlorobenzene
 - C. 1,4-dichlorobenzene
 - D. 2,3-dichlorobenzene
 - E. 2,4-dichlorobenzene
48. The change of internal energy in a certain exothermic reaction is -250 kJ/mol . If the magnitude of work done to the system is 150 kJ , what is the heat of the reaction?
- A. -400 kJ
 - B. -250 kJ
 - C. -100 kJ
 - D. 100 kJ
 - E. 400 kJ
49. Which atom or ion does the following electronic configuration most likely represent? $1s^2 2s^2 2p^6 3s^2 3p^6 3d^2$
- A. Ca
 - B. Ca^{2+}
 - C. S^{2-}
 - D. Ti
 - E. Ti^{2+}
50. The standard enthalpy of formation for CH_3NH_2 is:
- A. $2 \text{ C (s)} + 5 \text{ H}_2 \text{ (g)} + \text{ N}_2 \text{ (g)} \rightarrow 2 \text{ CH}_3\text{NH}_2$
 - B. $\text{C (s)} + 5 \text{ H}^* \text{ (g)} + \text{ N}^* \text{ (g)} \rightarrow \text{CH}_3\text{NH}_2$
 - C. $\text{C (s)} + 5/2 \text{ H}_2 \text{ (g)} + 1/2 \text{ N}_2 \text{ (g)} \rightarrow \text{CH}_3\text{NH}_2$
 - D. $\text{CH}_4 \text{ (g)} + \text{NH}_3 \text{ (g)} \rightarrow \text{CH}_3\text{NH}_2 + \text{H}_2$
 - E. $\text{CH}_3\text{NH}_2 \text{ (g)} + 3/2 \text{ O}_2 \text{ (g)} \rightarrow \text{CO}_2 \text{ (g)} + 5/2 \text{ H}_2\text{O (g)}$

AP Chemistry Final Exam
Version Q
Fall 2006

3 Free Response questions, 45 minutes

CALCULATORS MAY BE USED. You will also have a periodic table, equation sheets, and the standard reduction potential table.

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. Attention should be paid to significant figures.

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

Record all your work on this exam; you will only be given credit for answers showing work.

NAME:

PERIOD: 1 2 3 4

December 12-14, 2006

SCORE: $\frac{\text{_____}}{\text{Correct}}$ - $\frac{\text{_____}}{\text{Incorrect}}/4$ = $\frac{\text{_____}}{\text{M.C. Total}}$

Blank

F.R. Total

Raw Score

+
Curve

Overall

Version Q**Fall 06-07**

1. (17 pts) A sample of NH_3 at STP in a rigid (inflexible) container has a volume of 3.00 L.
- (3 pts) What specific conditions does “STP” describe?

- (3 pts) If the temperature changes to 300.0 K, what is the new pressure of NH_3 ?

Ans =

- (3 pts) How many moles of NH_3 are there in the container?

Ans =

- (4 pts) At STP, a sample of Gas X is added to the container of NH_3 described above until the mole fraction of Gas X is 0.400. How many molecules of Gas X have been added?

Ans =

- (4 pts) If the ratio of effusion rates of NH_3 to Gas X is 3.2, what is the molar mass of Gas X?

Ans =

2. (15 pts) When 8.00 g of a gaseous chlorine-containing hydrocarbon is combusted, 11.10 g of carbon dioxide and 4.54 g of water are formed, along with an unknown amount of chlorine gas.
- (4 pts) What is the empirical formula of the unknown compound?

Ans =

- (4 pts) Assuming that there are 4 carbons in the molecular formula, draw one appropriate Lewis structure of this compound, and name it.

Name =

- (2 pts) There are _____ sigma bonds and _____ pi bonds of the molecule you have drawn in part b.
- (2 pts) Unbranched hydrocarbons are often called straight-chain hydrocarbons. How is this term misleading?
- (3 pts) Another hydrocarbon, C_3H_6 , reacts with I_2 . Draw one of the likely products of this reaction.

3. (18 pts) For each of the following three reactions, in part (i) write a BALANCED equation and in part (ii) answer the question about the reaction. In part (ii), 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.

a. Sulfur trioxide gas is bubbled through a solution of sodium oxide.

i.

ii. What is the oxidation state of sulfur in sulfur trioxide?

Ans =

b. A sample of solid cesium iodide is added to a solution of silver oxalate.

i.

ii. How many unpaired electrons are there in the silver ion?

Ans =

c. The electron affinity of carbon is measured.

i.

ii. What is the standard elemental form of carbon?

Ans =

**AP Chemistry Final Exam
Version R
Fall 2006**

50 Multiple Choice questions, 60 minutes

NO CALCULATORS MAY BE USED. You will have a periodic table.

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

Guessing: One-fourth of the number of questions you answer incorrectly will be subtracted from the number of questions you answer correctly.

You may write on this exam; however, you will only be given credit for answers recorded on the Scantron sheet.

NAME:

PERIOD: 1 2 3 4

December 12-14, 2006

Directions: Each set of lettered choices below refers to the numbered statements immediately following it. Select the option that best fits each statement. A choice may be used once, more than once, or not at all in each set.

Questions 1-3

- A. Bromine
- B. Cadmium
- C. Hydrogen
- D. Sulfur

1. Liquid at room temperature
2. Has a common oxidation state of +6
3. Colorless

Questions 4-6

- A. Contains the most electronegative element
- B. Has ionic bond(s)
- C. Is lustrous
- D. Is paramagnetic

4. SF₄
5. O₂
6. Mg

Directions: Choose the best option for each question or statement.

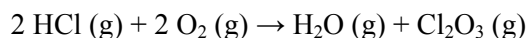
7. A 5 L birthday balloon sits in the sun, warming to 40 °C with a pressure of 2 atm. What will be the volume when the temperature drops to 20 °C and the pressure to 1 atm?

A. $5 \times \frac{20}{40} \times \frac{2}{1}$ B. $5 \times \frac{40}{20} \times \frac{1}{2}$ C. $5 \times \frac{293}{313}$ D. $5 \times \frac{2}{1} \times \frac{293}{313}$ E. $\sqrt{5 \times \frac{20}{40} \times \frac{293}{313}}$

8. How many oxygen atoms are present in one formula unit of ferric chlorate hexahydrate?

- A. 18
- B. 15
- C. 12
- D. 9
- E. 6

9. How many liters of water measured at STP will form when 1 mole of HCl (g) completely reacts in the following already balanced reaction?



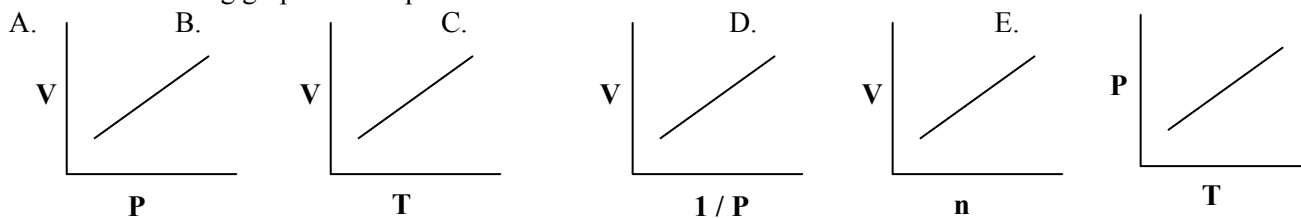
- A. 44.8 l
- B. 33.6 L
- C. 22.4 L
- D. 11.2 L
- E. 1.50 L

10. Which of the following is associated with an electron transition from $n = 4$ to $n = 1$?

- A. Far-infrared
- B. Infrared
- C. Ultraviolet
- D. Visible
- E. X-ray

11. Which series of elements represents decreasing first ionization energy?
- As, P, N
 - P, S, Cl
 - Li, B, F
 - O, S, Se
 - Se, Cl, Ne
12. Which of the following has resonance structures?
- H₂S
 - NH₄⁺
 - SF₄
 - SO₂
 - CO
13. What is the approximate molecular geometry of the central carbon in a molecule of propane?
- Bent
 - Linear
 - Tetrahedral
 - Trigonal pyramidal
 - Trigonal planar
14. The functional group in the molecule "CH₃OCH₃" represents a/an:
- Alcohol
 - Aldehyde
 - Carboxylic acid
 - Ether
 - Ketone
15. How many milliliters of a 1-M solution of sulfuric acid should be added to distilled water to prepare a 1 L of a 0.01-M solution?
- 0.1
 - 1
 - 10
 - 100
 - 1000
16. How many oxygen atoms are in 1 mole of ozone gas at STP?
- 16.00
 - 32.00
 - 6.022×10^{23}
 - 1.204×10^{24}
 - 1.806×10^{24}
17. The name for I₂Cl₃ is:
- Diiodine trichloride
 - Iodine chloride
 - Iodine (III) chloride (II)
 - Iodine (II) trichloride
 - Iodine (III) trichloride
18. What are the products when a solution of lead (IV) acetate is mixed with a solution of sodium iodide?
- PbI₄ (s) and NaC₂H₃O₂ (aq)
 - PbI₄ (aq) and NaC₂H₃O₂ (aq)
 - PbI₄ (aq) and NaC₂H₃O₂ (s)
 - PbI₄ (s) and NaC₂H₃O₂ (s)
 - PbNa(s) and C₂H₃BrO₂ (s)

19. Which of the following graphs best represents Charles' law?



20. The empirical formula for a compound is CH_3O . If the molar mass is approximately 120 g/mol, what is the molecular formula of the compound?

- A. CH_3O
- B. $\text{C}_2\text{H}_6\text{O}_2$
- C. $\text{C}_3\text{H}_9\text{O}_3$
- D. $\text{C}_4\text{H}_{12}\text{O}_4$
- E. $\text{C}_6\text{H}_{18}\text{O}_6$

21. Which arrangement of elements demonstrates the trend of decreasing atomic radius?

- A. F, N, B
- B. I, Br, Cl
- C. O, P, Ge
- D. S, Al, Na
- E. Li, He, H

22. Which of the following atoms or ions has no unpaired electrons?

- I. Ar
- II. P
- III. Zn^{2+}

- A. I only
- B. II only
- C. III only
- D. I and II
- E. I and III

23. A sample of barium chloride dihydrate is heated. Which error would cause the experimental number of moles of water determined to be lower than the actual amount of moles of water?

- A. The crucible and lid are not initially heated to constant mass.
- B. All of the water is not driven (by heating) from the hydrate.
- C. A volatile impurity was in the hydrated sample.
- D. Some of the hydrate is lost due to splattering out of the crucible.
- E. After heating, the sample is stored in a desiccator overnight.

24. The following compounds are correctly matched to the statement at right EXCEPT:

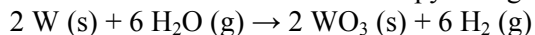
<u>Compound</u>	<u>Statement</u>
A. $\text{K}(\text{C}_2\text{H}_3\text{O}_2)_2$	flame test is lilac
B. $\text{Ni}(\text{NO}_3)_2$	solution is green
C. K_2CrO_4	solution is yellow
D. KCl	solution is colorless
E. LiBr	flame test is yellow

25. Which of the following will result in the production of H_2 (g)?
- I. A solution of carbonic acid is warmed.
 - II. Potassium is added to water.
 - III. Hydrochloric acid is added to sodium hydroxide.
- A. I only
 - B. II only
 - C. III only
 - D. I and II only
 - E. I and III only
26. A student performs an experiment that involves burning a metal to form its oxide, and records the following data:
- | | |
|--|---------|
| Mass of weighing paper only | 1.120 g |
| Mass of weighing paper and metal | 1.170 g |
| Mass of weighing paper and metal oxide | 1.200 g |

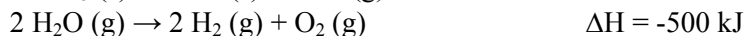
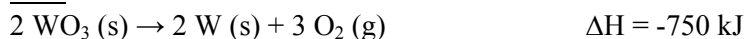
How many significant figures should be used to report the mass ratio of oxygen to metal in the final product?

- A. 1
 - B. 2
 - C. 3
 - D. 4
 - E. 5
27. Addition of which of the following solutions will allow you to differentiate between solutions of Na_2CO_3 and Na_2SO_4 ?
- A. KCl
 - B. NH_4NO_3
 - C. AgNO_3
 - D. Li_3PO_4
 - E. $\text{Zn}(\text{C}_2\text{H}_3\text{O}_2)_2$
28. What is the concentration of sodium ion when 200 mL of 4-M NaNO_3 is mixed with 200 mL of 1-M Na_2CrO_4 solution?
- A. 0.8 M
 - B. 1 M
 - C. 1.2 M
 - D. 2.5 M
 - E. 3 M

29. Use the data below to determine the enthalpy change of the following already balanced reaction:



Data:



- A. -2250 kJ
 - B. -1250 kJ
 - C. 0 kJ
 - D. 250 kJ
 - E. 750 kJ
30. Which gas would exhibit the most ideal behavior at STP?
- A. Ar
 - B. CO
 - C. C_2H_6
 - D. CH_4
 - E. Kr

31. At STP, equimolar amounts of N_2O , CO , and Cl_2 occupy a balloon that slowly deflates. Which of the following lists these gases in order of increasing rate of effusion?
- N_2O , CO , Cl_2
 - N_2O , Cl_2 , CO
 - Cl_2 , N_2O , CO
 - Cl_2 , CO , N_2O
 - CO , N_2O , Cl_2
32. Which of the following is/are chemical process(es) for separating a mixture?
- Chromatography
 - Magnetism
 - Precipitation
- I only
 - II only
 - III only
 - I and II only
 - I and III only
33. Ernest Rutherford discovered the _____ using a _____ apparatus.
- Charge of the electron, "oil drop"
 - Electron, cathode ray tube
 - Neutron, radioisotope
 - Nucleus, "gold foil"
 - Quark, linear accelerator
34. The ion that is likely to form the salt with the highest lattice energy is:
- Br^{1-}
 - Ca^{2+}
 - Cl^{1-}
 - K^{1+}
 - S^{2-}
35. Which set of quantum numbers is not permissible?
- 1, 0, 0, $\frac{1}{2}$
 - 2, 1, 1, $-\frac{1}{2}$
 - 3, 2, -1, $-\frac{1}{2}$
 - 3, 0, 0, $\frac{1}{2}$
 - 4, 2, -3, $\frac{1}{2}$
36. How many moles of H_2O are produced in the combustion of 1 mole of cis-2-butene?
- 3
 - 4
 - 5
 - $\frac{11}{2}$
 - $\frac{13}{2}$
37. What do HCN , C_2H_2 , and N_2 have in common?
- Linear shape
 - Polar molecule
 - Triple bond
- I only
 - III only
 - I and II only
 - I and III only
 - I, II and III

38. Nickel can form NiCl_3 and NiCl_2 , whereas calcium forms CaCl_2 but not CaCl_3 . What is the primary reason for this?
- Calcium only forms ionic bonds.
 - Calcium does not use the 3d sublevel to hybridize.
 - Calcium has only 2 electrons in the valence shell.
 - Calcium has a lower electronegativity than nickel.
 - Calcium has delocalized electrons.
39. Which of the following has an electron geometry that matches the molecular geometry?
- SF_4
 - H_2O
 - NCl_3
 - XeF_2
 - CCl_4
40. What is the total number of isomers for C_5H_{12} ?
- 2
 - 3
 - 4
 - 5
 - 6
41. Which series is ranked in order from largest to smallest (becoming less negative) electron affinity?
- Si, P, S
 - Si, S, P
 - P, Si, S
 - S, P, Si
 - S, Si, P
42. What is the oxidation state of phosphorus in phosphite?
- 1
 - 0
 - 1
 - 3
 - 5
43. As the frequency of electromagnetic radiation decreases, the energy
- Becomes undefined
 - Decreases
 - Increases
 - Remains constant
 - Varies exponentially
44. A central atom that has a square planar molecular geometry is most likely to feature _____ hybrid orbitals.
- sp
 - sp^2
 - sp^3
 - sp^3d
 - sp^3d^2
45. Which of the following atoms or ions is largest in size?
- F^{1-}
 - K^{1+}
 - Mg^{2+}
 - O^{2-}
 - Ar

46. The product(s) of the reaction between a metal oxide and acid is:
- F. An acid
 - G. A base
 - H. A salt
 - I. Both a salt and water
 - J. Both a base and a salt
47. 1,2-dimethylbenzene is also named:
- A. meta-dimethylbenzene
 - B. naphthalene
 - C. ortho-dimethylbenzene
 - D. para-dimethylbenzene
 - E. 5,6-dimethylbenzene
48. The change of internal energy in a certain endothermic reaction is 150 kJ/mol. If the magnitude of work done by the system is 50 kJ, what is the heat of the reaction?
- A. -200 kJ
 - B. -100 kJ
 - C. 50 kJ
 - D. 100 kJ
 - E. 200 kJ
49. Which atom or ion does the following electronic configuration most likely represent? $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$
- A. Cr^{1+}
 - B. Cr^{2+}
 - C. Mn
 - D. Mn^{1+}
 - E. Fe^{1+}
50. The standard enthalpy of formation for NaBr is:
- A. $2 \text{Na (s)} + \text{Br}_2 \text{(s)} \rightarrow 2 \text{NaBr (s)}$
 - B. $\text{Na (s)} + \frac{1}{2} \text{Br}_2 \text{(s)} \rightarrow \text{NaBr (s)}$
 - C. $2 \text{Na (s)} + \text{Br}_2 \text{(l)} \rightarrow 2 \text{NaBr (s)}$
 - D. $\text{Na (s)} + \frac{1}{2} \text{Br}_2 \text{(l)} \rightarrow 2 \text{NaBr (s)}$
 - E. $\text{Na (s)} + \text{Br (s)} \rightarrow \text{NaBr (s)}$

AP Chemistry Final Exam
Version R
Fall 2006

3 Free Response questions, 45 minutes

CALCULATORS MAY BE USED. You will also have a periodic table, equation sheets, and the standard reduction potential table.

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. Attention should be paid to significant figures.

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

Record all your work on this exam; you will only be given credit for answers showing work.

NAME:

PERIOD: 1 2 3 4

December 12-14, 2006

SCORE: $\frac{\text{Correct}}{\text{Blank}} - \frac{\text{Incorrect}}{4} = \frac{\text{M.C. Total}}{\text{M.C. Total}}$

Blank

F.R. Total

Raw Score

+ Curve

Overall

4. (17 pts) A sample of CCl_4 at a pressure of 600.0 mm Hg and 25.0 °C in a flexible container has a volume of 3.00 L.

a. (3 pts) How many atmospheres does this pressure represent?

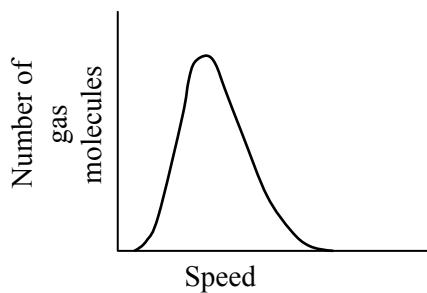
b. (3 pts) If the temperature changes to 50.0 °C and the pressure to 750.0 mm Hg, what is the new volume?

Ans =

c. (3 pts) How many moles of CCl_4 are there in the container?

Ans =

d. (4 pts) The distribution of molecular speeds of the sample of CCl_4 is shown below. The CCl_4 is removed from the container, and a sample of Gas Z is added to the container under the conditions described in part a above. If Gas Z has a lower molar mass than CCl_4 , sketch the shape of the distribution of molecular speeds of Gas Z ON the axes below.



Explain your reasoning:

e. (4 pts) If Gas Z is more ideal than CCl_4 , how will the measured pressure of Gas Z be different from that of CCl_4 under the conditions in part a? Why?

5. (15 pts) When 15.00 g of a gaseous nitrogen-containing hydrocarbon is combusted, 36.16 g of carbon dioxide and 20.34 g of water are formed, along with an unknown amount of N_2O .
- a. (4 pts) What is the empirical formula of the unknown compound?

Ans =

- b. (4 pts) Assuming that there are 4 carbons in the molecular formula, draw one appropriate Lewis structure of this compound, and name it.

Name =

- c. (2 pts) The molecular geometry of N in this molecule is _____.

The type of hybridization employed by N in this molecule is _____.

- d. (2 pts) Describe the functional group or structure in alkenes and cycloalkanes that makes each class of hydrocarbons distinct. Explain briefly, in 1-2 sentences or with drawings, why they both have the same general formula, C_nH_{2n} , compared to that of alkanes, C_nH_{2n+2} .
- e. (3 pts) When will an alkene or cycloalkane exhibit delocalization of electrons? Explain briefly, in 1-2 sentences or with drawings.

6. (18 pts) For each of the following three reactions, in part (i) write a BALANCED equation and in part (ii) answer the question about the reaction. In part (ii), 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.

a. A sample of solid potassium chromate is added to a solution of mercurous acetate.
i.

ii. How many unpaired electrons are there in the mercuric ion? Ans =

b. A piece of lead metal is added to a concentrated solution of hydrochloric acid.
i.

ii. What is the standard elemental form of chlorine? Ans =

c. Ethene reacts with hydrogen gas.
i.

ii. What are the two most common oxidation states of the element hydrogen? Ans =