Exam: Ch 1 – 5 & Reaction Products: Precipitation **Name:**
I have neither given nor received aid on this exam.
AP Chem (75 pts) **Period: 5 6 7** **September 24, 2004**
Version I

MC Score: ____(correct)/15 - ____(incorrect)/4 = ____	**FR Score: ____**	**Overall: ____**

Erase mistakes completely. For problems involving calculations, no credit will be given if work is not shown.

SECTION I: Multiple Choice (3 pts each): Choose the option that is the best answer or completes each question or statement. Write your answers in the blanks provided. In this section, as a correction for haphazard guessing, one-fourth of the number of questions you answer incorrectly will be subtracted from the number of questions you answer correctly.

1. If matter is uniform throughout, cannot be separated into other substances by physical processes, but can be decomposed into other substances by chemical processes, it is a/an:
   A. Compound
   B. Element
   C. Homogeneous mixture
   D. Either A or B
   E. None of the above or not enough information is provided. Ans: ____

2. The correct result of the following addition is: 12 + 1.2 + 0.12 + 0.012
   A. 13
   B. 13.3
   C. 13.33
   D. 13.332
   E. None of the above or not enough information is provided. Ans: ____

3. Which of the following statements is false concerning Rutherford's conclusions about the structure of the atom?
   A. Some alpha particles were deflected slightly, so the nucleus must have a positive charge.
   B. A few alpha particles bounced back because they interacted wit a small center of the atom
   C. Most of the alpha particles passed through the foil, so most of the atom must be empty space.
   D. Because the particles that bounced back moved at approximately their original speed, the nucleus of the atom must be very dense.
   E. None of the above are false or not enough information is provided. Ans: ____

4. Cathode rays are deflected away from a negatively-charged plate because:
   A. They are not affected by gravity.
   B. They are positively-charged particles.
   C. They are negatively-charged particles.
   D. They are made of alpha particles.
   E. None of the above or not enough information is provided. Ans: ____

5. Which of the following does not occur as diatomic molecules in elemental form?
   A. Oxygen
   B. Nitrogen
   C. Sulfur
   D. Bromine
   E. None of the above or not enough information is provided. Ans: ____

6. A 10.31 g sample of a compound contains 6.180g carbon, 1.386 g hydrogen, and 2.744 g oxygen. What is the empirical formula of the compound?
   A. C_3H_8O
   B. C_3H_5O
   C. $C_6H_{16}O_2$
   D. $C_3H_9O_3$
   E. None of the above or not enough information is provided. Ans: ____

7. A compound has a molar mass of 174 g/mol and an empirical formula of CHO. What is the molecular formula of the compound?
   A. CHO
   B. $C_2H_2O_2$
   C. $C_4H_4O_4$
   D. $C_6H_6O_6$
   E. None of the above or not enough information is provided. Ans: ____

8. The net ionic equation for the reaction between aqueous solutions of HBr and KOH is:
   A. $HBr\ (aq) + KOH\ (aq) \rightarrow H_2O\ (l) + K^+\ (aq) + Br^-\ (aq)$
   B. $HBr\ (aq) + OH^-\ (aq) \rightarrow H_2O\ (l) + Br^-\ (aq)$
   C. $H^+\ (aq) + OH^-\ (aq) \rightarrow H_2O\ (l)$
   D. $H^+\ (aq) + Br^-\ (aq) + K^+\ (aq) + OH^-\ (aq) \rightarrow H_2O\ (l) + K^+\ (aq) + Br^-\ (aq)$
   E. None of the above or not enough information is provided. Ans: ____

9. Which of the following compounds are weak electrolytes?
   I. HCl
   II. $HC_2H_3O_2$
   III. NH_3
   IV. KCl

   A. Options I and IV
   B. I, II, III, and IV
   C. II and IV
   D. II and III
   E. None of the above or not enough information is provided. Ans: ____

10. Which of the following is false concerning 2.00 L of a 0.100 M solution of $Ca_3(PO_4)_2$?
   A. This solution contains 0.200 mol of $Ca_3(PO_4)_2$.
   B. This solution contains 0.800 mol of oxygen atoms.
   C. 1.00 L of this solution is required to furnish 0.300 mol of Ca^{2+} ions.
   D. There are 6.022×10^{22} phosphorus atoms in 500.0 mL of this solution
   E. None of the above are false or not enough information is provided. Ans: ____

11. You are given two clear, colorless solutions of the same unknown monoprotic acid, but with different concentrations. Which statement is true?
   A. There is no chemical method available to distinguish them.
   B. It would take more base solution (per milliliter of unknown solution) to neutralize the more concentrated solution.
   C. If the same volume of each sample were taken, then more base solution would be required to neutralize the one with lower concentration.
   D. The product of the concentration and volume of the less concentrated solution equals the product of concentration and volume of the more concentrated solution.
   E. None of the above or not enough information is provided. Ans: ____

12. What mass of insoluble product is formed when 47.8 mL of 0.334 M sodium fluoride is treated with an excess of calcium nitrate?
    A. 1.25
    B. 0.472
    C. 0.943
    D. 0.623
    E. None of the above or not enough information is provided. Ans: ____

13. Of the following, $\Delta H°_f$ is <u>not</u> zero for:
    A. O_2 (g)
    B. C (s)
    C. F_2 (g)
    D. Cl_2 (g)
    E. None of the above or not enough information is provided. Ans: ____

14. Given the data at the right, $\Delta H°_{rxn}$ for the following reaction is:
    IF_7 (g) + I_2 (g) → IF_5 (g) + 2 IF (g)

    A. 69
    B. 311
    C. -1991
    D. -69
    E. None of the above or not enough information is provided. Ans: ____

Substance	$\Delta H°_f$ (kJ/mol)
HF (g)	-269
IF (g)	-95
IF_5 (g)	-840
IF_7 (g)	-941
HI (g)	26

15. ΔE is positive when:
    A. When a system absorbs heat and does work.
    B. When a system gives off heat and does work.
    C. When a system absorbs heat and has work done on it.
    D. When a system gives off heat and has work done on it.
    E. None of the above or not enough information is provided. Ans: ____

SECTION II: Free Response

16. (18 pts) Natural rubidium is composed of two isotopes: ^{85}Rb (mass = 84.9117 amu) and ^{87}Rb. The ratio of atoms of $^{85}Rb/^{87}Rb$ in natural rubidium is 2.591.
    a. (4 pts) How are the two isotopes of Rb quantitatively similar?

    b. (4 pts) How are the two isotopes of Rb quantitatively different?

    c. (10 pts) Calculate the mass of ^{87}Rb.

Ans = ____

17. (12 pts) The combustion of titanium produces titanium (III) oxide (note: not balanced):
    $Ti\ (s) + O_2\ (g) \rightarrow Ti_2O_3\ (s)$

    When 0.721 g of Ti are combusted in a calorimeter, the temperature of the calorimeter increases from 25.00°C to 53.80°C. In a separate experiment, the heat capacity of the calorimeter is measured to be 9.84 kJ / K.
    a. (6 pts) What is the heat produced in this experiment of the combustion of Ti in a calorimeter?

Ans = ____

    b. (6 pts) What is the heat of reaction for the combustion of a mole of Ti in this calorimeter?

Ans = ____

Exam: Ch 1 – 5 & Reaction Products: Precipitation **Name:**
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AP Chem (75 pts) **Period: 5 6 7** **September 24, 2004**
Version J

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Erase mistakes completely. For problems involving calculations, no credit will be given if work is not shown.

SECTION I: Multiple Choice (3 pts each): Choose the option that is the best answer or completes each question or statement. Write your answers in the blanks provided. In this section, as a correction for haphazard guessing, one-fourth of the number of questions you answer incorrectly will be subtracted from the number of questions you answer correctly.

1. If matter is uniform throughout and cannot be separated into other substances by physical processes, it is a/an:
   A. Compound
   B. Element
   C. Heterogeneous mixture
   D. Either A or B
   E. None of the above or not enough information is provided. Ans: ____

2. The correct result of the following addition is: 120 + 12 + 1.2 + 0.12
   A. 130
   B. 133.
   C. 133.3
   D. 133.32
   E. None of the above or not enough information is provided. Ans: ____

3. Which of the following statements is false concerning Rutherford's conclusions about the structure of the atom?
   A. Some alpha particles were deflected slightly, so the nucleus must have a positive charge.
   B. A few alpha particles bounced back because they interacted with a small center of the atom
   C. Most of the alpha particles passed through the foil, so most of the atom must be empty space.
   D. Some of the alpha particles were deflected in opposite directions, so some were repelled by the nucleus and some were attracted to electrons.
   E. None of the above or not enough information is provided. Ans: ____

4. Cathode rays curve toward a positively-charged plate because:
   A. They are affected by gravity.
   B. They are positively-charged particles.
   C. They are negatively-charged particles.
   D. They are emitted by all matter.
   E. None of the above or not enough information is provided. Ans: ____

5. Which of the following does not occur as diatomic molecules in elemental form?
   A. Fluorine
   B. Hydrogen
   C. Phosphorus
   D. Iodine
   E. None of the above or not enough information is provided. Ans: ____

6. A 5.281 g sample of a compound contains 3.334 carbon, 0.4663 g hydrogen, and 1.481 g oxygen. What is the empirical formula of the compound?
   A. C_3H_8O
   B. C_3H_5O
   C. $C_6H_{16}O_2$
   D. $C_3H_9O_3$
   E. None of the above or not enough information is provided. Ans: ____

7. A compound has a molar mass of 164 g/mol and an empirical formula of C_2HO. What is the molecular formula of the compound?
   A. C_2HO
   B. $C_4H_2O_2$
   C. $C_8H_4O_4$
   D. $C_{12}H_6O_6$
   E. None of the above or not enough information is provided. Ans: ____

8. The net ionic equation for the reaction between aqueous solutions of HI and $Ca(OH)_2$ is:
   A. $HI\ (aq) + OH^-\ (aq) \rightarrow H_2O\ (l) + I^-\ (aq)$
   B. $2\ HI\ (aq) + Ca^{2+} + 2\ OH^-\ (aq) \rightarrow 2\ H_2O\ (l) + CaI_2\ (s)$
   C. $H^+\ (aq) + OH^-\ (aq) \rightarrow H_2O\ (l)$
   D. $I^-\ (aq) + Ca^{2+}\ (aq) \rightarrow CaI_2\ (s)$
   E. None of the above or not enough information is provided. Ans: ____

9. Which of the following compounds are weak electrolytes?
   I. $H_2C_2O_4$
   II. NH_3
   III. $Be(OH)_2$
   IV. $SrSO_4$

   A. Options I and II
   B. I, II, and III
   C. II and III
   D. III and IV
   E. None of the above or not enough information is provided. Ans: ____

10. Which of the following is false concerning 4.00 L of a 0.200 M solution of $Ca_3(PO_4)_2$?
   A. This solution contains 0.800 mol of $Ca_3(PO_4)_2$.
   B. This solution contains 6.400 mol of oxygen atoms.
   C. 1.00 L of this solution is required to furnish 0.400 mol of PO_4^{3-} ions.
   D. There are 6.022×10^{23} phosphorus atoms in 2.500 L of this solution
   E. None of the above or not enough information is provided. Ans: ____

11. You are given two clear, colorless solutions of the same unknown alkali metal hydroxide, but with different concentrations. Which statement is false?
   A. If the same volume of each sample were taken, then more acid solution would be required to neutralize the one with lower concentration.
   B. The product of the concentration and volume of the less concentrated solution equals the product of concentration and volume of the more concentrated solution.
   C. It would take more acid solution (per milliliter of unknown solution) to neutralize the more concentrated solution.
   D. The ratio of moles of alkali metals ions to hydroxide ions is the same in each solution.
   E. None of the above are false or not enough information is provided. Ans: ____

12. What mass of insoluble product is formed when 35.5 mL of 0.184 M lead(II) nitrate is treated with an excess of hydrobromic acid?
    A. 1.19
    B. 2.38
    C. 4.77
    D. 17.5
    E. None of the above or not enough information is provided. Ans: ____

13. Of the following, $\Delta H°_f$ is not zero for:
    A. H_2 (g)
    B. Si (s)
    C. N_2 (g)
    D. I_2 (l)
    E. None of the above or not enough information is provided. Ans: ____

14. Given the data at the right, $\Delta H°_{rxn}$ for the following reaction is:
    $4\ NH_3\ (g) + 5\ O_2\ (g) \rightarrow 4\ NO\ (g) + 6\ H_2O\ (l)$

    A. -1172
    B. -150
    C. -1540
    D. -1892
    E. None of the above or not enough information is provided. Ans: ____

Substance	$\Delta H°_f$ (kJ/mol)
H_2O (l)	-286
NO (g)	90
NO_2 (g)	34
HNO_3 (aq)	-207
NH_3 (g)	-46

15. ΔE is negative when:
    A. When a system absorbs heat and does work.
    B. When a system gives off heat and does work.
    C. When a system absorbs heat and has work done on it.
    D. When a system gives off heat and has work done on it.
    E. None of the above or not enough information is provided. Ans: ____

SECTION II: Free Response

16. (18 pts) Natural gallium is composed of two isotopes: ^{69}Ga (mass = 68.9256 amu) and ^{71}Ga. The ratio of atoms of $^{69}Ga/^{71}Ga$ in natural gallium is 1.507.
    a. (4 pts) How are the two isotopes of Ga quantitatively similar?

    b. (4 pts) How are the two isotopes of Ga quantitatively different?

    c. (10 pts) Calculate the mass of ^{71}Ga.

Ans = ____

17. (12 pts) The combustion of cobalt produces cobalt dioxide (note: not balanced):
    $Co\ (s) + O_2\ (g) \rightarrow Co_3O_4\ (s)$

    When 1.221 g of Co are combusted in a calorimeter, the temperature of the calorimeter increases from 15.00°C to 42.83°C. In a separate experiment, the heat capacity of the calorimeter is measured to be 7.58 J / K.
    a. (6 pts) What is the heat produced in this experiment of the combustion of Co in a calorimeter?

Ans = ____

    b. (6 pts) What is the heat of reaction for the combustion of a mole of Co in this calorimeter?

Ans = ____

Exam: Ch 1 – 5 & Reaction Products: Precipitation
AP Chem (75 pts)
Version K

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   B. Si (s)
   C. N_2 (g)
   D. I_2 (l)
   E. None of the above or not enough information is provided. Ans: ____

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   $4\ NH_3\ (g) + 5\ O_2\ (g) \rightarrow 4\ NO\ (g) + 6\ H_2O\ (l)$

Substance	$\Delta H°_f$ (kJ/mol)
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   C. When a system absorbs heat and has work done on it.
   D. When a system gives off heat and has work done on it.
   E. None of the above or not enough information is provided. Ans: ____

5. Which of the following does not occur as diatomic molecules in elemental form?
   A. Fluorine
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   C. Phosphorus
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6. A 5.281 g sample of a compound contains 3.334 carbon, 0.4663 g hydrogen, and 1.481 g oxygen. What is the empirical formula of the compound?
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   B. $2\ HI\ (aq) + Ca^{2+} + 2\ OH^-\ (aq) \rightarrow 2\ H_2O\ (l) + CaI_2\ (s)$
   C. $H^+\ (aq) + OH^-\ (aq) \rightarrow H_2O\ (l)$
   D. $I^-\ (aq) + Ca^{2+}\ (aq) \rightarrow CaI_2\ (s)$
   E. None of the above or not enough information is provided. Ans: ____

9. Which of the following compounds are weak electrolytes?
   I. $H_2C_2O_4$
   II. NH_3
   III. $Be(OH)_2$
   IV. $SrSO_4$
   A. Options I and II
   B. I, II, and III
   C. II and III
   D. III and IV
   E. None of the above or not enough information is provided. Ans: ____

10. Which of the following is false concerning 4.00 L of a 0.200 M solution of $Ca_3(PO_4)_2$?
   A. This solution contains 0.800 mol of $Ca_3(PO_4)_2$.
   B. This solution contains 1.600 mol of oxygen atoms.
   C. 1.00 L of this solution is required to furnish 0.400 mol of PO_4^{3-} ions.
   D. There are 6.022×10^{23} phosphorus atoms in 2.500 L of this solution
   E. None of the above or not enough information is provided. Ans: ____

11. If matter is uniform throughout and cannot be separated into other substances by physical processes, it is a/an:
   A. Compound
   B. Element
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   A. 130
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    D. Some of the alpha particles were deflected in opposite directions, so some were repelled by the nucleus and some were attracted to electrons.
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14. Cathode rays curve toward a positively-charged plate because:
    A. They are affected by gravity.
    B. They are positively-charged particles.
    C. They are negatively-charged particles.
    D. They are emitted by all matter.
    E. None of the above or not enough information is provided. Ans: ____

15. You are given two clear, colorless solutions of the same unknown alkali metal hydroxide, but with different concentrations. Which statement is false?
    A. If the same volume of each sample were taken, then more acid solution would be required to neutralize the one with greater concentration.
    B. The product of the concentration and volume of the less concentrated solution equals the product of concentration and volume of the more concentrated solution.
    C. It would take more acid solution (per milliliter of unknown solution) to neutralize the more concentrated solution.
    D. The ratio of moles of alkali metals ions to hydroxide ions is the same in each solution.
    E. None of the above are false or not enough information is provided. Ans: ____

SECTION II: Free Response

16. (18 pts) Natural potassium is composed of two isotopes: ^{39}K (mass = 38.9637074 amu) and ^{41}K. The ratio of atoms of $^{39}K/^{41}K$ in natural potassium is 13.857.
    a. (4 pts) How are the two isotopes of K qualitatively similar?

    b. (4 pts) Besides having different natural abundances, how are the two isotopes of K qualitatively different?

    c. (10 pts) Calculate the mass of ^{41}K.

Ans = ____

17. (12 pts) The combustion of cobalt produces cobalt dioxide (note: not balanced):
    $Mn\ (s) + O_2\ (g) \rightarrow Mn_3O_4\ (s)$

    When 1.521 g of Mn are combusted in a calorimeter, the temperature of the calorimeter increases from 25.00°C to 32.83°C. In a separate experiment, the heat capacity of the calorimeter is measured to be 6.48 J / K.
    a. (6 pts) What is the heat produced in this experiment of the combustion of Mn in a calorimeter?

Ans = ____

    b. (6 pts) What is the heat of reaction for the combustion of a mole of Mn in this calorimeter?

Ans = ____