Name _____

SSN _____

CHEM 121a Exam 2 Fall 1998

This exam consists of 1 short problem (worth 9 pts), 24 multiple choice questions (each worth 3 pts), and 9 true-false questions (each worth 2 pts). There are a total of 100 possible points (you get 1 point for putting your name on your exam).

Written Problem

Write out the solution to the written problem. Please show all of your work.

1. Several chemical precipitations were presented as demonstrations. Write out a balanced **molecular equation** for the reaction of iron(III) nitrate with sodium sulfide, a balanced **complete ionic equation** for the reaction of lead(II) acetate with sodium sulfide, and a balanced **net ionic equation** for the reaction of silver nitrate with sodium sulfide. (9 pts)

Multiple Choice

Please print your name and the "Test Color" on your Scantron sheet. Carefully mark the appropriate answer to each question on the Scantron sheet, and show any work in the space provided. Please hand in both the Exam and the Scantron sheet.

1. How many grams of NaCl are contained in 350. mL of a 0.250 M solution of sodium chloride?

   a. 41.7 g
   b. 5.11 g
   c. 14.6 g
   d. 87.5 g
   e. 33.2 g

2. What volume of 12.0 M nitric acid is required to prepare 6.00 L of 0.100 M nitric acid?

a. 1.20 L
b. 1.00 L
c. 0.500 L
d. 0.0500 L
e. 0.0200 L

3. The net ionic equation for the reaction of aluminum sulfate and sodium hydroxide contains which of the following species?

a. $3Al^{3+}(aq)$
b. $OH^{-}(aq)$
c. $3OH^{-}(aq)$
d. $2Al^{3+}(aq)$
e. $2Al(OH)_3(s)$

4. Which of the following is not a strong base?

a. $Ca(OH)_2$
b. KOH
c. NH_3
d. LiOH
e. $Sr(OH)_2$

5. When sodium chloride and lead(II) nitrate react in an aqueous solution, which of the following terms will be present in the balanced molecular equation?

a. PbCl(s)
b. $Pb_2Cl(s)$
c. $NaNO_3(aq)$
d. $2NaNO_3(aq)$
e. $2PbCl_2(s)$

6. The following reactions:

$Pb^{2+} + 2I^{-} \rightarrow PbI_2$

$2Ce^{4+} + 2I^{-} \rightarrow I_2 + 2Ce^{3+}$

$HOAc + NH_3 \rightarrow NH_4^{+} + OAc^{-}$

are examples of

a. acid-base reactions.
b. unbalanced reactions.
c. precipitation, acid-base, and redox reactions, respectively.
d. redox, acid-base, and precipitation reactions, respectively.
e. precipitation, redox, and acid-base reactions, respectively.

7. Which of the following compounds is soluble in water?

a. $Ni(OH)_2$
b. K_3PO_4
c. $BaSO_4$
d. $CoCO_3$
e. $PbCl_2$

8. You mix 60.0 mL of 1.0 M silver nitrate with 25.0 mL of 0.80 M sodium chloride. What mass of silver chloride should you form?

a. 2.9 g
b. 5.8 g
c. 8.7 g
d. 9.6 g
e. 14.2 g

9. A 1.000-g sample of a metal chloride, MCl_2, is dissolved in water and treated with excess aqueous silver nitrate. The silver chloride that formed weighed 1.286 g. Calculate the atomic mass of M.

a. 222.8 g
b. 76.00 g
c. 152.0 g
d. 304.0 g
e. 286.0 g

10. For which one of the following acid solutions will 50.0 mL neutralize 50.0 mL of a 0.2 M $Ba(OH)_2$ solution?

a. 0.1 M HCl
b. 0.2 M HNO_3
c. 0.3 M HBr
d. 0.1 M H_2SO_3
e. 0.2 M H_2SO_4

11. Sulfamic acid, HSO_3NH_2 (molar mass = 97.1 g/mol), is a strong monoprotic acid that can be used to standardize a strong base:

$HSO_3NH_2(aq) + KOH(aq) \rightarrow KSO_3NH_2(aq) + H_2O(l)$

A 0.179-g sample of HSO_3NH_2 required 19.4 mL of an aqueous solution of KOH for complete reaction. What is the molarity of the KOH solution?

a. 9.25 M
b. 9.50×10^{-5} M
c. 0.0950 M
d. 0.194 M
e. 1.94 M

12. In the reaction $2Ca(s) + O_2(g) \rightarrow 2CaO(s)$, which species is oxidized?

a. O_2
b. O^{2-}
c. Ca
d. Ca^{2+}
e. none of these

13. In the reaction $P_4(s) + 10Cl_2(g) \rightarrow 4PCl_5(s)$, the reducing agent is

a. chlorine.
b. PCl_5.
c. phosphorus.
d. Cl^-.
e. none of these

14. Balance the following oxidation-reduction reaction using the half-reaction method:

$Fe^{3+} + I^- \rightarrow Fe^{2+} + I_2$

In the balanced equation, the coefficient of Fe^{2+} is

a. 1.
b. 2.
c. 3.
d. 4.
e. none of these

15. Given the reaction

$2MnO_4^- + 5H_2O_2 + 6H^+ \rightarrow 2Mn^{2+} + 8H_2O + 5O_2$

determine the number of electrons involved in this reaction.

a. 10
b. 8
c. 6
d. 4
e. 2

16. Standard temperature and pressure (STP) is defined as:

a. 0 K and 1 mm Hg
b. 273 K and 1 atm
c. 0 °F and 760 mm Hg
d. 273 °C and 760 torr
e. −273 K and 1 atm

17. The height of a column of mercury in a barometer would decrease as the barometer was carried up a mountain because

a. the pressure increases
b. there are fewer particles colliding with the mercury in the dish
c. the force of gravity changes
d. the temperature decreases
e. none of the above are true

18. At 1000 °C and 10. torr, the density of a certain element in the gaseous state is 2.9×10^{-3} g/L. The element is:

a. Ne
b. He
c. Na
d. Ar
e. Hg

19. A 5.10-L sample of chlorine gas is prepared at 15 °C and 740. torr. Calculate the volume of this sample of chlorine gas at standard conditions of temperature and pressure.

a. 6.41 L
b. 4.71 L
c. 5.89 L
d. 11.4 L
e. 2.97 L

20. A sample of 35.1 g of methane gas has a volume of 5.20 L at a pressure of 2.70 atm. Calculate the temperature.

a. 4.87 K
b. 78.1 K
c. 46.3 K
d. 275 K
e. 129 K

21. What volume does 28.0 g of N_2 occupy at STP?

a. 5.60 L
b. 11.2 L
c. 22.4 L
d. 44.8 L
e. 28.0 L

22. A gaseous mixture containing 1.5 mol Ar and 3.5 mol CO_2 has a total pressure of 7.0 atm. What is the partial pressure of CO_2?

a. 1.8 atm
b. 2.1 atm
c. 3.5 atm
d. 4.9 atm
e. 2.4 atm

23. Use the kinetic molecular theory of gases to predict what would happen to a closed sample of a gas whose temperature increased while its volume decreased.

a. Its pressure would decrease.
b. Its pressure would increase.
c. Its pressure would hold constant.
d. The number of moles of the gas would decrease.
e. The average kinetic energy of the molecules of the gas would decrease.

24. Calculate the ratio of the effusion rates of N_2 and N_2O, (rate N_2)/(rate N_2O).

a. 0.637/1
b. 1.57/1
c. 1.25/1
d. 0.798/1
e. 1.61/1

Table 4.1 Simple Rules for the Solubility of Salts in Water

1. Most nitrate (NO_3^-) and acetate ($C_2H_3O_2^-$) salts are soluble.
2. Most salts containing the alkali metal ions (Li^+, Na^+, K^+, Cs^+, Rb^+) and the ammonium ion (NH_4^+) are soluble.
3. Most chloride, bromide, and iodide salts are soluble. Notable exceptions are salts containing the ions Ag^+, Pb^{2+}, and Hg_2^{2+}.
4. Most sulfate salts are soluble. Notable exceptions are $BaSO_4$, $PbSO_4$, $HgSO_4$, and $CaSO_4$.
5. Most hydroxide salts are only slightly soluble. The important soluble hydroxides are NaOH and KOH. The compounds $Ba(OH)_2$, $Sr(OH)_2$, and $Ca(OH)_2$ are marginally soluble.
6. Most sulfide (S^{2-}), carbonate (CO_3^{2-}), chromate (CrO_4^{2-}), and phosphate (PO_4^{3-}) salts are only slightly soluble.

Universal Gas Constant, R = 0.08206 (L·atm)/(mol·K)

Pressure Conversions, 1 atm = 760 torr = 760 mm Hg

Graham's Law of Effusion, $\frac{\text{rate}_1}{\text{rate}_2} = \frac{\sqrt{M_2}}{\sqrt{M_1}} = \sqrt{\frac{M_2}{M_1}}$

True-False

If the statement is true, do nothing. If the statement is false, write a replacement for the underlined word, phrase, or number to make the statement true.

1. Increasing the number of gas particles in a closed, rigid continer causes the pressure in the container to <u>increase</u>. _____

2. At constant temperature and pressure, a fixed amount of a gas is <u>inversely</u> proportional to its volume. _____

3. The substance oxidized during a redox reaction is the <u>oxidizing</u> agent. _____

4. A 0.005 M hydrochloric acid solution is best described as a <u>strong</u> acid solution. _____

5. The oxidation state of chromium in K_2CrO_4 is <u>+7</u>. _____

6. Oxidation-reduction reactions involve the transfer of <u>oxygen</u>. _____

7. The relationship between the pressure of a trapped gas and its volume at constant temperature is described by <u>Boyle's</u> Law. _____

8. One mole of a gas at standard temperature and pressure has a volume of <u>22.4</u> L. _____

9. Sucrose, a molecular compound, is a <u>strong electrolyte</u>. _____

Name	(1)	_____
Written Problem	(9)	_____
Multiple Choice	(72)	_____
True-False	(18)	_____
Exam 2 Total	(100)	_____