HONOUR CHEMISTRY (Semester 1): FINAL EXAM (Practice Test)

1 atm = 760 mm Hg = 760 torr = 101.325 kPa $T_K = T_C + 273.15$

STP = 22.4 L/mol @ 0.00°C & 101.325 kPa (1 atm) **SATP = 24.8 L/mol @ 25.0°C & 100. kPa**

$$R = 0.0821\ \frac{\text{L}\bullet\text{atm}}{\text{K}\bullet\text{mol}} \quad \text{or} \quad 8.314\ \frac{\text{L}\bullet\text{kPa}}{\text{K}\bullet\text{mol}} \qquad D = \frac{m}{V} \qquad n = \frac{m}{M} \qquad C_1V_1 = C_2V_2$$

$$PV = nRT \qquad \frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2} \qquad \frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}} \qquad \chi_1 = \frac{n_1}{n_{Total}} = \frac{P_1}{P_{Total}}$$

$$P_{\text{Total}} = P_1 + P_2 + P_3 + \ldots \qquad n_{\text{Total}} = n_1 + n_2 + n_3 + \ldots$$

$$\%\ \text{error} = \left|\frac{Theoretical - Exprimental}{Theoretical}\right| \times 100\% \qquad \%\ \text{yield} = \frac{Exprimental}{Theoretical} \times 100\%$$

$$\%\ \text{by Mass} = \frac{m_{solute}}{m_{solution}} \times 100\% \qquad \%\ (\text{v/v}) = \frac{V_{solute}}{V_{solution}} \times 100\% \qquad \%\ (\text{m/v}) = \frac{m_{solute}\ \text{in g}}{V_{solution}\ \text{in mL}} \times 100\%$$

$$C = \frac{n_{solute}}{V_{solution}} \qquad \text{Molality} = \frac{n_{solute}}{m_{solvent}\ \text{in kg}} \qquad \text{ppm} = \frac{m_{solute}\ (\text{mg})}{V_{solution}\ (\text{L})} \qquad \text{ppb} = \frac{m_{solute}\ (\mu\text{g})}{V_{solution}\ (\text{L})}$$

$$C = kP \qquad i = \frac{n_{ions}}{n_{solute}} \qquad \Delta T_b = iK_b \times \text{Molality}_{\text{solute}} \qquad \Delta T_f = iK_f \times \text{Molality}_{\text{solute}}$$

Part A*: *Multiple Choice **(The real final exam will not have that many multiple choice questions but the questions below cover most of the main concepts taught.)**

1. A physical property is demonstrated by

A. table sugar being digested in the intestine . **B.** vinegar dissolving scale from an old tea kettle.
C. wood burning in a fire place. **D.** oil floating on water.

2. The separation technique that could be used to describe making coffee from a coffee machine is

A. distillation **B.** chromatography **C.** filtration **D.** extraction

3. In the mid 1800's an economical method of producing steel was developed. This situation is best described by

A. the needs of society encouraging a new technology.
B. an event in the environment causing a change in technology.
C. a new technology prompting a change in society.
D. a new discovery influencing technology.

4. The properties that are characteristic of non-metals are

A. dull, brittle, non-conductors. **B.** shiny, malleable, non-conductors.
C. dull, brittle, conductors. **D.** malleable, ductile, conductors.

5. The atomic number of an atom is the

A. sum of the number of protons and neutrons. **B.** number of neutrons only
C. sum of the number of protons, neutrons, and electrons. **D.** number of protons only

6. The model of an atom developed by Niels Bohr was described as

A. plum pudding **B.** nuclear **C.** electron levels **D.** solid sphere

7. An element in Group 15, Period 3 of the periodic table will have how many valence electrons?

A. 5 **B.** 15 **C.** 1 **D.** 3

8. What happens to non-metal atoms in the formation of ionic compounds?

A. They lose electrons and form negative ions. **B.** They lose electrons and form positive ions.
C. They gain electrons and form negative ions. **D.** They gain electrons and form positive ions.

9. Molecular compounds are characterized by

A. sharing of electrons. **B.** positive and negative ions attracting each other.
C. electrons changing energy levels. **D.** positive and negative ions repelling each other.

10. Soluble ionic compounds are composed of

A. ions and are conductive in water. **B.** molecules and are not conductive in water.
C. molecules and are conductive in water. **D.** ions and are not conductive in water.

11. When writing the formula for a binary ionic compound, it is necessary to

A. cross multiply the electron valence numbers of each atom.
B. write the valence number of electrons as a subscript for each atom.
C. have an equal number of atoms for each element.
D. balance the number of electrons gained and lost.

12. The correct chemical formula for cobalt(III) chloride is

A. Co_3Cl **B.** Co_3Cl_3 **C.** $CoCl_3$ **D.** $CoCl$

13. The common name for the molecular compound H_2O_2 is

A. dihydrogen dioxide **B.** hydrogen peroxide **C.** hydrate **D.** heavy water

14. The molecular compound is

A. Na_2SO_4 **B.** $(NH_4)_2CO_3$ **C.** CH_3OH **D.** $CaCO_3$

15. The chemical formula for hydrosulphuric acid is

A. $H_2SO_{3\,(aq)}$ **B.** $H_2S_{\,(aq)}$ **C.** $HS_{\,(aq)}$ **D.** $H_2SO_{4\,(aq)}$

16. A chemical change is the result of the production of a new substance with

A. physical and chemical properties different from the original substances
B. chemical properties different from and physical properties a blend of the original substances
C. physical and chemical properties the same as the original substances
D. chemical properties different and physical properties the same as the original substances

17. The chemical equation representing a simple decomposition reaction is

A. $2\,NaCl_{\,(s)} \rightarrow 2\,Na_{\,(s)} + Cl_{2\,(g)}$ **B.** $2\,C_8H_{18\,(l)} + 25\,O_{2\,(g)} \rightarrow 16\,CO_{2\,(g)} + 18\,H_2O_{\,(g)}$
C. $NaOH_{\,(aq)} + HCl_{\,(aq)} \rightarrow NaCl_{\,(s)} + H_2O_{\,(l)}$ **D.** $2\,Mg_{(s)} + O_{2(g)} \rightarrow 2\,MgO_{\,(s)}$

18. In a single replacement reaction, the metal atom always replaces the

A. first compound in the chemical equation. **B.** second compound in the chemical equation.
C. metal ion in the compound. **D.** non-metal ion in the compound.

19. The chemical equation representing a double replacement reaction is

A. $2\,Fe_2O_{3\,(s)} \rightarrow 4\,Fe_{\,(s)} + 3\,O_{2\,(g)}$ **B.** $Na_2CO_{3\,(aq)} + CaCl_{2\,(aq)} \rightarrow CaCO_{3\,(s)} + 2\,NaCl_{\,(aq)}$
C. $16\,Na_{\,(s)} + S_{8\,(s)} \rightarrow 8\,Na_2S_{\,(s)}$ **D.** $2\,K_{\,(s)} + 2\,H_2O_{\,(l)} \rightarrow 2\,KOH_{\,(aq)} + H_{2\,(g)}$

20. What is the best word translation of the chemical equation?

$$NaCl_{(aq)} + AgNO_{3\,(aq)} \rightarrow NaNO_{3\,(aq)} + AgCl_{(s)}$$

A. A salt solution reacts with a solution of silver nitrate to produce a sodium nitrate solution and a silver chloride precipitate.
B. A sodium chloride solution reacts with a solution of silver nitrate to produce a sodium nitrate solution and a silver chloride precipitate.
C. Table salt reacts with a silver nitrate solution to produce a sodium nitrate solution and a silver chloride solution.
D. A sodium chloride solution reacts with a silver nitrate solution to produce a sodium nitrate solution and a silver chloride solution.

21. The law of conservation of mass predicts that the

A. initial mass will be equal to the sum of the masses of the reactants and the sum of the masses of the products.
B. sum of the masses of the reactants will be equal to the sum of the masses of the products.
C. sum of the masses of the products subtracted from the masses of the reactants will be equal to the initial mass.
D. initial mass added to the mass of the reactants will be equal to the sum of the masses of the products.

22. Use the unbalanced chemical equation to answer the question.

$$H_3PO_{4\,(aq)} + NH_4OH_{(aq)} \rightarrow H_2O_{(l)} + (NH_4)_3PO_{4\,(aq)}$$

If correctly balanced, this chemical equation would have 3 moles of

A. ammonium phosphate and phosphoric acid **B.** ammonium phosphate and ammonium hydroxide
C. ammonium hydroxide and phosphoric acid **D.** ammonium hydroxide and water

23. The number of grams in six moles of liquid carbon tetrachloride is

A. 461.43 **B.** 922.86 **C.** 47.46 **D.** 153.81

24. Surface tension may be described as the

A. force of attraction between molecules of the same substance
B. attraction of molecules of one substance towards molecules of a different substance
C. pull of liquid molecules towards the surface of the liquid
D. tendency of molecules to be pulled from the surface to the interior of a liquid

25. Water can absorb large amounts of heat and still remain liquid because of its high

A. freezing point **B.** density **C.** specific heat capacity **D.** melting point

26. Some observations were recorded for a substance.

I. The substance is a white crystalline solid.
II. The substance dissolves in water.
III. A solution of the substance conducts electricity.

The substance is most likely

A. $C_6H_{12}O_6$ **B.** $AlCl_3$ **C.** CO_2 **D.** CCl_4

27. A chemist wishes to make 200. mL of a 0.600 mol/L solution of $KOH_{(aq)}$. What volume of 2.00 mol/L stock solution will be required for this dilution?

A. 670. mL **B.** 60.0 mL **C.** 1.67×10^4 mL **D.** 240. mL

28. A student prepared four aqueous solutions of an ionic compound.

I. 0.20 mol of solute in 5.0 L of solution **II.** 0.50 mol of solute in 2.0 L of solution
III. 3.0 mol of solute in 15 L of solution **IV.** 1.0 mol of solute in 3.0 L of solution

The most dilute solution is

A. III **B.** IV **C.** I **D.** II

29. Materials used in the titration between a known concentration acid and an unknown concentration of base are

I. pippete **II.** Erlenmeyer flasks **III.** buret **IV.** beakers to hold the original acid and base

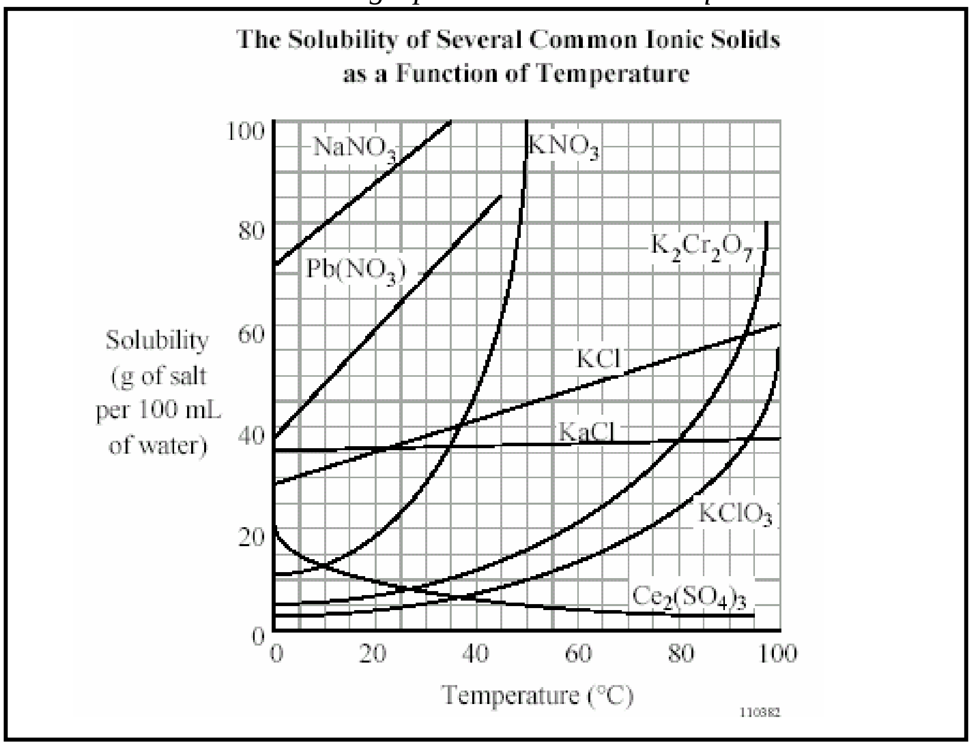
What material can be left wet when used in the titration analysis?

A. III **B.** II **C.** I **D.** IV

30. Which pair of aqueous solutions would produce a precipitate when mixed?

A. $MgCl_{2\,(aq)}$ and $Na_2SO_{4\,(aq)}$ **B.** $KF_{(aq)}$ and $NiBr_{2\,(aq)}$
C. $Na_2S_{(aq)}$ and $Cr(NO_3)_{3\,(aq)}$ **D.** $KCl_{(aq)}$ and $Mg(NO_3)_{2\,(aq)}$

Use the graph to answer the next question.



31. The substance shown on the graph that is most soluble at 0°C is

A. KNO_3 **B.** NaCl **C.** $NaNO_3$ **D.** $KClO_3$

32. A student prepared a list of solutes.

I. $CaCl_{2\,(s)}$ **II.** $Al_2(SO_4)_{3\,(s)}$ **III.** $H_2SO_{4\,(l)}$ **IV.** $NaNO_{3\,(s)}$

If the student prepared equal volumes of 0.10 mol/L solutions of each substance, which solute would produce the highest concentration of dissolved ions?

A. III **B.** IV **C.** I **D.** II

33. The concentration of Cl^- available in 110. mL of a solution containing 5.55 g of $CaCl_2$ is

A. 0.668 mol/L **B.** 0.005 50 mol/L **C.** 0.909 mol/L **D.** 0.455 mol/L

34. Students made the following statements in describing the gas phase.

I. Gas particles do not attract or repel each other.
II. Molecules of different gases at the same temperature have the same average speed.
III. Collisions of gas particles are perfectly elastic and no energy is lost during collisions.
IV. Molecules of gases are particles of negligible volume compared to the spaces between them.

Which statements are postulates of the kinetic molecular theory?

A. I, II, and IV **B.** I, III, and IV **C.** II, III, and IV **D.** I, II, and III

35. The new volume of a fixed mass of gas whose pressure is increased from 100 kPa to 400 kPa at a constant temperature is

A. four times the original volume **B.** one half the original volume
C. one fourth the original volume **D.** two times the original volume

36. Decreasing the volume of a gas at constant temperature causes the pressure to increase because

A. the molecules are striking a smaller area with a greater force
B. the molecules are moving faster
C. there are more molecules
D. the molecules are striking a smaller area with the same force

37. Three 1.0 L flasks contain He, N_2, and H_2S at SATP. Which statement indicates the relative number of molecules in the flasks?

A. All three flasks contain the same number of molecules.
B. The flask of H_2S contains the most molecules.
C. The flask of He contains the most molecules.
D. The flask of N_2 contains the most molecules.

38. A student collects 1.00 L of a gaseous hydrocarbon at 27°C and 101 kPa. The mass of the sample is 1.79 g. The hydrocarbon has the structural formula

A. C_3H_8 **B.** C_2H_6 **C.** CH_4 **D.** C_2H_4

39. Carbon dioxide gas is sometimes used to carbonate beverages. A sample of carbon dioxide occupies a volume of 180. mL at 35.0°C and 88.9 kPa. The volume occupied by the gas at STP is

A. 178 mL **B.** 140. mL **C.** 181 mL **D.** 155 mL

40. How many moles of oxygen are needed to burn 3.00 moles of butane ($C_4H_{10\,(g)}$) in a butane lighter?

A. 19.5 **B.** 2.15 **C.** 6.52 **D.** 13.0

41. Hydrofluoric acid, $HF_{(aq)}$, is not stored in glass containers, $SiO_{2\,(s)}$, because it reacts with glass. The products of the reaction are $SiF_{4\,(aq)}$ and water. Calculate the mass of $HF_{(aq)}$ that is needed to react completely with 60.0 g of $SiO_{2\,(s)}$

A. 89.5 g **B.** 79.9 g **C.** 5.00 g **D.** 20.0 g

42. A remedy for an upset stomach is produced when a tablet is dissolved in water. The balanced chemical equation is

$$C_6H_8O_{7\,(aq)} + 3\ NaHCO_{3\,(aq)} \rightarrow Na_3C_6H_5O_{7\,(aq)} + 3\ CO_{2\,(g)} + 3\ H_2O_{(l)}$$

What volume of $CO_{2\,(g)}$ at STP conditions would result if a tablet containing 16 g of $C_6H_8O_{7\,(aq)}$ was used?

A. 6.8 L **B.** 11 L **C.** 5.6 L **D.** 1.9 L

43. Plants remove $CO_{2\,(g)}$ from the air during photosynthesis. The overall reaction is

$$6\ CO_{2\ (g)} + 6\ H_2O_{\ (l)} \rightarrow C_6H_{12}O_{6\ (s)} + 6\ O_{2\ (g)}.$$

Assuming that the temperature is 10.0°C and the pressure is 80.0 kPa, the volume of $CO_{2\ (g)}$ needed to produce 160. g of $C_6H_{12}O_{6\ (s)}$ is

A. 198 L **B.** 157 L **C.** 26.1 L **D.** 235 L

44. Lead(II) chromate can be produced by the reaction of $Pb(NO_3)_{2\ (aq)}$ with $K_2CrO_{4\ (aq)}$. What volume of 0.250 mol/L $Pb(NO_3)_{2\ (aq)}$ is needed to produce 100. g of $PbCrO_{4\ (s)}$?

A. 12.9 L **B.** 1.24 L **C.** 0.390 L **D.** 25.0 L

45. In the theoretical reaction $2\ B_{\ (aq)} + 3\ D_{\ (aq)} \rightarrow E_{\ (aq)} + 4\ F_{\ (aq)}$, the concentration of $D_{\ (aq)}$ is 0.40 mol/L. If 25.0 mL of aqueous B is needed to react completely with 30.0 mL of aqueous D, the concentration of $B_{\ (aq)}$ is

A. 0.32 mol/L **B.** 0.72 mol/L **C.** 0.48 mol/L **D.** 0.40 mol/L

46. Ammonia phosphate can be produced by reacting phosphoric acid with ammonium hydroxide. The balanced equation is $H_3PO_{4\ (aq)} + 3\ NH_4OH_{\ (aq)} \rightarrow (NH_4)_3PO_{4\ (aq)} + 3\ H_2O_{\ (l)}$. The mass of ammonium phosphate produced from 325 mL of 0.500 mol/L ammonium hydroxide is

A. 24.2 g **B.** 8.08 g **C.** 6.12 g **D.** 72.7 g

47. When 0.137 g of an unknown carbonate, X_2CO_3, were reacted with $CaCl_2$ solution, the mass of the precipitate formed was 0.100 g. Assuming that X represents an alkali metal, which statement about the experiment is correct?

A. The mass of XCl formed is 0.100 g.
B. X_2CO_3 should be in excess.
C. Calcium chloride should be in excess.
D. The filtrate contains carbonate and calcium ions.

48. If 5.01 g of Na_2CrO_4 is reacted with 10.2 g of $Pb(NO_3)_{2\ (aq)}$, then one can conclude that

A. Na_2CrO_4 is the limiting reagent
B. 10.0 g of lead(II) chromate are produced
C. lead(II) nitrate is in excess
D. $Pb(NO_3)_{2\ (aq)}$ is the limiting reagent

49. The label on a 750. mL bottle of wine indicated that the alcohol content was 82.5 mL. The concentration, expressed in percent by volume, is

A. 8.25% **B.** 11.0% **C.** 12.0% **D.** 11.5%

50. The concentration of glucose in blood plasma is 0.090%. This means that the mass of glucose in 100. mL of blood is

A. 0.90 mg **B.** 0.090 mg **C.** 90. mg **D.** 9.0 mg

51. In a titration, a 20. mL sample of $NaOH_{\ (aq)}$ was neutralized by 14.9 mL of 0.13 mol/L $H_2SO_{4\ (aq)}$. The concentration of the base is

A. 0.35 mol/L **B.** 0.048 mol/L **C.** 8.7 mol/L **D.** 0.19 mol/L

52. Which factor does not affect the solubility of a solid electrolyte in a liquid solvent?

A. temperature **B.** nature of the solvent **C.** pressure **D.** nature of the solute

53. Which of the following factors is important ***only*** for the solubility of gases in solvents?

A. the nature of the solute.
B. the nature of the solvent.
C. the pressure of the gas.
D. the temperature.
E. the atmospheric pressure.

54. A substance whose water solution does NOT conduct a current is a(n)

A. polar substance. **B.** nonelectrolyte **C.** electroloyte **D.** ionic substance

55. If the amount of solute present in a solution at a given temperature is less than the maximum amount that can dissolve at that temperature, the solution is said to be

A. saturated **B.** unsaturated **C.** supersaturated **D.** concentrated

56. What is the molality of a solution that contains 516 g KNO_3 in 4.47 L water?

A. 0.315 *m* **B.** 0.779 *m* **C.** 1.02 *m* **D.** 1.14 *m*

57. A solution of sugar in water has a density of 1.05 g/cm^3. If you have 75.0 mL of the solution, and if the solution is 8.10% sugar by mass, how many grams of sugar are there in the solution?

A. 63.8 g **B.** 6.38 g **C.** 60.8 g **D.** 6.08 g

58. What is the boiling point change for a solution containing 0.328 moles of naphthalene (a nonvolatile, nonionizing compound) in 250. g of liquid benzene? (K_b = 2.53°C/*m* for benzene)

A. 3.32°C **B.** 1.93°C **C.** 7.41°C **D.** 4.31°C

59. Which of the following aqueous solutions has the highest boiling point?

A. 1.0 *m* $C_6H_{12}O_6$ **B.** 1.0 *m* $Al(NO_3)_3$ **C.** 1.0 *m* Na_2SO_4 **D.** 1.0 *m* KCH_3COO

60. Compared with a 0.01 *m* sugar solution, a 0.01 *m* $MgCl_2$ solution has

A. the same boiling-point elevation. **B.** about twice the boiling-point elevation.
C. about three times the boiling-point elevation. **D.** about four times the boiling-point elevation.

61. When a 20.0 g sample of an unknown compound is dissolved in 500. g of benzene (a nonelectrolytic, noniozizing compound), the freezing point of the resulting solution of 3.77°C. The freezing point of pure benzene is 5.48°C and K_f for benzene is 5.12°C/*m*. Calculate the molar mass of the unknown compound

A. 120. g/mol **B.** 140. g/mol **C.** 100. g/mol **D.** 80.0 g/mol

62. The attractive forces in a liquid are

A. strong enough to prevent the particles from changing positions.
B. too weak to hold the particles in fixed positions.
C. more effective than those in a solid.
D. nonexistence so particles will always repel each other.

63. If the temperature of a closed liquid-vapor equilibrium system is raised, its vapour pressure

A. decreases. **B.** increases. **C.** remains the same. **D.** shows no relationship.

64. Why would a camper near the top of Mt. Everest find that water boils at less than 100ºC?

A. There is greater atmospheric pressure than at sea level. **B.** The atmosphere has more moisture.
C. There is less atmospheric pressure than at sea level. **D.** The atmosphere has less moisture.

65. At its triple point, water can

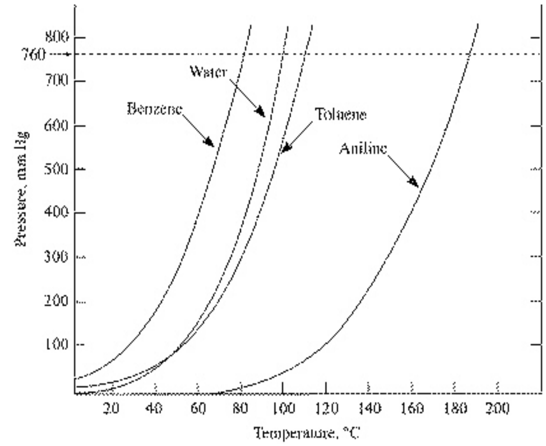
A. have only three pressure values. **B.** exist in equilibrium in three different phases.
C. only be present as vapour. **D.** exist only as a solid.

66. A sample of helium diffuses 4.57 times faster than an unknown gas diffuses. What is the molar mass of the unknown gas?

A. 12.0 g/mol **B.** 18.2 g/mol **C.** 38.8 g/mol **D.** 83.6 g/mol

67. According to the figure to the right, what is the most volatile substance shown?

A. benzene
B. water
C. toluene
D. aniline



68. Why is ice less dense than liquid water?

A. The molecules in liquid water can crowd together more compactly than in ice.
B. Liquid water's energy level is lower than that of ice.
C. Liquid water molecules are farther apart than the molecules in ice.
D. Liquid water has fewer chemical impurities than ice has.

69. The critical temperature of a substance is the

A. temperature which the vapour pressure of the liquid is equal to the external pressure.
B. temperature at which the vapour pressure of the liquid is equal to 760 mm Hg.
C. temperature at which the solid, liquid and vapour phases are all in equilibrium.
D. lowest temperature above which a substance cannot be liquefied at any applied pressure.

70. Unlike in an ideal gas, in a real gas

A. all particles move in the same direction. **B.** all particeles have the same kinetic energy.
C. the particles cannot diffuse. **D.** the particles exert attractive forces on each other.

71. Using the table below, what is the partial pressure of water vapor in oxygen gas collected by water displacement at 10.ºC and 750. mm Hg?

Temperature (°C)	0	5	10	15	20	25	30	35	40	50
Water Vapour Pressure (mm Hg)	4.6	6.5	9.2	12.8	17.5	23.8	31.8	42.2	55.3	92.5

A. 9.2 mm Hg **B.** 740.8 mm Hg **C.** 750. mm Hg **D.** 759.2 mm Hg

72. A 1.00 L sample of a gas has a mass of 1.92 g at STP. What is the molar mass of the gas?

A. 1.92 g/mol **B.** 19.2 g/mol **C.** 22.4 g/mol **D.** 43.0 g/mol

73. The ideal gas law is equivalent to Charles's law when

A. the number of moles and the pressure are constant. **C.** volume of the gas is 22.4 L.
B. the number of moles and the temperature are constant. **D.** $R = 0$.

74. A gas sample with a mass of 2.50 g is collected at 20.0ºC and 732.5 mm Hg. The volume is 1.28 L. What is the molar mass of the gas?

A. 1.26 g/mol **B.** 2.04 g/mol **C.** 13.7 g/mol **D.** 48.8 g/mol

75. The balanced equation for the complete combustion of methane is $CH_{4\,(g)} + 2\ O_{2\,(g)} \rightarrow 2\ H_2O_{(g)} + CO_{2\,(g)}$. If 50. L of methane at STP are burned, what volume of carbon dioxide will be produced at STP?

A. 17 L **B.** 25 L **C.** 50. L **D.** 100. L

Answers

1.	**D**	**11.**	**D**	**21.**	**B**	**31.**	**C**	**41.**	**B**	**51.**	**D**	**61.**	**A**	**71.**	**A**
2.	**C**	**12.**	**C**	**22.**	**D**	**32.**	**D**	**42.**	**C**	**52.**	**C**	**62.**	**B**	**72.**	**D**
3.	**C**	**13.**	**B**	**23.**	**B**	**33.**	**C**	**43.**	**B**	**53.**	**C**	**63.**	**B**	**73.**	**A**
4.	**A**	**14.**	**C**	**24.**	**D**	**34.**	**B**	**44.**	**B**	**54.**	**B**	**64.**	**C**	**74.**	**D**
5.	**D**	**15.**	**B**	**25.**	**C**	**35.**	**C**	**45.**	**A**	**55.**	**B**	**65.**	**B**	**75.**	**C**
6.	**C**	**16.**	**A**	**26.**	**B**	**36.**	**D**	**46.**	**B**	**56.**	**D**	**66.**	**D**		
7.	**A**	**17.**	**A**	**27.**	**B**	**37.**	**A**	**47.**	**C**	**57.**	**B**	**67.**	**A**		
8.	**C**	**18.**	**C**	**28.**	**C**	**38.**	**A**	**48.**	**D**	**58.**	**A**	**68.**	**C**		
9.	**A**	**19.**	**B**	**29.**	**B**	**39.**	**B**	**49.**	**B**	**59.**	**B**	**69.**	**D**		
10.	**A**	**20.**	**B**	**30.**	**C**	**40.**	**A**	**50.**	**C**	**60.**	**C**	**70.**	**D**		

Numerical Response

(The real exam will contain some short answer questions that require small amount of calculations. They are liked the multiple choice questions involving calculations, except with no choices shown. They will be mixed in with the multiple choice section.)

Part B*: *Extended Response

(The real final exam will contain long answer questions of *some but not all* of the following topics.)

- **Average Atomic Mass with Mass Numbers of Isotopes and their Relative Percentage Abundance**
- **Balancing and Writing Chemical Equations**
- **Writing Complete and Net-Ionic Chemical Equations**
- **Finding Molecular and Empirical Formula from % Masses of Elements in a Compound**
- **Simple Stoichiometry (mass, solution and/or gas) with no Limiting Reagents**
- **Advanced Stoichiometry (mass, solution and/or gas) with Limiting Reagents**
- **% Error Calculation and Error Analysis**
- **Calculations involving Combined Gas Law, Ideal Gas Law (with Density and Molar Mass Derivations), Partial Pressures, Mole Fractions, and Effusion**
- **Colligative Properties (Boiling Point Elevation and Freezing Point Depression) of Nonelectrolytic and Electrolytic Solutions**
- **Determining Molar Mass using Boiling Point Elevation or Freezing Point Depression of a Nonelectrolytic Solution**