Gr. 11 Chemistry
Exam Review

You are encouraged to use this exam review as a set of practice questions. Reading over all your class notes, handouts and laboratories is essential for preparing for this exam.

The following Equations, Constants, Equivalencies and Element Activities will be given to you during your upcoming exam.

Equations:

$n = \frac{m}{mm}$ $\quad C = \frac{n}{V}$ $\quad n = \frac{v}{V}$ $\quad C_1V_1 = C_2V_2$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $\quad \frac{P_1}{T_1} = \frac{P_2}{T_2}$ $\quad P_1V_1 = P_2V_2$ $\quad \frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$^oK = {}^oC + 273$ $\quad {}^oC = {}^oK - 273$

Constants:

Avogadro's number (N_A): 1 mole = 6.02×10^{23} particles
At S.T.P. molar volume: 22.4 L/mol

Equivalencies:

1 kg = 1000 g 1 L = 1000 mL

1 atm = 760 mmHg = 101.3 kPa = 14.7 lb/in^2 = 1013 mbar = 760 torr

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Element Activities:

Metals (most to least active): Li, K, Ba, Ca, Na, Mg, Al, Zn, Fe, Ni, Sn, Pb, H_2, Cu, Hg, Ag, Au

Nonmetals (most to least active): F_2, Cl_2, Br_2, I_2

UNIT 1- CHEMICAL REACTIONS

1. Name the following compounds:
   a. $Mg(NO_3)_2$ b. $NaHCO_3$ c. CCl_4 d. KPO_4

2. Give the molecular formula for the following compounds.
   a. dinitrogen trioxide
   b. ammonium phosphate
   c. copper (II) sulphate
   d. diphosphorus pentoxide

3. Balance the following reactions:
   a. ____ Mg + ____ N_2 → ____ Mg_3N_2
   b. ____ Fe + ____ H_2SO_4 → ____ $Fe_2(SO_4)_3$ + ____ H_2
   c. ____ $Ni(NO_3)_2$ + ____ $Al(OH)_3$ → ____ $Ni(OH)_2$ + ____ $Al(NO_3)_3$
   d. ____ CH_4 + ____ O_2 → ____ CO_2 + ____ H_2O
   e. ____ $LiAlH_4$ + ____ H_2O → ____ $LiOH$ + ____ $Al(OH)_3$ + ____ H_2

4. Predict the products of the reactions below, then write the balanced equation.
   a. (Single replacement) magnesium bromide + chlorine →
   b. (Single replacement) aluminum + iron(III) oxide →
   c. (Synthesis) nitrogen + hydrogen →
   d. (Double replacement) sodium hydroxide + hydrogen chloride →
   e. (Hydrogen combustion) $C_3H_8 + O_2$ →
   f. (Decomposition) sodium oxide →

5. Convert to moles:
   a. 6.74 g of Si
   b. 9.8 g of nitrogen gas
   c. 7.40×10^{22} atoms of zinc
   d. 10.4 g of NaOH
   e. 10.1 L of SO_2 gas at S.T.P.

6. Convert to mass (grams)
   a. 4.50×10^{-3} mol of C atoms
   b. 0.125 mol of $CaCO_3$ molecules
   c. 3.61×10^{23} atoms of Na
   d. 7.84 L of NH_3 gas at S.T.P.

7. Calculate the mass of 0.300 mol of Na_3PO_4.

8. How many moles in 23.4 g of $Al(NO_3)_3$?

9. Calculate the number of moles of each element in 0.50 moles of $Al(NO_3)_3$.

10. Determine the number of individual atoms of each element in 22.5 g of iron (II) hydroxide.

11. Calculate the mass of 3.0×10^4 molecules of $Ba(HCO_3)_2$.

12. Determine the mass of 0.600 mol of aluminium hydrogen carbonate.

13. How many moles are in 59.1 g of $Ca(NO_3)_2$?

14. Determine the mass of 1.00×10^6 molecules of $Mg(OH)_2$.

15. How many moles of hydrogen are produced from the reaction of 12.8g of zinc with excess hydrochloric acid?
    $Zn + 2HCl \rightarrow ZnCl_2 + H_2$

16. Given 0.45 moles of O_2 gas and excess H_2S, Calculate: $2H_2S + 3O_2 \rightarrow 2SO_2 + 2H_2O$
    a. moles of H_2S required
    b. volume of SO_2 gas produced at S.T.P.

17. Given 39.1 g of iron metal, Calculate: $3Fe + 2O_2 \rightarrow 1Fe_3O_4$
    a. moles of oxygen gas consumed. b. mass of iron oxide formed.

18. Use the following information and the balanced reaction below to answer the following questions:
    $4NH_3 + 3O_2 \rightarrow 2N_2 + 6H_2O + 34kJ$
    If 13.6 g of ammonia react with an excess of oxygen gas, calculate:
    a. Mass of water formed.
    b. The volume of nitrogen gas produced at S.T.P.
    c. The energy released from the reaction.

Limiting Factor: For questions 19-24, identify the limiting factor, the amount of excess reactant, and then calculate the amount of indicated product formed from the amounts given. Show all work.

19. Given 6.0 mol of H_2 gas and 1.5 mol of N_2 gas according to the following reaction, calculate the volume of NH_3 gas produced at S.T.P. $3H_2 + N_2 \rightarrow 2NH_3$

20. Given 3.0 moles of methane and 4.0 moles of oxygen, calculate the moles of carbon dioxide gas produced.
    $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

21. Given 5.0 mol of acetylene and 11.0 mol of oxygen gas, calculate the moles of CO_2 gas produced.
    $2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$

22. Given 5.0 mol of sulfur and 8.4 mol of oxygen gas, calculate the mass of SO_3 gas produced.
    $2S + 3O_2 \rightarrow 2SO_3$

23. Given 0.16 g of hydrogen gas and 5.6 g of nitrogen gas, calculate the mass of HN_3 produced.
    $H_2 + 3N_2 \rightarrow 2HN_3$

24. Calculate the mass of carbon dioxide gas produced given 10.5 g of ethane gas reacting with 38.4 g of oxygen gas according to the following reaction:
    $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

25. Calculate the relative atomic mass of substance X if it has 2 isotopes:
    Isotope 1 has a mass of 23.568 amu and is 43.9% abundant, and Isotope 2 has a mass of 24.898 amu and is 56.1% abundant.

26. Calculate the percent composition of each element in the following compounds:
    a. $NaHCO_3$ b. $K_2S_2O_3$

27. What mass of mercury would be found in a 25.0 g sample of Hg_2S?

28. What would be the formula of a compound with the following empirical formula?
    a. 30.44% N and 69.56% oxygen b. 81.7% C and 18.3% H

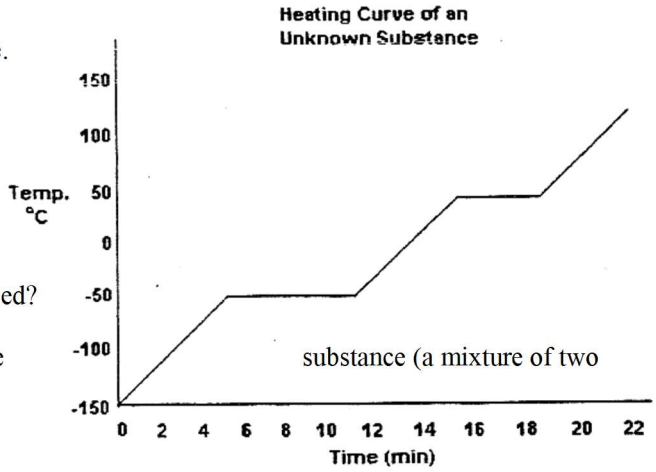
UNIT 2 – PHYSICAL PROPERTIES OF MATTER

Define the following terms as they relate to chemistry.

- freezing temperature
- vapour pressure
- manometer
- amorphous
- sublimation
- crystal lattice
- unit cell
- allotrope
- kinetic molecular theory
- boiling point
- barometer
- phase change

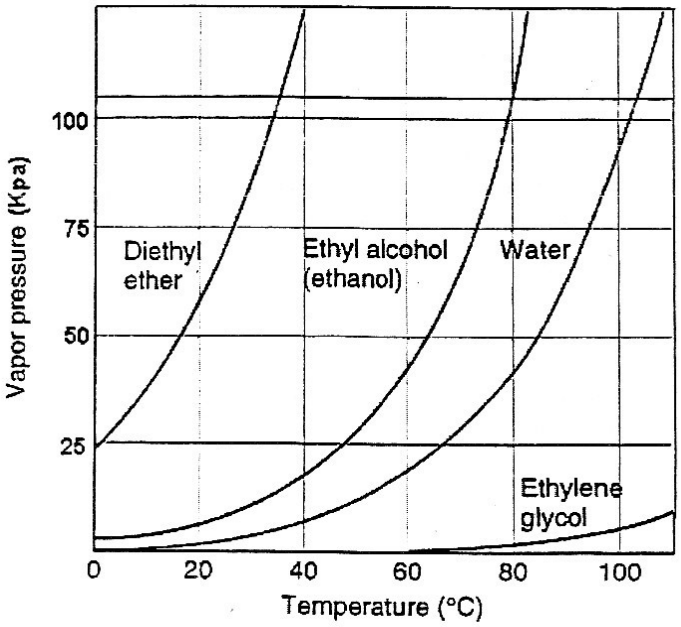
Using the graph:

1. Label the different states of matter represented at each phase.
   a. The boiling point is _____
   b. The melting point is _____
2. Explain what is represented by the plateaus.
3. Why is there no change in temperature at the plateaus?
4. How would the graph change if there was a larger sample used?
5. How would the graph change if the substance was an impure or more substances)?
6. Indicate, on the graph, when KE changes and when PE changes.



7. Sketch a cooling curve for the same substance from 200°C to 0°C.
   a. What would be the freezing point? b. What would be the condensing point?

Vapour Pressure:



8. Using the graph, compare the three substances measured. Which one has the greatest intermolecular forces?
9. How do you know?
10. The normal boiling point of ethanol is _____.
11. How could we make water boil at 80°C?
12. Explain the process of boiling. Discuss what happens to the molecules, temperature and energy.
13. How do a substance's intermolecular forces contribute to a substance melting or boiling point?
14. How are evaporation and boiling similar? Different?
15. What are the three IMF discussed in class? How do these forces relate to melting and boiling points?
16. How is temperature related to the kinetic energy of a substance?
17. Differentiate between solids, liquids, and gases in terms of shape, compressibility, and volume.
18. What are the three main points of the kinetic molecular theory?
19. Using the KMT, explain why a balloon collapses when it is placed in the fridge.
20. Why is evaporation considered to be a cooling process?

UNIT 3 – GASES & THE ATMOSPHERE

1. How do you convert between Kelvin and degrees Celsius?

2. Express your understanding of Boyle's law:
   a. In words
   b. Symbolically
   c. With drawings representing what occurs at the molecular level.
   d. Describe two everyday examples that demonstrate Boyle's Law.

3. Express your understanding of Charles's law:
   a. In words.
   b. Symbolically
   c. With drawings representing what occurs at the molecular level.
   d. Describe two everyday examples that demonstrate Charles's Law.

4. Express your understanding of Gay-Lussac's law:
   a. In words.
   b. Symbolically
   c. With drawings representing what occurs at the molecular level.
   d. Describe two everyday examples that demonstrate Gay-Lussac's Law.

5. At 25°C, a gas occupies 340.0 L and exerts a pressure of 954 kPa. What pressure would the gas exert if the volume was increased to 500.0 L?

6. A gas, with an initial pressure of 850 mmHg, is later found to occupy a volume of 24.0 L at a pressure of 75.0 kPa. What was the initial volume of the gas if the temperature does not change?

7. If the temperature of 8.00 L of a gas at 25.0°C is increased to 227°C, determine the volume at the new temperature.

8. If the volume of 20.0 L of gas is increased to 235 L when the temperature is raised to 855°C, what was the initial temperature of the sample?

9. Divers get "the bends" if they come up too fast because gas in their blood expands, forming bubbles in their blood. If a diver has 0.050 L of gas in his blood under a pressure of 250 atm, then rises instantaneously to a depth where his blood has a pressure of 50.0 atm, what will the volume of gas in his blood be? Do you think this will harm the diver?

10. A gas that has a volume of 28.0 liters, a temperature of 45.0 ^{0}C, and an unknown pressure has its volume increased to 34.0 liters and its temperature decreased to 35.0 ^{0}C. If I measure the pressure after the change to be 2.00 atm, what was the original pressure of the gas?

11. If I have 2.90 L of gas at a pressure of 5.00 atm and a temperature of 50.0 ^{0}C, what will be the temperature of the gas if I decrease the volume of the gas to 2.40 L and the pressure to 3.00 atm?

12. A cylinder of gas has a pressure of 10.0 atmospheres at room temperature of 20.0°C. If the cylinder were taken outside to a welding job where the temperature was -20.0°C, what would be its pressure?

13. From the list of scientists below, select three and write about their connection to gases and the atmosphere.

Amadeo Avogadro	John Dalton	Blaise Pascal
Jacques Charles	Galileo Galilei	Robert Boyle
Joseph Louis Gay-Lussac	Christiaan Huygens	Evangelista Torricelli

14. Has oxygen always been a component of the earth's atmosphere? What conditions led to its increased abundance?

15. How is air quality defined and measured in Canada? What is the Canadian Government doing to improve air quality?

16. What is air pollution? What are two main components of smog?

UNIT 4 – SOLUTIONS

1. Describe how one could increase the solubility of a solid in a liquid.

2. A glass of cold water left sitting on a counter at room temperature usually develops many small gas bubbles on the inside of the glass. Describe what is likely happening.

3. Discuss how the solubility of a substance is dependent on the nature of the solute and solvent.

4. Explain the difference between an unsaturated, a saturated and a supersaturated solution.

5. What three things can generally be done to increase the amount of solid that will dissolve in a solvent?

6. Write the reaction or equation that represents the dissolving of the following compounds in water:
   a. Na_2SO_4 →
   b. $(NH_4)_2CO_3$ →

7. Using your solubility chart determine which of the following compounds are soluble or insoluble. If it is insoluble write the correct molecular formula.
   a. aluminum hydroxide
   b. calcium nitrate
   c. magnesium phosphate
   d. zinc chloride
   e. iron (III) sulphate
   f. rubidium carbonate

8. Write double replacement reactions for the mixing of the following solutions(include phases)
   a. lithium sulphate and lead (II) nitrate
   b. ammonium phosphate and calcium chloride

9. Use the solubility graph to answer the following questions:
   a. What is the solubility of $NaNO_3$ at 10°C?
   b. What temperature would saturate 4 g/10 g H_2O solution of KCl?
   c. What kind of solution is
      i. 8 g/50 mL $KClO_3$ at 80°C?
      ii. 30 g/25 mL of $NaNO_3$ at 25°C
      iii. 110g / 200 mL of NH_3 at 20°C
   d. At what temperature do solubilities of NaCl and NH_4Cl become the same?
   e. A solution of KNO_3 contains 80 g/100 g H_2O at 70°C. What three things could be done to saturate this solution?

10. Describe in detail how you would prepare 250.0 ml of a 0.400 mol/L solution of NaCl.

11. Calculate the concentration if 0.400 mol of NaCl is dissolved in 500.0 ml of solution.

12. Calculate the mass of solid required to make 150.0 ml of 0.75 mol/L solution of $NaHCO_3$.

13. Determine the final concentration when 75.0 ml of water is added to 150.0 ml of a 0.855 mol/L solution of H_2SO_4.

14. What mass of sodium sulfate would be needed to make 50.0 ml of 0.150 mol/L solution?

15. If 50.0 ml of water was added to a solution with a volume of 125.0 ml having a concentration of 0.400 mol/L, what would be the new concentration?

16. 325.0 ml of water was added to 150.0 ml of 0.200 mol/L solution. Calculate the new concentration.

17. 250 ml of a 0.600 mol/L solution is diluted to 400.0 ml. Calculate the new concentration.

18. Calculate what volume of a stock 6.00 mol/L HNO_3 acid would be needed to make 400.0 ml of a 0.200 mol/L solution.

19. What volume of water must be added to 50.0 ml of a 0.900 mol/L solution to make a 0.180 mol/L solution?

20. Calculate the concentration of a 200.0 ml solution that contains 0.250 moles of solute.

21. Find the concentration of a solution that contains 1.45 moles dissolved in 2.30 L of solution.

22. What mass of $AgNO_3$ would be needed to make 250.0 ml of a 1.50 mol/L solution?

23. How much solution would be needed to dissolve 50.0 g of K_2SO_4 to make a 0.500 mol/L solution?

24. What volume of solution would be required to dissolve 18.04 g of aluminum sulfide to make a 0.160 mol/L solution?

25. If you have 150 mL of a 30% aqueous solution of ethanol, what volume of ethanol is in the solution?

26. What is the percent by mass of $NaHCO_3$ in a solution containing 20 g of $NaHCO_3$ dissolved in 600 mL of water?

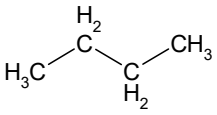
27. A 100.5 mL intravenous solution contains 5.1 g of glucose ($C_6H_{12}O_6$). What is the concentration of the solution?

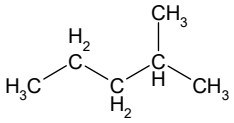
UNIT 5 – ORGANIC CHEMISTRY

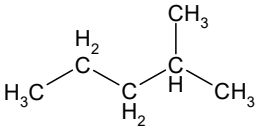
1. Compare and Contrast alkanes, alkenes and alkynes in terms of:

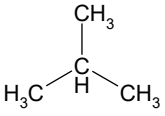
	Alkanes	Alkenes	Alkynes
Bonding			
General Formula			
Structural Formula			
Reactivity			
Uses			

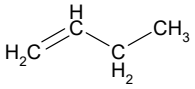
2. Name the following:

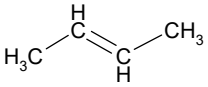
a. 

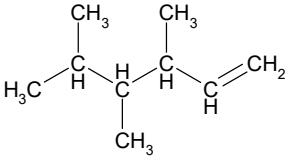
b. 

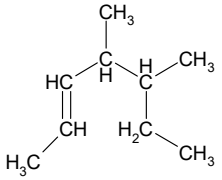
c. 

d. 

e. 

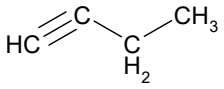
f. 

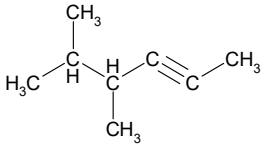
g. 

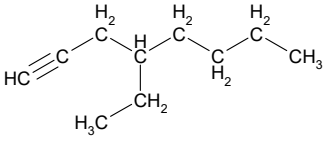
h. 

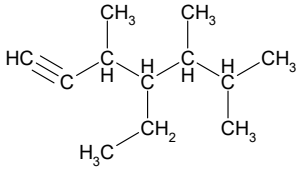
3. Draw and name all the structural isomers for the formula C_5H_{10}

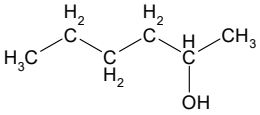
4. Name the following:

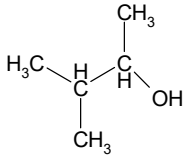
a. 

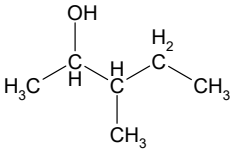
b. 

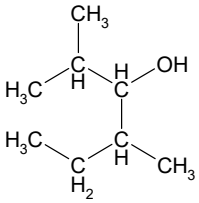
c. 

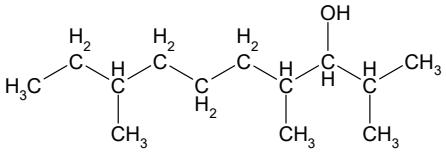
d. 

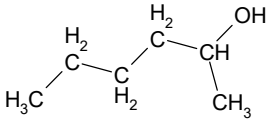
e. 

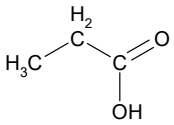
f. 

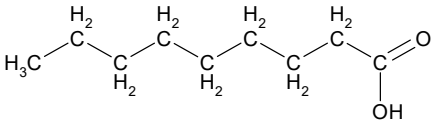
g. 

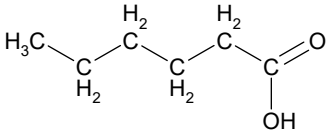
h. 

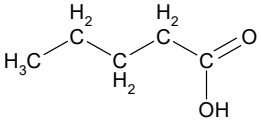
i. 

j. 

k. 

l. 

m. 

n. 

5. Draw each of the following structures and give the name of the group to which each belongs.
   a. 3-ethyl -4-methyloctane
   b. 3,4-diethyl-2 hexene
   c. 3-ethylhexane
   d. pentyl-butanoate
   e. butanoic acid
   f. 2-propanol
   g. 2,4-dimethyl-3 heptanol
   h. ethyl propanoate
   i. ethyl ethanoate