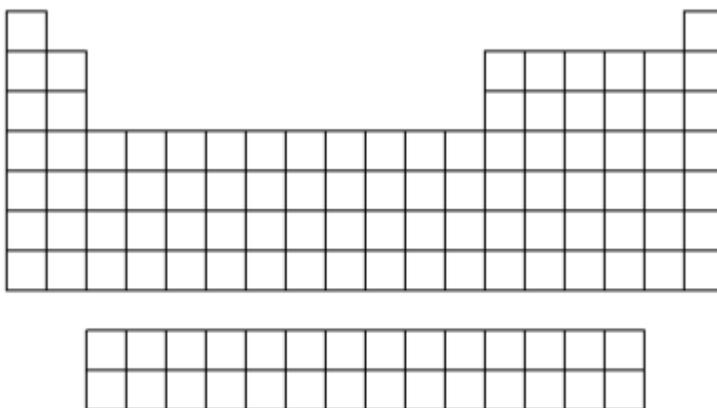


# Grade 11/12 Exam Review

1. On the periodic table below, label the following groups of elements: metals, non-metals, metalloids, transition metals, halogens, noble gases, alkali metals, and alkaline earth metals.



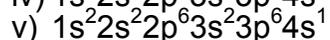
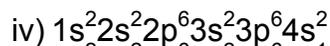
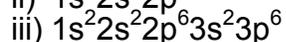
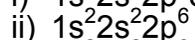
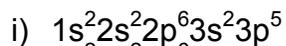
2. Fill in the following chart with the number of electrons, protons, neutrons, atomic number, mass number, and the element notations

Atom	Atomic Number	Mass Number	# of Protons	# of neutrons	# of electrons
K <sup>+</sup>					
P <sup>3-</sup>					
	13		13	14	
		75		42	
	74	184	74		
P <sup>3-</sup>					

3. Draw **Bohr diagrams** and **Lewis dot diagrams** for the following elements and ions: Li, O, and F

4. Draw **Bohr diagrams** of the following **IONS**: Mg<sup>2+</sup>, B<sup>3+</sup>, and N<sup>3-</sup>

5. Consider the following electron configuration for neutral atoms:



- Which of these would you expect to be an alkaline earth metal?
- List the five atoms in order of increasing atomic radii?
- Which of these would you expect to have the lowest ionization energy?
- Which of the following would you expect to be in the same family?

6. Consider the following atoms:  $^{16}_8\text{X}$ ,  $^{17}_9\text{Y}$ , and  $^{17}_8\text{Z}$

Which of these atoms (if any) are isotopes of the same element? Explain your reasoning.

7. Find the average atomic mass of P, when P-30 has a 77% abundance, and P- 32 has a 23% abundance.

8. Use the following information provided below to calculate the average atomic mass of element X/

ISOTOPE	ABUNDANCE	MASS (amu)
$^{302}\text{X}$	12.64	302.04
$^{304}\text{X}$	18.23	304.12
$^{306}\text{X}$	69.13	305.03

9. What is ionization energy, electron affinity, and electronegativity?

10. Describe what happens to the **atomic radius** and effective **nuclear charge** across a row and down a group.

11. All of the trends in the periodic table can be explained by two major factors: Effective nuclear charge and distance of electrons from nucleus. For the following elements decide which one has a larger atomic radius, electronegativity, ionization energy, and reactivity.

		Largest Atomic Radius	Largest Electronegativity	Largest Ionization Energy	Greatest Reactivity	Rationale/Justification for choice.
O	Po					
B	N					
Ni	Pt					
Au	Cu					
As	N					
I	Cl					

12. Describe how reactivity is linked to ionization energy for the metals and electron affinity for the non- metals.

13. What is the octet rule and what does it mean for any element that has its octet full?
14. What is the bonding capacity of the following elements: P, S, Cl, N, O, and F
15. Define the following terms: alloy, metalloid, solution, hydrate
16. Describe the difference between **ionic bonds** and **covalent bonds** (non-polar and polar covalent). Be sure to include which type of elements are joined together for each type of bond, how strong the bond is, if the electrons are either transferred or shared.
17. Describe polar covalent, non-polar covalent, pure-covalent, and ionic bond with respect to electro-negativities.
18. Determine the bond type in the following compounds using electronegativity values, and indicate if they are ionic or covalent bonds and draw the appropriate Lewis structures.  
 a) LiF                                      b) F<sub>2</sub>                                      c) MgS                                      d) CO<sub>2</sub>
19. Distinguish fully between polar and non-polar substances, and their ability to dissolve in different solvents.
20. Name the following compounds:

NaF	
CoO	
MgH <sub>2</sub>	
SO <sub>2</sub>	
Li <sub>2</sub> O <sub>2</sub>	
AgOH	
HBr <sub>(aq)</sub>	
AlN	
Cu(NO <sub>3</sub> ) <sub>2</sub>	
HBrO <sub>3(aq)</sub>	
LiH <sub>2</sub> PO <sub>4</sub>	

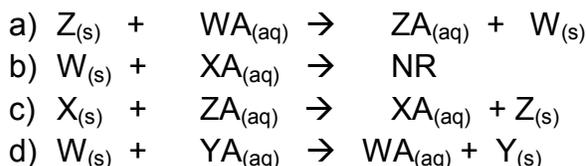
LiBr	
Sn(O <sub>2</sub> ) <sub>2</sub>	
SbBr <sub>5</sub>	
NaBrO <sub>2</sub>	
HgO	
CS <sub>2</sub>	
HBrO <sub>2(aq)</sub>	
Ba(ClO <sub>4</sub> ) <sub>2</sub>	
Na <sub>2</sub> CO <sub>2</sub>	
Mg(MnO <sub>2</sub> ) <sub>2</sub>	
LiCN	

21. Write the chemical formula for the following:

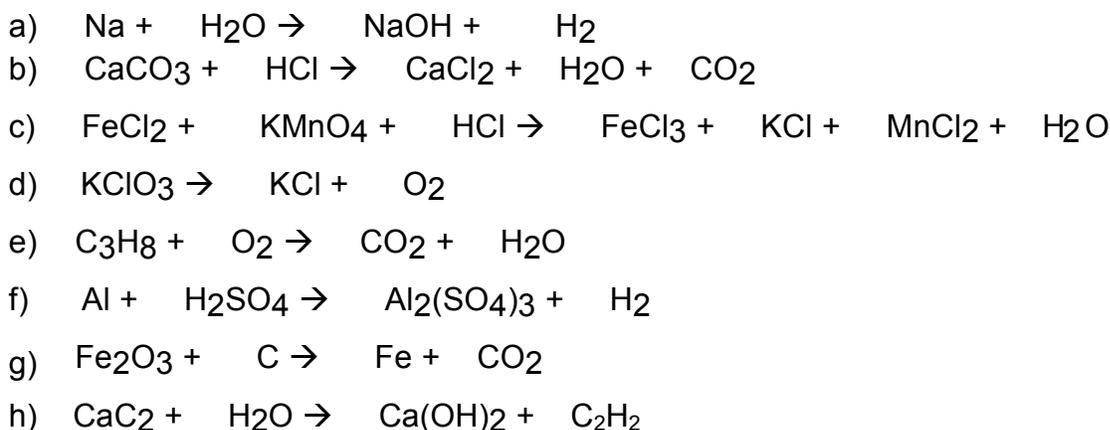
sodium bromide	
ferric hydroxide	
barium carbonate	
silver perchlorate	
aluminum hypobromite	
nikel (ii) sulfate	
carbon tetrachloride	
antinomy (v) perbromate	
lithium manganate	

copper (ii) nitrate	
potassium sulfite	
manganese (iv) oxide	
hypobromous acid	
lithium phosphite	
dihydrogen monoxide	
zinc hydrogen phosphate	
magnesium dichromate	
bimuth (v) sulfide	

22. Distinguish fully between *intermolecular* and *intramolecular* forces.
23. In an experiment designed to compare the reactivity of 4 metals (W,X,Y, and Z), the metallic elements were reacted with aqueous solutions containing their ions and an anion A. The following observations were made when the single displacement reactions were attempted.

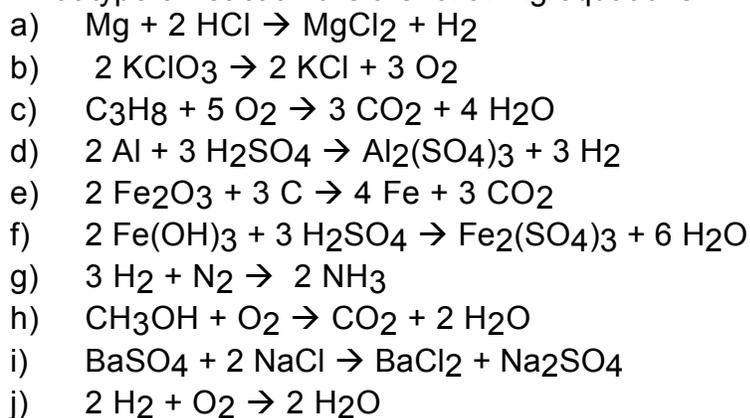


24. Balance the following equations.

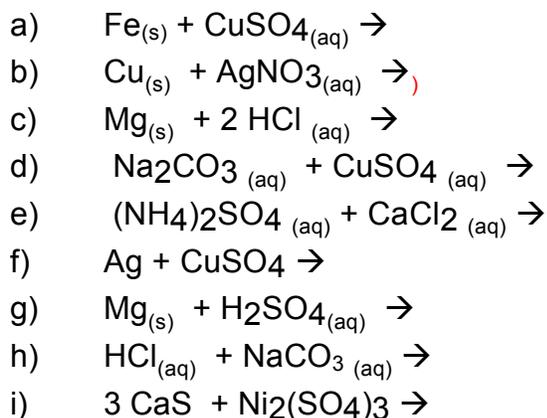


25. Define the law of conservation of mass and the law of definite proportions

26. What type of reaction are the following equations.



27. Complete the following reactions. Remember to balance them and indicate states.



28. For the following pairs of aqueous solutions write the balanced chemical equation, total ionic equation and net ionic equation.

- a) sodium sulfide and iron (II) sulfate
- b) ammonium iodide and silver nitrate
- c) potassium carbonate and iron (II) nitrate

29. Distinguish **fully** between the following terms:

- a) Limiting reagent and excess reagent
- b) Actual yield and theoretical yield
- c) Empirical formula and molecular formula

30. What is the molar mass of the following?

- a)  $\text{NH}_3$
- b)  $\text{AgNO}_3$
- c)  $\text{C}_6\text{H}_{12}\text{O}_6$
- d)  $\text{Mg}(\text{BrO}_4)_2$

31. How many moles of  $\text{AlBr}_3$  are there if there is: recall.  $n=m/M$

- a) 4.6 grams
- b) 3.9 grams
- c)  $2.3 \times 10^6 \text{g}$

32. How many grams of  $\text{B}_2\text{S}_3$  is there if there is:

- a) 3.8 moles
- b) 2.9 moles
- c)  $7.3 \times 10^4$  moles

33. How many atoms of He are there if there are:

- a) 4.7 moles
- b) 2.9 moles
- c) 8.6 moles

34. How many atoms of O is there in:

- a) 7.8 moles of  $\text{AgNO}_3$
- b) 9.2 moles of  $\text{CO}_2$
- c) 3.3 moles of  $\text{O}_2$

35. Calculate the percentage by mass of each element in the following compounds:

- a)  $\text{CH}_4$
- b)  $\text{C}_3\text{H}_8$
- c)  $\text{NaHCO}_3$

36. Ammonium nitrate,  $\text{NH}_4\text{NO}_3$ , and ammonium sulphate,  $(\text{NH}_4)_2\text{SO}_4$ , are both used as fertilizers. Show by calculation which compound has the greater percentage by mass of nitrogen.

37. Determine the empirical formula of each of the following compounds, using the percentage composition by mass given.

- a) 85.7% carbon, 14.3% hydrogen
- b) 62.6% lead, 8.4% nitrogen, 29.0% oxygen

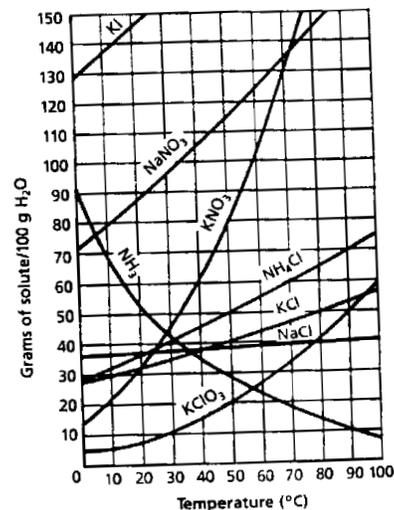
38. Chemical analysis of one of the constituents of gasoline showed that it consists of 92.29% C and 7.71% H by mass. If the molecular mass of the compound is 78 g/mol, determine its molecular formula.

39. A compound of silicon and fluorine was analyzed and found to consist of 33.0% silicon and 67.0% fluorine by mass. The molecular mass of the compound was determined by experiment to be 170 g/mol. What is the molecular formula of the compound?

40. A crystal is added to a solution, Describe what happens to the crystal if the solution is unsaturated, saturated, and supersaturated.

41. Consider the following solubility curves

- a) What is the solubility of  $\text{KNO}_3$ , at  $50^\circ\text{C}$ ?
- b) What must the temperature be to create a saturated solution of  $\text{KNO}_3$ , using 50 g of the salt and 50 g of water?
- c) What mass of  $\text{KNO}_3$  will precipitate if a saturated solution of  $\text{KNO}_3$  at  $60^\circ\text{C}$  is cooled to  $10^\circ\text{C}$ ?





65. Calculate the number of:
- Moles in 45.2 L of carbon dioxide gas at STP
  - Molecules in 45.2 L of carbon dioxide gas at STP
  - Moles in 45.2 L of oxygen gas at STP
  - Moles of 45.2 L of carbon dioxide gas at 25°C and 97.0 kPa
  - 45.2 g of carbon dioxide gas at STP
  - 45.2 g of oxygen gas at STP
66. What is the density of methane gas (CH<sub>4</sub>) at 20°C and 115 kPa?
67. What is the pressure of He if it begins at 78°C with a pressure of 56 kPa and then gets changed to a temperature of 109°C?
68. What is the Temperature of O<sub>2</sub> gas if it starts at 45°C and a volume of 7L and ends at a volume of 30L?
69. What would be the new temperature of a gas that begins at 56°C with a pressure of 90.0 kPa and changes to a pressure of 207 kPa?
70. What would be the final volume of He if it begins at 4.0 °C and at a volume of 8.0 L, once the temperature is increased by 7.0°C.
71. What would be the pressure of F<sub>2</sub> gas if the initial pressure was 67 kPa and the volume increased from 4.0 L to 9.0 L.
72. What is the initial volume of Cl<sub>2</sub> if it ends with a volume of 6.0L? The initial pressure is 145 kPa with a temperature of 70°C and ends with a pressure of 200 kPa with a temperature of 45°C.
73. A sample of gas has a volume of 150mL at 260K and 92.3 kPa. What will the new volume be at 376K and 123 kPa?
74. In a large syringe, 48 mL of ammonia gas at STP is compressed to 24 mL and 110 kPa. What must the new temperature of the gas be?
75. What is the temperature of Ar if there is 3.6 g, 560 kPa, and 7.4L? Remember R=8.31 kPa L/mol K
76. A balloon contains 2.0 L of He gas at STP. How many moles of He are present?
77. A student collected 245 mL of unknown gas X over water at an atmospheric pressure of 108.6 kPa and a temperature of 20°C. If the mass of the gas is 0.7802 g, determine the molar mass of gas X.

## **STIOCHIOMETRY REVIEW PROBLEMS**

78. Use the following equation for all three problems:  $2 \text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2 \text{H}_2\text{O}(\text{g})$
- How many moles of water are produced when 5.00 moles of oxygen are consumed?
  - If 3.00 moles of water are produced, how many grams of oxygen must be consumed?
  - How many moles of hydrogen gas must be used, given that data in problem b)?
  - What mass of water is produced when 105 g of hydrogen gas reacts with excess oxygen?
79. What mass of sodium carbonate must be used in order to produce 10.36 L of carbon dioxide gas at 24°C and 103 kPa, according to the following neutralization reaction.



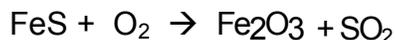
80. Given:  $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$

- What mass of oxygen is required to react with 1200 g of ethanol?
- If 655 g of water is produced, what mass of ethanol is burned?

81. Sodium Hydroxide, when mixed with hydrochloric acid, will produce sodium chloride and water.

- Write the balanced equation for the reaction.
- What mass of sodium hydroxide must be used to produce 225 g of Sodium Chloride?

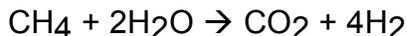
82. The sulphur dioxide produced in this reaction, and in other reactions similar to it, is responsible for much of the acid rain that falls on North America. What mass of iron(III) oxide can be obtained by the roasting of 774 g of the sulphide ore? What mass of sulphur dioxide is produced?



83. One of the reactions used in the smelting of copper ores to produce copper and sulfur dioxide involves reacting copper (I) oxide with copper (I) sulfide. When 250 kg of copper (I) oxide is heated with 125 kg of copper (I) sulfide, 285 kg of copper is recovered.

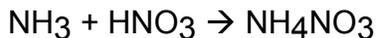
- write the balanced chemical equation for this reaction.
- Determine the limiting reagent.
- Calculate the theoretical yield using stoichiometry
- Determine the percentage yield of copper.

84. Solid carbon dioxide (dry ice) may be used for refrigeration. Some of this carbon dioxide is obtained as a by-product when hydrogen is produced from methane in the following reaction.



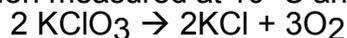
- What mass of carbon dioxide should be obtained from the complete reaction of 1250 g of methane?
- If the actual yield obtained is 3000 g, what is the percentage yield?

85. Ammonium nitrate is an important compound used both as a fertilizer and as an explosive. It is produced by reacting ammonia with concentrated nitric acid.



- What mass of ammonium nitrate can theoretically be produced from the reaction of 375.0 g of ammonia with excess nitric acid?
- If the percentage yield is 88.5%, what mass of ammonium nitrate is actually obtained?

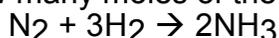
86. During the formation of 35 g of potassium chloride, what volume of oxygen gas was produced when measured at 10°C and 100 kPa?



87. If 129 g of oxygen gas and 300 g of propane are mixed and allowed to react as shown below, determine the volume of water vapour formed at 116 kPa and 120°C?



88. How many moles of the following are required to manufacture 5.0 mol of ammonia?



- Nitrogen
- Hydrogen

89. Consider:  $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$   
How many moles of oxygen are required to react with:
- 3.0 mol of propane
  - 20.0 mol of propane
  - 0.2 mol of propane
90. What volume of 0.520 M sodium hydroxide is needed to neutralize 100 mL of 7.50 M hydrobromic acid solution?
91. If I have 4.15 g of Iron Sulfide, how many grams of Iron (III) Oxide will be made?
- $$4FeS + 5O_2 \rightarrow 2Fe_2O_3 + 4SO_2$$
92. If I have 3.8 g of oxygen, how much water will be made?
- $$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$$
93. If I have 4.5 g of sodium and 6.4 grams of chlorine, which is the limiting reactant and which is in excess?
- $$2Na + Cl_2 \rightarrow 2NaCl$$
94. If I have 3.2 g of aluminum and 5.4 g of bromine, which is the limiting reactant and which is in excess?
95. What mass of carbon dioxide should be obtained from the complete reaction of 1250 g of methane and 2000 g of water?
- $$CH_4 + 2H_2O \rightarrow CO_2 + 4H_2$$
96. If I have 4.3 g of  $N_2H_4$  and 6.8 g of  $O_2$ , what will the percent yield be if in a Reaction, I get 4.9 g of  $HNO_3$  produced?
- $$2N_2H_4 + 7O_2 \rightarrow 4HNO_3 + 2H_2O$$
97. Consider the following reaction:  
 $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$
- If 1.5 L of propane gas are burned in a barbecue what volume of carbon dioxide is produced **and** what volume of oxygen is consumed? (Assume all gases are at STP)
  - If 35 g of propane gas is burned in a barbecue what volume of water vapor is produced assuming SATP?
  - If 35 g of propane gas is burned in a barbecue what volume of oxygen gas is consumed at SATP?
98. Excess Pb(II) reacts with 25 mL of 1.5 M hydrofluoric acid to produce hydrogen gas at  $22^\circ C$  and 88.5 kPa. How many liters of dry hydrogen gas are collected?
99. 100.0 mL of 0.20 mol/L sodium carbonate solution and 200.0 mL of 0.10 mol/L calcium nitrate solution are mixed together. Calculate the mass of precipitate that will form, and the concentration of each of the ions remaining in solution.
100. 500.0 g of copper metal is reacted with 2.50 L of 3.00 mol/L nitric acid solution. Calculate how much of the copper metal remains after the reaction is complete.