

Grade 11 Chemistry Exam Review

1. 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 ⁺					
Es					
Mo					
P ³⁻					
	13		13	14	
		75		42	
				117	78
		184	74		
	99	252			
		260		157	

2. Draw Bohr diagrams and Lewis dot diagrams for the following elements: Li, Ca, Al, C, P, O, F, K
 3. Draw Bohr diagrams of the following ions: Na⁺, Mg²⁺, B³⁺, Si⁴⁺, N³⁻, S²⁻, Cl⁻.
 4. Find the average atomic mass of P when the atomic mass with 15 neutrons is 30 is in 77% abundance and the atomic mass with 17 neutrons is 32 is in 23% abundance. (30.46 amu)
 5. Find the Average atomic mass of Ca when the element which has 20 neutrons is in 12% abundance and the element which has 21 neutrons is in 88% abundance. (40.88 amu)
 6. Find the average atomic mass of Cr if the atomic number is 24 and the two isotopes are; 18 neutrons at 97% abundance, and 19 neutrons at 3% abundance. (42.03 amu)
 7. What is ionization energy, electron affinity, and electronegativity?
 8. For the following elements decide which one has a larger atomic radius, electronegativity, ionization energy, and reactivity.

		Atomic Radius	electronegativity	ionization energy	reactivity
		largest	largest	largest	greatest
O	Po				
B	N				
Ni	Pt				
Mg	Ra				
K	Fe				
Ag	Rb				
Au	Cu				
Hg	Zn				
I	Cl				
As	N				

9. Describe how the atomic radius gets smaller as we add more electrons in a row.
 10. Describe how the reactivity is linked to ionization energy for the metals and electron affinity for the non-metals.
 11. Which family of elements do the following elements belong?
 a) He _____ b) Cl _____
 c) Ca _____ d) Cs _____
 e) Pm _____ f) Es _____
 g) Yb _____ h) I _____
 i) Np _____ j) Sr _____
 k) Fr _____ l) Xe _____
12. What is the octet rule and what does it mean for any element that has its octet full.
 13. What is the bonding capacity of the following elements: P, S, Cl, Na, K, Ba, B, Mg, Li, Si
 14. Define the following terms: alloy, metalloid, solution, hydrate
 15. How is the matter classified?
 16. Describe the difference between ionic bonds and covalent bonds. 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. Indicate whether the following are ionic or covalent bonds and draw the lewis structures would look with the bonds.
 a) LiF b) F₂ c) MgS d) O₂
 e) AlF₃ f) CO₂ g) H₂O h) Mg₃N₂

18. Describe polar covalent, non-polar covalent, pure covalent, and ionic bond with respect to electronegativities.

19. Discuss polar vs non-polar substances and their ability to dissolve in different solvents.

20. Name the following compounds

- | | | | | | |
|---|--------------------------|-----------------------------------|-----------------------------------|---|--------------------|
| a) NaF | b) CaF ₂ | c) CoO | d) Mg ₃ N ₂ | e) ZnBr ₂ | f) CO ₂ |
| g) SnCl ₂ | h) CrF ₂ | i) MnO ₂ | j) MnS ₂ | k) Cu ₃ N ₂ | l) SO ₂ |
| m) AsBr ₃ | n) CuO | o) AlBr ₃ | p) Hg ₂ O | q) Br ₂ O | r) FrH |
| s) SnS ₂ | t) MnCl ₂ | u) Li ₂ O ₂ | v) CaO | w) AlN | x) KH |
| y) BeBr ₂ | z) SnS | ai) LiBr | bi) SnCl ₄ | ci) MgH ₂ | di) CO |
| ei) SbBr ₅ | fi) Cu ₂ O | gi) Li ₂ O | hi) MnS ₂ | ii) MnCl ₄ | j) SrO |
| ki) HgO | li) CCl ₄ | mi) Cu ₃ N | ni) CS ₂ | oi) NaBrO ₂ | |
| pi) Ca(NO ₃) ₂ | qi) Fe(ClO) ₂ | ri) HBrO ₂ | si) HgCO ₃ | ti) Ba(ClO ₄) ₂ | |
| ui) Li ₃ PO ₃ | vi) CuS | wi) PbF ₄ | xi) MgCO ₃ | yi) Al ₂ (SO ₃) ₃ | |
| zi) Ca ₃ (PO ₃) ₂ | | | | | |

21. Write the chemical formula for the following

- | | |
|----------------------------|-----------------------------|
| a) Sodium Bromide | b) Copper (II) Nitrite |
| c) Ferric Hydroxide | d) Magnesium Carbonate |
| e) Iron (II) Sulfide | f) Potassium Sulfite |
| g) Barium Carbonate | h) Lead (IV) Phosphate |
| i) Sodium Perchlorate | j) Hypobromous Acid |
| k) Dihydrogen Monoxide | l) Bismuth (V) Sulfide |
| m) Tin (IV) Fluoride | n) Manganese (IV) Oxide |
| o) Cesium Sulfite | p) Silver Iodide |
| q) Sulfur Trioxide | r) Calcium Chloride |
| s) Aluminum hypobromite | t) Calcium Phosphate |
| u) Sodium Oxide | v) Lithium Phosphite |
| w) Silver Perchlorate | x) Zinc Chlorite |
| y) Lithium Sulfate | z) Carbon Tetrachloride |
| ai) Cobalt (III) Hydroxide | bi) Calcium Hypobromite |
| ci) Magnesium Iodate | di) Potassium Sulfate |
| ei) Nickel (II) Sulfate | fi) Antimony (V) Perbromate |
| gi) Calcium Phosphite | hi) Silver Nitrate |

22. Balance the following equations.

- $\text{Na} + \text{H}_2\text{O} \rightarrow \text{NaOH} + \text{H}_2$
- $\text{CaCO}_3 + \text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$
- $\text{Mg} + \text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$
- $\text{KClO}_3 \rightarrow \text{KCl} + \text{O}_2$
- $\text{C}_3\text{H}_8 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
- $\text{Al} + \text{H}_2\text{SO}_4 \rightarrow \text{Al}_2(\text{SO}_4)_3 + \text{H}_2$
- $\text{Fe}_2\text{O}_3 + \text{C} \rightarrow \text{Fe} + \text{CO}_2$
- $\text{NH}_3 + \text{O}_2 \rightarrow \text{NO} + \text{H}_2\text{O}$
- $\text{Fe}(\text{OH})_3 + \text{H}_2\text{SO}_4 \rightarrow \text{Fe}_2(\text{SO}_4)_3 + \text{H}_2\text{O}$
- $\text{CaC}_2 + \text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2 + \text{C}_2\text{H}_2$
- $\text{CH}_3\text{OH} + \text{O}_2 \rightarrow \text{CO} + \text{H}_2\text{O}$
- $\text{FeCl}_2 + \text{KMnO}_4 + \text{HCl} \rightarrow \text{FeCl}_3 + \text{KCl} + \text{MnCl}_2 + \text{H}_2\text{O}$
- $\text{Cu} + \text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{NO} + \text{H}_2\text{O}$

23. Define the law of conservation of mass

24. Define the law of definite proportions

25. Define the law of constant composition

26. What type of reaction are the following unbalanced equations. Balance them

- $\text{Na} + \text{H}_2\text{O} \rightarrow \text{NaOH} + \text{H}_2$
- $\text{Mg} + \text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$
- $\text{KClO}_3 \rightarrow \text{KCl} + \text{O}_2$
- $\text{C}_3\text{H}_8 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
- $\text{Al} + \text{H}_2\text{SO}_4 \rightarrow \text{Al}_2(\text{SO}_4)_3 + \text{H}_2$
- $\text{Fe}_2\text{O}_3 + \text{C} \rightarrow \text{Fe} + \text{CO}_2$
- $\text{Fe}(\text{OH})_3 + \text{H}_2\text{SO}_4 \rightarrow \text{Fe}_2(\text{SO}_4)_3 + \text{H}_2\text{O}$
- $\text{H}_2 + \text{N}_2 \rightarrow \text{NH}_3$
- $\text{CH}_3\text{OH} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
- $\text{BaSO}_4 + \text{NaCl} \rightarrow \text{BaCl}_2 + \text{Na}_2\text{SO}_4$
- $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$

27. Complete the following reactions. Remember to balance them. If it is a double displacement look at the solubility rules and if it is a single displacement reaction, look at the activity series.

- a) $\text{Fe} + \text{CuSO}_4 \rightarrow$
- b) $\text{Cu} + \text{AgNO}_3 \rightarrow$
- c) $\text{Mg} + \text{HCl} \rightarrow$
- d) $\text{Li} + \text{H}_2\text{O} \rightarrow$
- e) $\text{Na}_2\text{CO}_3 + \text{CuSO}_4 \rightarrow$
- f) $(\text{NH}_4)_2\text{SO}_4 + \text{CaCl}_2 \rightarrow$
- g) $\text{KOH} + \text{Co}(\text{NO}_3)_2 \rightarrow$
- h) $\text{Na}_2\text{S} + \text{Pb}(\text{NO}_3)_2 \rightarrow$
- i) $\text{Zn} + \text{Pb}(\text{NO}_3)_2 \rightarrow$
- j) $\text{Ag} + \text{CuSO}_4 \rightarrow$
- k) $\text{Al} + \text{NiCl}_2 \rightarrow$
- l) $\text{Mg} + \text{H}_2\text{SO}_4 \rightarrow$
- m) $\text{MgS} + \text{Cu}(\text{ClO}_4)_2 \rightarrow$
- n) $\text{Ba}(\text{OH})_2 + \text{ZnSO}_4 \rightarrow$
- o) $\text{KBr} + \text{AgOH} \rightarrow$
- p) $\text{CaS} + \text{Ni}_2(\text{SO}_4)_3 \rightarrow$

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) cesium phosphate and calcium bromide
- c) ammonium iodide and silver nitrate
- d) potassium carbonate and iron (II) nitrate
- e) aluminum nitrate and sodium phosphate

29. What is the molar mass of the following.

- a) NH_3 (17g/mol)
- b) AgNO_3 (170 g/mol)
- c) H_2O (18g/mol)
- d) $\text{C}_6\text{H}_{12}\text{O}_6$ (180g/mol)
- e) AlCl_3 (133.35g/mol)
- f) $\text{Mg}(\text{BrO}_4)_2$ (312.1g/mol)
- g) $\text{Fe}_2(\text{CO}_3)_3$ (292 g/mol)
- h) CO_2 (44 g/mol)

30. How many moles of AlBr_3 are there if there is:

- a) 4.6 grams (0.0172 mol)
- b) 3.9 grams (0.0146 mol)
- c) 2.3×10^6 grams (8625 mol)

31. How many grams of B_2S_3 is there if there is:

- a) 3.8 moles (447 g)
- b) 2.9 moles (341 g)
- c) 7.3×10^4 (8.59 x 10⁶ g)

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

- a) 4.7 moles (2.83×10^{24} atoms)
- b) 2.9 moles (1.75×10^{24} atoms)
- c) 8.6 moles (5.18×10^{24} atoms)

33. How many atoms of O is there in:

- a) 7.8 moles of AgNO_3 (1.4×10^{25} atoms)
- b) 9.2 moles of CO_2 (1.1×10^{25} atoms)
- c) 3.3 moles of O_2 (4.0×10^{24} atoms)

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

- a) CH_4 (%C=75%, %H=25%)
- b) C_3H_8 (%C=81%, %H=19%)
- c) NaHCO_3 (%Na=27.4%, %H=1.2%, %C=14.3%, %O=57.1%)

35. Iron and oxygen combine to form two different compounds. The formulas of the compounds are FeO and Fe_2O_3 . Calculate the percentage by mass of iron and oxygen in each compound. (FeO %Fe=77.7%, %O=22.3% Fe_2O_3 %Fe=70%, %O=30%)

36. Ammonium nitrate, NH_4NO_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. (NH_4NO_3)

37. Determine the empirical formula of each of the following compounds. The percentage composition by mass is given.

- a) 85.7% carbon, 14.3% hydrogen (CH_2)
- b) 52.9% aluminum, 47.1% oxygen (Al_2O_3)
- c) 62.6% lead, 8.4% nitrogen, 29.0% oxygen (PbN_2O_6)

38. A compound of carbon, hydrogen, and chlorine consists of 49.0%, 2.75% hydrogen, and 48.3% chlorine by mass. What is the empirical formula of the compound? ($\text{C}_3\text{H}_2\text{Cl}$)

39. Chemical analysis of rubbing alcohol show that it consists of 59.97% carbon, 13.35% hydrogen, and 26.68% oxygen by mass. What is the empirical formula of rubbing alcohol? ($\text{C}_3\text{H}_8\text{O}$)

40. Chemical analysis of one of the constituents of gasoline showed that it consists of 92.29% carbon and 7.71% hydrogen by mass. If the molecular mass of the compound is 78 g/mol, determine its molecular formula. (C₆H₆)
41. 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? (Si₂F₆)
42. Glucose is an important source of energy for organisms. Analysis of a sample of glucose shows that it consists of 39.95% carbon, 6.71% hydrogen, and the remainder oxygen. In a separate experiment, the molar mass of glucose is found to be 180 g/mol. Determine the molecular formula of glucose. (C₆H₁₂O₆)
43. $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$
- What mass of oxygen is required to react with 1200 g of ethanol (2504 g)
 - If 655 g of water is produced, what mass of ethanol is burned? (558 g)
44. 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 can be prepared by the reaction of 225 g of calcium hydroxide with excess sodium carbonate. (154 g)
- $$4FeS + 7O_2 \rightarrow 2Fe_2O_3 + 4SO_2$$
45. The sulphur dioxide produced in this reaction, and in other reactions similar in 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? (703.5 g, 563.8g)
46. 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.
- $$CH_4 + 2H_2O \rightarrow CO_2 + 4H_2$$
- What mass of carbon dioxide should be obtained from the complete reaction of 1250 g of methane? (3437.5 g)
 - If the actual yield obtained is 3000 g, what is the percentage yield? (87.3 %)
47. 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.
- $$NH_3 + HNO_3 \rightarrow NH_4NO_3$$
- What mass of ammonium nitrate can theoretically be produced from the reaction of 375.0 g of ammonia with excess nitric acid? (1764.7 g)
 - If the percentage yield is 88.5%, what mass of ammonium nitrate is actually obtained? (1561.8 g)
48. Finish the following equations taking into account the solubility rules. Circle all spectator ions (the ones that remain as ions)
- $NaI + Pb(NO_3)_2$
 - $CaCl_2 + Na_2CO_3$
 - $BaBr_2 + Na_2SO_4$
 - $CuSO_4 + K_2CO_3$
 - $NH_4OH + FeI_2$
49. What is the difference between an Arrhenius acid/base and a Bronsted-Lowry acid/base.
50. What is the concentration of a solution of 3.7 moles of CH₄
- 1L (3.7 mol/L)
 - 7L (0.529 mol/L)
 - 450 mL (8.22 mol/L)
51. What is the volume of 5.8 moles of a solution of NaCl
- 4.5 moles/L (1.29 L)
 - 2.9 moles/L (2L)
52. What is the concentration of a solution of 8L of 4.7 moles/L, if it is diluted to 200L. (0.188 mol/L)
53. What is the concentration of a solution of 200 mL of 3.2 mol/L, if it is diluted to 1L. (0.64 mol/L)
54. What is the concentration of sulfate ions in the solution that has 4.0 g of ammonium sulfate dissolved in 350 mL of water?
55. If you perform an acid base titration and place 50 mL of 0.25 mol/L acetic acid into an Erlenmeyer and read the burette initially at 3.5 mL and at the endpoint at 25.2 mL, what is the concentration of the base? (0.576 mol/L)
56. If the hydronium ion concentration of a solution is 2.5×10^{-6} , what is the hydroxide ion concentration, the pH, and the pOH. ([OH⁻]= 4×10^{-9} mol/L, pH=5.6, pOH=8.4)
57. If the hydroxide ion concentration of a solution is 4.7×10^{-4} , what is the hydronium ion concentration, the pH, and the pOH. ([H⁺]= 2.13×10^{-11} mol/L, pH=10.67, pOH=3.33)
58. If the pH of a solution is 3.4, what is the pOH, the hydroxide concentration, and the hydronium ion concentration. (pOH=10.6, [H⁺]= 3.98×10^{-4} mol/L, [OH⁻]= 2.5×10^{-11} mol/L)
59. If the pOH of a solution is 8.4, what is the pH, the hydroxide concentration, and the hydronium ion concentration? (pH=5.6, [H⁺]= 2.5×10^{-6} mol/L, [OH⁻]= 3.98×10^{-9} mol/L)

60. Describe Boyle's Law, Charle's Law, and the Pressure-Temperature Law.
61. What is the difference between STP and SATP?
62. What is the volume of 1 mol of a gas at STP (Molar Volume)
63. 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. (60.5 kPa)
64. What is the Temperature of O₂ gas if it starts at 45°C and a volume of 7L and ends at a volume of 30L? (1372 K)
65. What would be the new temperature of a gas that begins at 56°C with a pressure of 90 kPa and changes to a pressure of 207 kPa. (757 K)
66. What would be the volume of He if it begins at 4°C at of volume of 8L and the temperature then increases by 7°C. (8.09 L)
67. What would be the pressure of F₂ gas if the initial pressure was 67 kPa and the volume increased from 4L to 9L. (29.8 kPa)
68. What is the initial volume of Cl₂ if it ends with a volume of 6L. The initial pressure is 145 kPa with a volume of 7L and ends with a pressure of 200 kPa with a volume of 4L. (8.93 L)
69. $\text{KClO}_3 \rightarrow \text{KCl} + \text{O}_2$
Balance the following equation before starting the question.
During the formation of 35 g of potassium chloride, what volume of oxygen gas was produced when measured at 10°C and 100 kPa. (16.6 L)
70. What is the pressure of F₂ gas if it starts at a volume of 4L and ends at a volume that is increased by 8L and a pressure of 78Kpa. (234 kPa)
71. A sample of gas has a volume of 150mL at 260 K and 92.3 kPa. What will the new volume be at 376 K and 123 kPa?
72. 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?
73. What is the pressure of Ne if it begins at 100kPa, 8L, and 33°C that changes to 2L at 56°C. (412.9 kPa)
74. What is the temperature of Ar if there is 3.6 g, 560 kPa, and 7.4L. Remember R=8.314 kPa L/mol K (5532 K)
75. A balloon contains 2.0 L of He gas at STP. How many moles of He are present?
76. $\text{N}_2 + \text{H}_2 \rightarrow \text{NH}_3$
How many moles of the following are required to manufacture 5.0 mol of ammonia?
a) Nitrogen (2.5 mol)
b) Hydrogen (7.5 mol)
77. $\text{C}_3\text{H}_8 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
How many moles of oxygen are required to react with
a) 3.0 mol of propane (15 mol)
b) 20.0 mol of propane (100 mol)
c) 0.2 mol of propane (1 mol)
78. $\text{FeS} + \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3 + \text{SO}_2$
If I have 4.15 g of Iron Sulfide, how many grams of Iron (III) Oxide will be made? (3.77 g)
79. $\text{C}_2\text{H}_5\text{OH} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
If I have 3.8 g of oxygen, how much water will be made? (2.14 g)
80. $\text{Na} + \text{Cl}_2 \rightarrow \text{NaCl}$
If I have 4.5 g of sodium and 6.4 grams of chlorine, which is the limiting reactant and which is in excess? (Na is the limiting Reactant)
81. $\text{Al} + \text{Br}_2 \rightarrow \text{AlBr}_3$
If I have 3.2 g of aluminum and 5.4 g of bromine, which is the limiting reactant and which is in excess? (Br₂ is the limiting Reactant)
82. $\text{CH}_4 + \text{H}_2\text{O} \rightarrow \text{CO}_2 + \text{H}_2$
What mass of carbon dioxide should be obtained from the complete reaction of 1250 g of methane and 2000 g of water? (2444 g)
83. $\text{N}_2\text{H}_4 + \text{O}_2 \rightarrow \text{HNO}_3 + \text{H}_2\text{O}$
If I have 4.3 g of N₂H₄ and 6.8 g of O₂, what will the percent yield be if in a Reaction, I get 4.9 g of HNO₃ produced? (64%)
84. Consider the following reaction:
 $\text{C}_3\text{H}_{8(g)} + 5\text{O}_{2(g)} \rightarrow 3\text{CO}_{2(g)} + 4\text{H}_2\text{O}_{(g)}$
a) 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)
b) If 35 g of propane gas is burned in a barbecue what volume of water vapor is produced assuming SATP?
c) If 35 g of propane gas is burned in a barbecue what volume of oxygen gas is consumed at SATP?
85. Excess Pb(II) reacts with 25 mL of 1.5 M hydrofluoric acid to produce hydrogen gas at 22 °C and 88.5 kPa. How many liters of dry hydrogen gas are collected?

