# Grade 11 Chemistry Exam Review

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Questions:

***Unit 1: Matter***

1. What is the definition of a solid, liquid and a gas?
2. Name some qualitative and quantitative observations.
3. What is a physical change?
4. What is a chemical change?
5. What are some signs that there was a chemical change?
6. A salt company produces a sample of NaCl that has a mass of 75g. Inside the sample, there is 25g of sodium and 50g of chlorine. The second salt company has a sample mass of 90g. Inside the salt there is 30g of sodium and 60g of chlorine. Determine if these were samples of the same compound. (Hint: calculate percentage of Na and percentage of Cl in NaCl).

***Unit #1: Nomenclature + Balancing equations+ Types of reactions***

7. Define the oxidation number for chlorine in the following:
   a) NaCl b) $ClO_2$ c) $ClO_4^{-1}$ d) $HClO_3$ e) $Fe(ClO_3)_3$
8. State the name for the following binary compounds:

a) $MgCl_2$ b) $Li_2O$ c) $AlBr_3$ d) $CaI_2$

9. State the formula for the following binary elements
   a) Barium sulfide b) beryllium phosphide c) sodium nitride
10. Write names for the following multivalent metal compounds, (classical and stock):
    a) FeO b) $PbI_4$ c) HgF d) $Cu_3N_2$
11. State the formula for the following multivalent metal compounds
    a) Arsenous iodide b) Auric fluoride c) Stibinic sulfide
12. Name the following covalent compounds

a) $XeO_3$ b) $NCl_3$ c) $RnI_4$ d) CO e) $OF_2$ f) $S_2Cl_2$ g) $N_2O_3$

13. State the formula for the following covalent compounds

a) Phosphorous pentabromide b) carbon dioxide c) hydrogen dioxide

14. Name the following polyatomic compounds

a) $CH_3COONH_4$ b) $Fe_2(CO_3)_3$ c) $Al(NO_3)_3$

15. State the formula for the following polyatomic ions

a) Cupric Phosphate b) Hydrogen Cyanide c) Silver acetate

16. Name the following binary acids

a) $HCl_{(aq)}$ b) $HBr_{(aq)}$ c) $H_2S_{(aq)}$

17. State the formula for the following binary acids

a) Hydrophosphoric acid b) Hydroiodic acid c) Hydronitric acid

18. Name the following oxyacids

a) $H_2SO_{4(aq)}$ b) $HNO_{2(aq)}$ c) $HClO_{(aq)}$

19. State the formula for the following oxyacids

a) Carbonic acid b) Perchloric acid c) Acetic acid

20. Name the following hydrated compounds

a) $NiSO_4 . 7H_2O$ b) $Be(NO_2)_2 . 3H_2O$

21. State the formula for the following hydrated compounds

a) Iron (III) sulphate nonahydrate b) Potassium dichromate dihydrate

22. Balance the following equations

a) $H_2S + O_2 \rightarrow SO_2 + H_2$

b) $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$

c) $O_2 + CS_2 \rightarrow CO_2 + SO_2$

d) $Al + H_2SO_4 \rightarrow Al_2(SO_4)_3 + H_2$

e) $BaF_2 + K_3PO_4 \rightarrow Ba_3(PO_4)_2 + KF$

f) $Al + HCl \rightarrow AlCl_3 + H_2$

23. The following experimentwas completed with four metals Z, L, M and N and four solutions: $Z(NO_3)_2$, $LNO_3$, $M(NO_3)_2$ and $N(NO_3)_3$

- Metal L is placed into solutions $M(NO_3)_2$ and $N(NO_3)_3$, there is only a reaction observed with metal N but not metal M.
- Metal Z is placed in all three solutions and reacts with all three solutions.
- Metal N is placed in all three solutions and there is no reaction in all three of them.

1. Write all of the metals in decreasing order from the most reactive to the less reactive metal.
2. Balance all of the possible equations

24. What are the (six) different types of reactions and provide an example for each.

***Unit #1: Measurement and Data Processing***

25. How many sig figs are there in each of the following numbers:
    a) 0.00001
    b) 1.00
    c) 254
    d) 230.
    e) 0.0500
    f) 2.045

***Unit #2: Stoichiometric Relationships***

26. There are $7.45 \times 10^{10}$ molecules of orange juice. How many moles of orange juice have been put in the glass?
27. There are 25 moles of chlorine in a pool. How many molecules of chlorine are there?
28. There are 1.5 moles of $H_2CO_3$. How many oxygenatoms are there?
29. Glucose, $C_6H_{12}O_6$, is used to make bread. The baker at the local bakery uses 4.23g of glucose in his famous bread recipe. Calculate the number of moles of $C_6H_{12}O_6$. Calculate the number of molecules. Find the number of C atoms. Find the number of H atoms. Find the total number of atoms.
30. Sodium bicarbonate, $NaHCO_3$, is used in baking powder. Calculate the percent composition by mass of Na, H, C and O in this compound.
31. Acetic acid, $C_2H_4O_2$, is used in vinegar. Calculate the empirical formula if C= 40.0%, H= 6.70%, O= 53.3%.

32. $2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$, if there is 2.05g of $Fe_2O_3$ and 7.82g of C, determine a) the limiting reagent b) the XS c) the mass of $CO_2$ d) the moles of the XS remaining e) the mass of the XS unused.

***Unit #3: Solution Chemistry***

33. 5.3 moles of Barium Hydroxide is dissolved in 750mL of water. What is the concentration of Barium Hydroxide solution?
34. Dissociate the following compounds
    a) $NaNO_{3(aq)}$
    b) $K_2SO_{4(aq)}$
    c) $MgF_{2(aq)}$
35. If 4.30g of Calcium iodide, $CaI_2$ is dissolved in 400mL of solution. What is the molar concentration of this solution and what is the concentration of the Iodide ions?
36. I have 40.0mL of 20.0M of a solution. In the other solution, I have 5.00M and with 60.0mL. a) How much of the concentrated solution must be put into the dilute solution? B) How much water do we need to add?
37. $Cr_{(s)} + NiCl_{2\,(aq)} \rightarrow CrCl_{3\,(aq)} + Ni_{(s)}$
    a) Balance the above equation
    b) Write the total net ionic equation
    c) Write the net ionic equation
38. What is the difference between a solute and a solvent?
39. $CdSO_{4(aq)} + K_2S_{(aq)} \rightarrow$
    a) Determine which product is the precipitate and name the products.
    b) Write a balanced equation for it.
    c) Define the total dissociated ionic equation.
    d) Define the net ionic equation.
    e) If $CdSO_4$ has 45.0mL of 2.1M and $K_2S$ has 55.0mL of 1.5M, find the LR and the XS.
    f) Define the mass of the produced precipitate.
    g) Define the mass of the XS of moles remaining.
    h) Define the percent yield if the experimental mass produced is 5.85g.
    i) Define the percent error.
    j) Define the $S^{2+}$ concentration in the final solution.
    k) Define the total number of ions in the initial $CdSO_4$ solution.
40. In a solution containing, 50.4g of $BeBr_2$ in 4.00L of solution. What are the concentrations of $Be^{2+}$ and $Br^-$ ?

***Unit #4: Acids-Bases***

41. What are some properties of acids and bases?
42. What's the difference between a strong and a weak electrolyte?
43. Determine which of the following is a Bronsted Lowry acid and a Bronsted Lowry base.

a) $HCl + H_2O \longleftrightarrow Cl^- + H_3O^+$
b) $H_2SO_4 + H_2O \longleftrightarrow HSO_4^- + H_3O^+$
c) $NH_3 + H_2O \longleftrightarrow NH_4^+ + OH^-$

44. Determine which are the Lewis acids and which are the Lewis Bases

a) $NH_3 + BF_3 \rightarrow NH_3 - BF_3$

b) $H^+ + NH_3 \rightarrow NH_4^+$

c) $Cu^{2+} + 4Cl \rightarrow CuCl_4^{2-}$

45. State three experimental methods to determine if it is a weak or a strong electrolyte?
46. 2.34g of HBr reacts with 1.13M of KOH to produce KBr and water. Find the volume of KOH.
47. 0.545M of NaOH reacts with 90.0mL of 0.980M of $H_2SO_4$ to produce a titration reaction. What is the volume of NaOH solution?
48. The hydronium ion has a concentration of $1.47 \times 10^{-5}$. A) State the pH. B) State the pOH. C) State the $OH^-$ concentration.
49. The pOH of a substance is 8.42. Find the hydronium ion concentration.
50. Name all of the a) strong acids b) weak acids c) strong bases d) weak bases.

***Unit #5: Gases***

51. A balloon has a pressure of 36.0 kPa at 65.0 degrees Celsius. If the balloon leaves our atmosphere and enters a different one with the temperature of 40.0 degrees Celsius. What would the new pressure be?
52. The jello was made with a volume of 34.0L and it was made at a temperature of 25 degrees Celsius. Once it was placed into the fridge, the temperature of the jello dropped to 13 degrees Celsius. What is the new volume of the jello?
53. What are the four factors that gases are affected by?
54. The air pressure in a bike tire Is 35 kPa with a volume of 70 L. The new air pressure becomes 465 kPa. What is the new volume of the tire?
55. There is 5.86 g at STP of $N_2O_3$. Find the volume.
56. What mass of argon, Ar, could be held in a container at 30 degrees Celsius, in a 22.0L container with an atmospheric air pressure of 3.14 kPa.
57. What number of moles does Chlorine, Cl have if it is kept at a temperature of 15 degrees Celsius, with 34.0L and at a pressure of 12.0 kPa.
58. A substance contains 74.0 % of carbon, 8.65% of Hydrogen and 17.3% of nitrogen. When approximately 3.10g was evaporated in 30.0L and produced a pressure of 155.0 kPa at 95 degrees Celsius. Calculate the molecular formula.

<u>Answer Key:</u>

***Unit #1: Matter***

1. **Solid:** definite shape, vibrate, molecules very close together and very attracted to each other. They have an ordered arrangement that's periodic and low energy.
   **Liquid:** Floats, particles more separated, no definite shape but take shape of a container. They have moderate attraction and they have moderate energy. They vibrate, rotate and translate.
   **Gas:** No definite shape but expands to fill the container, high energy, not a strong attraction, move in the direction that they can move in. They translate.
2. **Qualitative:** color, feel, taste, smell

**Quantitative:** Mass, pH, measurements (width, length, height)

3. **Physical Change:** Change of state or change of appearance without a change in chemical composition. Change is reversible.
4. **Chemical change**– change in appearance with a change in chemical composition
   - Formation of new materials
   - Heat absorbed or liberated
   - Change is irreversible
5. – Bubbles of gas appear
   - Some precipitate forms
   - A color change occurs
   - The temperature changes
   - Light is emitted
   - A change in volume occurs
   - A change in electrical conductivity occurs
   - A change in the melting point or boiling point occurs
   - A change in smell or taste occurs
   - A change in any distinctive chemical or physical property occurs
6. Yes, the samples are from the same compound. Sample #1 and sample #2, sodium is 33.3% and chlorine is 66.7%.

***Unit #1: Nomenclature + Balancing Equations + Types of Reactions***

7. A) -1 B) +4 C) +8 d) +5 e) +5
8. A) magnesium chloride b) lithium oxide c) aluminum bromide d) calcium iodide
9. A) BaS b) $Be_3P_2$ c) $Na_3N$
10. A) Iron (II) oxide, Ferrous oxide b) Lead (IV) Iodide, Plumbic Iodide c) Mercury (I) fluoride, mercurous fluoride d) Copper (II) nitride, Cuprous nitride
11. A) $AsI_3$ b) $AuF_3$ c) $Sb_2S_5$
12. A) Xenon Trioxide b) Nitrogen trichloride c) Radon tetraiodide d) carbon monoxide e) Oxygen difluoride f) Disulfur dichloride g) Dinitride trioxide
13. A) $PBr_5$ b) $CO_2$ c) $H_2O$
14. A) Ammonium acetate b) Ferric carbonate, Iron (III) carbonate c) Aluminum nitrate
15. A) $Cu_3(PO_4)_2$ b) HCN c) $CH_3COOAg$
16. A) Hydrochloric acid b) Hydrobromic c) Hydrosulfuric
17. A) $H_3P$ b) HI c) $H_3N$
18. A) Sulphuric acid, Sulphuric (VI) acid b) Nitrous acid, Nitric (V) acid c) Chloric (I) acid, Hypochlorous acid
19. A) $H_2CO_3$ b) $HClO_4$ c) $CH_3COOH$
20. A) Nickel (II) sulfate heptahydrate, Nickelic sulfate heptahydrate b) Beryllium nitrite trihydrate
21. A) $Fe_2(SO_4)_3 . 9H_2O$ b) $K_2Cr_2O_7 . 2H_2O$
22. a) $1H_2S + 1O_2 \rightarrow 1SO_2 + 1H_2$(already balanced)

b) $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

c) $O_2 + CS_2 \rightarrow CO_2 + 2SO_2$

d) $2Al + 3H_2SO_4 \rightarrow Al_2(SO_4)_3 + 3H_2$

e) $3BaF_2 + 2K_3PO_4 \rightarrow Ba_3(PO_4)_2 + 6KF$

f) $2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2$

23. K>M>L>N
    - $2LNO_3 + X \rightarrow X(NO_3)_2 + 2L$
    - $M(NO_3)_2 + X \rightarrow X(NO_3)_2 + M$
    - $2N(NO_3)_3 + 3X \rightarrow 3X(NO_3)_2 + 2N$
    - $N(NO_3)_3 + 3L \rightarrow 3LNO_3 + N$
24. Synthesis ex) $Na + Cl \rightarrow NaCl$
    - Decomposition ex) $MgCl_2 \rightarrow Mg + Cl_2$
    - Single displacement ex) $2Al + Fe_2O_3 \rightarrow 2Fe + Al_2O_3$
    - Double displacement ex) $BaCl_2 + Na_2SO_4 \rightarrow BaSO_4 + 2NaCl$
    - Acid-base reactions ex) $MgO + 2HCl \rightarrow MgCl + H_2O$
    - Complete combustion ex) $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$
    - Incomplete combustion ex) $C_3H_6 + O_2 \rightarrow C + CO + CO_2 + H_2O$

***Unit #1: Measurement and Data Processing***

25. A) 1 sig fig b) 3 sig figs c) 3 sig figs d) 3 sig figs e) 3 sig figs f) 4 sig figs
26. $1.24 \times 10^{-13}$ moles

***Unit #2: Stoichiometric Relationships***

27. $1.51 \times 10^{25}$ molecules
28. $5.41 \times 10^{24}$ atoms
29. 0.0235moles, $1.41 \times 10^{22}$ molecules, $8.46 \times 10^{22}$ atoms of C, $1.69 \times 10^{23}$ atoms of H, $3.38 \times 10^{23}$ total atoms
30. Na= 27.4%, H= 1.20%, C= 14.3%, O= 57.1%
31. Empirical formula is $CH_{20}O$
32. The LR is $Fe_2O_3$. The XS is C. The mass of $CO_2$ is 0.847g. There are 0.632 moles of the XS remaining. The mass of the XS remaining is 7.59g.

***Unit #3: Solution Chemistry***

33. 7.07molar
34. a) $Na^+_{(aq)} + NO_3^-{}_{(aq)}$
    b) $K^+_{(aq)} + SO_4^{2-}{}_{(aq)}$
    c) $Mg^{2+}_{(aq)} + F^-_{(aq)}$
35. 0.0293M
36. a) 15mL b) 45.0mL
37. a) $2Cr_{(s)} + 3NiCL_{2\,(aq)} \rightarrow 2CrCl_{3\,(aq)} + 3Ni_{(s)}$
59. $2Cr_{(s)} + 3Ni^{2+}_{(aq)} + 6Cl^-_{(aq)} \rightarrow 2Cr^{3+}_{(aq)} + 6Cl^-_{(aq)} + 3Ni_{(s)}$
60. $2Cr_{(s)} + 3Ni^{2+}_{(aq)} \rightarrow 2Cr^{3+}_{(aq)} + 3Ni_{(s)}$
38. **Solute**: it is the substance that is being dissolved and it is usually present in smaller quantities.
    **Solvent:** It is the substance that is doing the dissolving and it is usually present in a larger amount.
39. A) $CdSO_{4(aq)} + K_2S_{(aq)} \rightarrow$ **$CdS_{(s)} + K_2SO_{4(aq)}$**

b) It is already balanced
c) $Cd^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)} + 2K^+_{(aq)} + S^{2-}_{(aq)} \rightarrow CdS_{(s)} + 2K^+_{(aq)} + SO_4^{2-}{}_{(aq)}$
d) $Cd^{2+}_{(aq)} + S^{2-}_{(aq)} \rightarrow CdS_{(s)}$
e) XS is $CdSO_4$ and the LR is $K_2S$
f) 11.9g
g) 2.50g
h) 49.2%
i) 50.8%
j) 0.945M
k) $3.41 \times 10^{23}$ ions
40. $Be^{2+}$ is 0.14927M and $Br^-$ is 0.29854M

***Unit #4: Acids-Bases***

41. **Acids:** Taste sour, change indicator paper red, pH 0-6, conduct electricity
**Bases:** taste is bitter, change the indicator paper blue, pH 8-14, conducts electricity
42. **Strong electrolytes:** 100% dissociation or ionization to form ions. Greater number of ions.
**Weak electrolytes:** partially, less than 5%, ionized/dissociated (two-way arrow) to form ions. Less ions.
43. A) HCl is the acid, $H_2O$ is the base, $Cl^-$ is the conjugate base and $H_3O^+$ is the conjugate acid
B) $H_2SO_4$ is the acid, $H_2O$ is the base, $HSO_4$ is the conjugate base and $H_3O^+$ is the conjugate acid.
C) $NH_3$is the base, $H_2O$is the acid, $NH_4$ is the conjugate acid and $OH^-$ is the conjugate base.
44. a) Lewis base, Lewis acid
b) Lewis acid, Lewis base
c) Lewis acid, Lewis base
45. –The electrical conductivity apparatus (bright= strong, weak= light)
    - Look at the pH paper that has a various range of colors.
    - Produce a reaction example a metal carbonate reacting with an acid. Production of bubbles rapidly indicates it is an acid.
46. Volume is $2.56 \times 10^{-2}$ L
47. Volume is 0.324L
48. A) The pH is 4.83. b) The pOH is 9.17. c) The hydroxide ion is $6.76 \times 10^{-10}$
49. $2.63 \times 10^{-6}$
50. a) HCl, HBr, HI, $HNO_3$, $H_2SO_4$, $HClO_4$
b) HF, $CH_3COOH$, $H_3PO_4$, $HNO_2$
c) NaOH, KOH, $Ca(OH)_2$, $Ba(OH)_2$ *all elements in group one and elements under calcium in group two plus the hydroxide ion
d) $NH_3$

***Unit #5: Gases***

51. P2 = 33.3kPa

52. V2 = 32.6 L
53. Pressure, Moles, Temperature (in kelvins), Volume
54. V2= 5.27L
55. V= 4.75 L
56. The mass of argon is 1.09g
57. The moles of Chlorine is 5.87.
58. 0.0252 is the new Molar value.