10 Chemistry Exam Revision

1. For the following examples determine whether they are a metal, a non-metal, a semi-metal (metalloid), or a noble gas.

a. Ca metal
b. Si metalloid
c. Br non-metal
d. Co metal
e. Ar non-metal + noble gas
f. K metal
g. O non-metal
h. Se non-metal
i. As metalloid
j. Mn metal
k. Kr non-metal
l. H non-metal

2. Using examples, define the terms:

a. atomic number: the number of protons in an atom
b. mass number: the number of protons and neutrons in an atom
c. isotope: versions of an element with the same number of protons but different numbers of neutrons
d. cation: a positive ion, normally an atom that has lost electrons
e. anion: a negative ion, normally an atom that has gained electrons
f. polyatomic ion: an ion made of multiple atoms
g. soluble: a substance that can dissolve in water
h. insoluble: a substance that cannot dissolve in water

3. Name the following groups on the periodic table:

a. 1: alkali metals
b. 2: alkaline earth metals
c. 17: halogens
d. 18: noble gases

4. Complete the table below:

Element	Charge	Mass No.	Atomic No.	No. Protons	No. Neutrons	No. Electrons
$^{59}_{27}Co$	neutral	59	27	27	32	27
$^{112}_{48}Cd^{2+}$	positive	112	48	48	64	46
$^{80}_{35}Br$	neutral	80	35	35	45	35
P^{3-}	negative	31	15	15	16	18
$^{88}_{38}Sr^{2+}$	positive	88	38	38	50	36

5. Complete the table below for **ionic compounds**:
Use ions table; Do **not** use mono, di, tri etc.

Name	Formula
Potassium chloride	KCl
Magnesium chloride	$MgCl_2$
Aluminium chloride	$AlCl_3$
Sodium nitrate	$NaNO_3$
Sodium carbonate	Na_2CO_3
Sodium phosphate	Na_3PO_4
Calcium nitrite	$Ca(NO_2)_2$
Calcium nitrate	$Ca(NO_3)_2$
Calcium nitride	Ca_3N_2
Zinc sulphite	$ZnSO_3$
Zinc sulphate	$ZnSO_4$
Zinc sulphide	ZnS
Iron (II) oxide	FeO
Iron (III) oxide	Fe_2O_3
Copper (I) hydroxide	$CuOH$
Copper (II) hydroxide	$Cu(OH)_2$
Ammonium nitrate	NH_4NO_3
Ammonium iodide	NH_4I
Ammonium sulphate	$(NH_4)_2SO_4$
silver chloride	$AgCl$
silver acetate	$AgCH_3COO$
silver oxide	Ag_2O
magnesium oxide	MgO
magnesium phosphate	$Mg_3(PO_4)_2$
tin (II) carbonate	$SnCO_3$
sin (IV) chloride	$SnCl_4$
sodium hydrogencarbonate	$NaHCO_3$
barium acetate	$Ba(CH_3COO)_2$

6. Complete the table below for **covalent compounds**:

Do not use ions table; Use mono, di, tri, tetra, penta, hexa, hepta, octa, nona, deca

Name	Formula
sulfur dioxide	SO_2
sulfur trioxide	SO_3
Carbon monoxide	CO
Carbon dioxide	CO_2
Trisulfur octaoxide	S_3O_8
diphosphorous hexafluoride	P_2F_6
dinitrogen pentoxide	N_2O_5
dinitrogen trioxide	N_2O_3

7. Balance the following equations:

$2\ H_{2(g)} + O_{2(g)} \rightarrow 2\ H_2O_{(g)}$

$N_{2(g)} + 3\ H_{2(g)} \rightarrow 2\ NH_{3(g)}$

$2\ C_4H_{10(g)} + 13\ O_{2(g)} \rightarrow 8\ CO_{2(g)} + 10\ H_2O_{(l)}$

$2\ NaMnO_{4(aq)} + H_2O_{2(l)} + 3\ H_2SO_{4(aq)} \rightarrow 2\ MnSO_{4(aq)} + Na_2SO_{4(aq)} + 3\ O_{2(g)} + 4\ H_2O_{(l)}$

$4\ NH_{3(g)} + 5\ O_{2(g)} \rightarrow 4\ NO_{(g)} + 6\ H_2O_{(l)}$

8. Write balanced chemical equations for the following reactions:

i. The decomposition of aluminium carbonate forming aluminium oxide and carbon dioxide.

$Al_2(CO_3)_3 \rightarrow Al_2O_3 + 3\ CO_2$

ii. The decomposition of tin (IV) hydrogencarbonate forming water, carbon dioxide and tin (IV) oxide.

$Sn(HCO_3)_4 \rightarrow SnO_2 + 4\ CO_2 + 2\ H_2O$

iii. Chromium is added to bromine gas forming chromium bromide.

$2\ Cr + 3\ Br_2 \rightarrow 2CrBr_3$

iv. The decomposition of lithium hydrogencarbonate, forming lithium oxide, water and carbon dioxide.

$2\ LiHCO_3 \rightarrow Li_2O + H_2O + 2\ CO_2$

v. Ammonium carbonate solution reacts with manganese (II) iodide solution.

$(NH_4)_2CO_{3(aq)} + MnI_{2(aq)} \rightarrow MnCO_{3(s)} + 2\ NH_4I_{(aq)}$

vi. Aluminium nitrate solution reacts with potassium hydroxide solution.

$Al(NO_3)_{3(aq)} + 3\ KOH_{(aq)} \rightarrow 3\ KNO_{3(aq)} + Al(OH)_{3(s)}$

vii. Sodium bromide solution is added to zinc sulfate solution.

no observable change

viii. Solid lead (II) nitrate is dissolved in water.

$Pb(NO_3)_{2(s)} \rightarrow Pb^{2+}_{(aq)} + 2\ NO_3^-{}_{(aq)}$

9. Name the common chemical tests for the following gases

a. carbon dioxide – limewater test

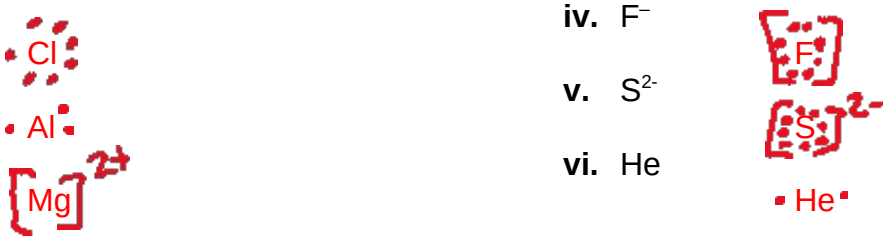
b. hydrogen – pop test
c. oxygen – glowing splint test

10. Write the electron configurations for the following substances.

i. C 2,4
ii. Ne 2,8
iii. Na 2,8,1
iv. O^{2-} 2,8
v. Ca^{2+} 2,8,8
vi. N^{3-} 2,8

11. Draw Lewis (electron dot) diagrams for the following:

i. C*l*
ii. A*l*
iii. Mg^{2+}
iv. F^-
v. S^{2-}
vi. He



12. Using examples, describe the relationship between the number of energy shells (levels) and valence electrons an atom has and its position on the periodic table.
Number of electrons determine the group number and number of electron shells determine the period. E.g., silicon is in group 14 because it has 4 valence electrons and is in period 3 because it has 3 electron shells.

13. In the following reaction; $CaCO_{3(s)} + 2HCl_{(aq)} \rightarrow CaCl_{2(aq)} + CO_{2(g)} + H_2O_{(l)}$, describe:

i. Two ways to measure the reaction rate.
time how long it takes CaCO3 to dissolve, time how long it takes to stop bubbling, time how long it takes to displace water out of a test tube

ii. Explain three ways to speed this reaction up (i.e., describe how the reaction rate increases rather than just listing how it could be sped up).
Heat the solution, crush the CaCO3 or shake the solution, see question 15 answers for explanations.

14. List the 3 requirements for a reaction to occur according to collision theory.

1. reactants must collide
2. reactants must collide with sufficient energy (activation energy)
3. reactants must collide with a favourable orientation

15. Use collision theory to explain in detail how each of the following factors can increase reaction rate:

a. Temperature
   Increasing temperature increases the kinetic energy of the particles, increasing the proportion of collisions that have sufficient kinetic energy to meet the activation energy which increases the rate of successful collisions and so increases the reaction rate. Also, the particles move faster and so the rate of collisions increases which also increases the reaction rate.
b. Concentration
   Increasing concentration decreases the distance between the particles which increases the rate of collisions which increases the reaction rate.
c. Agitation
   Agitation increases the number of reactant particles exposed to each other at the same time which increases the rate of collisions which increases the reaction rate.
d. Surface area
   Increasing the surface area exposes more reactant particles to each other at the same time which increases the rate of collisions which increases the reaction rate.
e. Catalysts
   Catalysts provide an alternate reaction pathway with a lower activation energy. This means a greater proportion of reactant particles will have sufficient kinetic energy to meet the activation energy which increases the rate of successful collisions which increases the reaction rate.

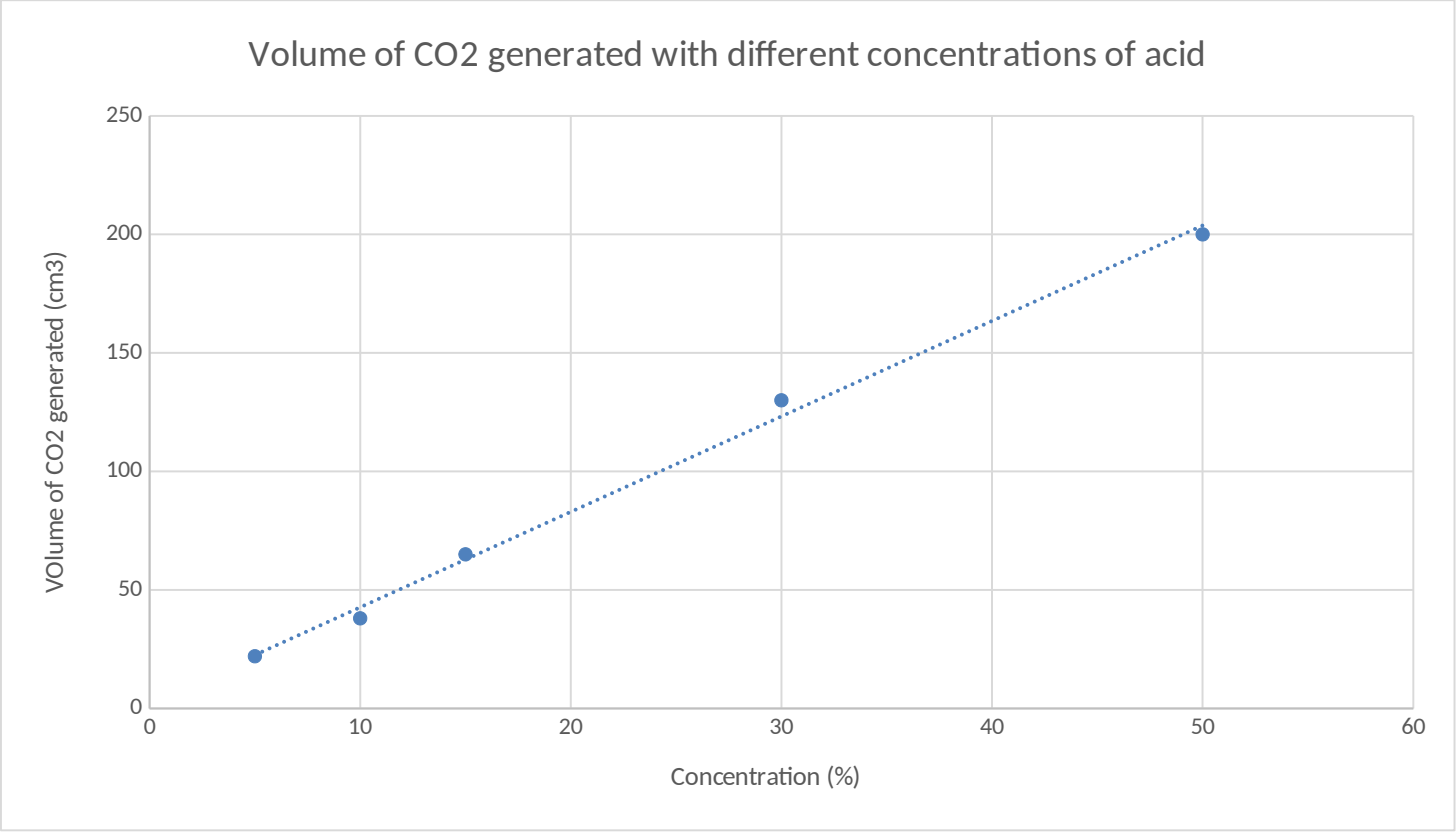
16. A group of students carried out an investigation to see how the concentration of acid affects the rate of the reaction between hydrochloric acid and chalk. Chalk contains calcium carbonate. They dropped a 3 cm piece of chalk into hydrochloric acid of different concentrations. They caught and measured the amount of carbon dioxide that was produced in 1 minute.

a. Name the following **variables** in this experiment:
   i. Independent: Hydrochloric acid concentration
   ii. Dependent: volume of CO_2, or reaction rate
   iii. **Two (2)** controlled variables: temperature of acid, surface area of chalk, agitation

Results:

Concentration (%)	**Volume of CO_2 generated (cm^3)**
50	200
30	130
15	65
10	38
5	22

b. Draw a graph of the results.



c. Write a conclusion for the experiment. As the concentration of hydrochloric acid increases, the reaction rate with chalk increases. OR As the concentration of hydrochloric acid increases, the volume of CO_2 generated in one minute.

Extension

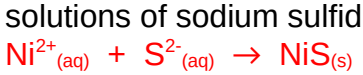
17. Write balanced ionic equations for the following reactions:

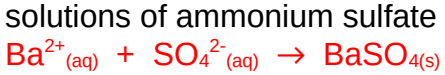
a. solutions of iron (II) sulfate and barium hydroxide are mixed

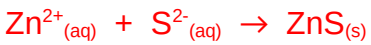

b. solutions of calcium chloride and potassium phosphate are mixed

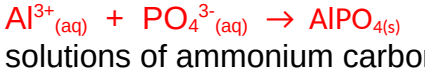

c. solutions of calcium nitrate and sodium chloride are mixed
no reaction

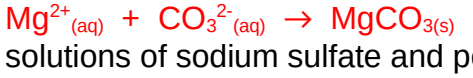
d. solution of potassium chloride and silver nitrate are mixed


e. solutions of sodium sulfide and nickel (II) sulfate are mixed


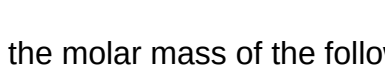
f. solutions of ammonium sulfate and barium chloride are mixed


g. solutions of sodium sulfide and zinc sulfate are mixed


h. solutions of aluminium nitrate and sodium phosphate are mixed


i. solutions of ammonium carbonate and magnesium sulfate are mixed


j. solutions of sodium sulfate and potassium sulfide are mixed
no observable change

k. solutions of lead (II) nitrate and lithium iodide are mixed


18. Calculate the molar mass of the following:

a. $KMnO_4$
$M=39.1+54.94+4x16=157.5$ g/mol

b. lithium nitrite
$M=6.94+14.01+2x16=52.95$ g/mol

c. PbO_2
$M=207.2+2x16=239.2$ g/mol

d. iron (III) hydroxide
$M=55.85+3x(1.008+16)=106.874$ g/mol

e. dinitrogen tetroxide
$M=2x14.01+4x16=92.02$ g/mol

19. Calculate the number of moles of the following:

i. SO_3 molecules in 143.4 g of SO_3
$M=32.06+3x16=80.06$ g/mol
$n=143.3/80.06=1.79$ mol

ii. Li_3PO_4 formula units in 796.2 g of Li_3PO_4
$M=3x6.94+30.97+4x16=115.79$ g/mol
$n=796.2/115.79=6.88$ mol

iii. O atoms in 963.4 g of $Sr_3(PO_4)_2$
$M=3x87.62+2x30.97+8x16=452.8$ g/mol
$n=963.4/452.8=2.13$ mol
$n_O = 2.13 \times 8 = 17.02$ mol

20. Calculate the mass of the following:

i. 6.53×10^{4} mol of $Zn(NO_2)_2$

M=65.38+2x14.01+4x16=157.4 g/mol

m=$6.53x10^{4}$x157.4=10278220 g

ii. 2.67×10^{-2} mol of CrI_3

M=52+3x126.9=432.7 g/mol

m=2.67x10-2x432.7=11.55 g

iii. $Sn(OH)_4$ that contains 32.7 mol of H atoms

M=118.7+4x(16+1.008)=186.7 g/mol

m=32.7x186.7=6106 g

iv. O atoms in 986.5g of $Fe(HSO_4)_3$

M=55.85+3x1.008+3x32.06+12x16=347.05 g/mol

n=986.5/347.05=2.84 mol

n of O=12x2.84=34.1 mol

m=34.1x16=545.8 g

21. Define the mole.

A mole is a number, known as Avogadro's number: 6.022 $x10^{23}$.