

HOMEWORK OF CHEMISTRY CLASS S6PCM& S6MCB 03/02/2021

1) There are three common isotopes of oxygen with mass number:16,17,18.

Identify the possible peaks that would be observed in a mass spectrum corresponding to O_2^+ ions.

2) Explain the following:

a) Phenylamine($C_6H_5NH_2$) is weaker base than ethylamine($CH_2CH_2NH_2$).

b) Chloroethanoic acid($ClCH_2COOH$) is a stronger acid than ethanoic acid(CH_3COOH).

3) i) write electronic configuration of copper in copper(I) chloride.

ii) Why compound of copper are blue?

4) Explain the following observations:

a) The solubility of hydroxides of group II elements increases down the group.

b) Lead (IV) chloride is covalent compound but lead (II) chloride is ionic.

5) With the help of relevant equations, explain how an aqueous solution of chlorine can be used to distinguish NaBr and NaI solutions.

6) The table below gives some data about the chlorides of elements of period 3.

Formula	NaCl	MgCl ₂	AlCl ₃	SiCl ₄	PCl ₃	S ₂ Cl ₂	Cl ₂
Boiling point °C	1465	1418	423	57	76	136	-34
pH of aqueous solution.	7	6	2	2	2	1	1

a) Explain why the boiling point of NaCl is higher than that of MgCl₂.)

b) Explain why the pH of NaCl is 7 and that of AlCl₃ is 2.

7) When dilute sulphuric acid is added to copper(I) oxide a pink solid X and a blue solution Y are formed. The pink solid X conducts electricity.

- a) Identify X and Y. b) write an equation for the reaction.
- c) Using examples from the reaction above, explain the meaning of Disproportionation.
- 8) Describe all colour changes that are observed when aqueous ammonia is gradually added to a solution of $\text{Cu}^{2+}_{\text{aq}}$. Write a balanced equation for one of the reaction that occurs.
- 9) Two gases reacted to form a gaseous products as shown by the following equations: $2\text{A}_{(\text{g})} + \text{B}_{(\text{g})} \rightarrow 2\text{C}_{(\text{g})}$.
- a) How is the yield of C affected by an increase in temperature? Explain your answer.
- b) 2 moles of gas A were reacted with 1 mole of gas B to form gas C in a closed vessel of a volume of 1 dm³. After reaching dynamic equilibrium, it was founded that 0.6 mol of A remained in the gaseous mixture.
- Calculate the value of the equilibrium constant K_c for the reaction.
- 10) A triglyceride represented by the letter A is an ester derived from glycerol and three fatty acids: hexadecanoic acid, octadecanoic acid and 2,4-hexadienoic acid.
- i) Write the structure of the triglyceride.
- ii) Write the equation of reaction between the triglyceride above and sodium hydroxide. what is the importance of this reaction.
- 11) a) Rubber is a natural polymer whose monomer monomer is 2-methylbuta-1,3-diene.
- i) write the structure formula of the monomer of rubber and the structural formula of rubber with 3 monomer units.
- ii) What is the importance of the vulcanization of rubber?

b) There are two types of nylon: nylon 6 and nylon 6,6. Their monomers are $\text{H}_2\text{N}-(\text{CH}_2)_6-\text{COOH}$ for nylon 6 and $\text{HOOC}-(\text{CH}_2)_4-\text{COOH}$ with $\text{H}_2\text{N}-(\text{CH}_2)_6-\text{NH}_2$ for nylon 6/6.

i) Explain why the two polymers are named differently by using the numbers 6 and 6/6.

ii) write the structural formula with 3 monomer units each of the polymers nylon6 and nylon 6/6.

12) Write an equation for a possible cracking reaction of the alkane $\text{C}_{16}\text{H}_{34}$ given that the products include ethane and propane in molar ratio 2:1 and only one other product.

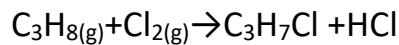
13) A 5g of the product of aluminium sulphate was dissolved in water and an excess of aqueous barium chloride was added. The precipitate of barium sulphate was dried and weighed. The mass of barium sulphate was found to be 2.33g.

Calculate the percentage by mass of aluminium sulphate.

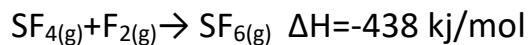
14) Use the bond enthalpies /bonds energies in the table below to answer the questions that follow:

Bond	Average bond enthalpy kj/mol
F-F	158
C-H	412
Cl-Cl	242
H-Cl	432
C-Cl	338

a) Calculate the enthalpy change for the reaction:



b) By considering the bonds broken and the bonds formed, calculate the average value for the S-F bond energy in the reaction.



15) The reversible reaction: $2 \text{SO}_{2(\text{g})} + \text{O}_{2(\text{g})} \rightleftharpoons 2 \text{SO}_{3(\text{g})}$ is the contact process for the manufacture of sulphuric acid using V_2O_5 catalyst.

a)i) Calculate the enthalpy of reaction of the forward reaction. You are given the enthalpies of formation of $\text{SO}_{2(\text{g})}$ and $\text{SO}_{3(\text{g})}$ which are -297 and -395 kJ/mol respectively.

ii) State and explain the effect of raising the temperature on the position of equilibrium of this reaction.

iii) The optimum temperature used in this industrial process is 450°C . Basing your answers on economics and chemical principles, suggest two reasons which determine the choice of this operating temperature.

iv) What is the effect of the catalyst on the position of equilibrium in this reaction.

b) i) what an expression for the equilibrium constant K_c for the reaction.

ii) what is the effect of increasing the concentrations.

16) Propanal is a liquid at room temperature with a boiling point of 49°C . It is prepared from compound Z as follows. It is mixed with dilute sulphuric acid and potassium dichromate(VI) and heated to a temperature of 50°C to ensure that propanal vaporizes as fast as it formed.

a) Give the name or structural formula of compound Z.

b) Why is propanal distilled off as fast as it.

c) what colour change would you observe in this experiment .

d) What reagent would use to confirm the presence of the functional group in propanal. what is the expected observation for a positive result?

e) Propanal is reacted with hydrogen cyanide and the product is hydrolysed by heating with a dilute acid.

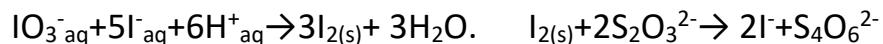
i) Name the type of reaction between propanal and HCN and give the structural formula of the product.

ii) what type of isomerism is shown by the product in (i)? Give a reason for your answer.

iii) Give the structural formula of the organic compound by hydrolysis of the compound in (i).

17)a) what mass of potassium iodate(KIO_3) would be required to make 250 cm^3 of a solution containing 0.017 mole per dm^3 .

b) When 25cm^3 of the solution of potassium iodate(v) of the above concentration in (a) was added to excess of acidified potassium iodide solution, the iodine produced reacted with 20cm^3 of a solution of sodium thiosulphate. Use these equations to answer the questions that follow:



i) Calculate the concentration of the sodium thiosulphate solution in mol/dm^3 and in g/dm^3 .

c) With the help of equations of reactions which occur at each electrode, outline what happens during electrolysis of dilute aqueous sodium chloride.

18)a) How does a sigma bond differ from a Pi bond?

b) state the number of sigma and Pi bonds which are present in the molecules below. i) C_2H_6 , ii) $\text{C}_2\text{H}_{2(\text{g})}$, iii) C_2H_2 .

C) State the type of hybridization shown by carbon in the following molecules: i) C_2H_2 , ii) C_2H_4 iii) C_2H_6 .

d) i) How does a dative covalent bond differ from the usual covalent bond?

ii) Draw a structure of the following species to show the types of bonds present in Al_2Cl_6 .

19. BeO is described as "amphoteric". Use two relevant balanced equations to explain what is meant by term "amphoteric".

20. Explain the following observations:

- i) The solubility of hydroxides of group II increases down the group.
- ii) Diamond is a poor conductor of electricity.
- iii) SiCl_4 is a volatile liquid at room temperature whereas SiO_2 is a solid with high melting point.
- iv) Sodium melts at only 97.8°C and magnesium melts at 665°C and yet both are metals.
- v) The ions fluorine, magnesium and sodium all have the same number of electrons. Arrange the above ions in order of increasing size(ionic radius).

VI) The volatility of group 17(VII) elements decreases down the group.

VII) The acidic strength of hydrogen halides increases down the group.

21) Fluorine and Fluoride show some properties which are not typical of the rest of the group(VII) members.

i) state two of these properties ii) Suggest reasons for that.

22) The table below shows the first ionisation energies(IE) and atomic numbers of elements in the third period of the periodic table.

Element	Na	Mg	Al	Si	P	S	Cl	Ar
1 st ionisation energy	500	740	590	790	1025	1000	1262	1532
Atomic number	11	12	13	14	15	16	17	16

i) Plot a graph of the 1st ionization energy against atomic number of the elements of the 3rd period.

ii) Explain the shape of the graph.

23) With the help of balanced equations outline the steps involved in the manufacture of nitric acid from ammonia by Ostwald process.

i) Explain the environmental impact of industrial production of nitric acid.

24) A student carried out experiments using chlorine through aqueous solution of potassium bromide aqueous. A reaction took place. Give an explanation for that reaction. What colour of the solution after the reaction has taken place?

i) Write equation of chlorine and cold sodium hydroxide.

ii) write equation of chlorine and hot sodium hydroxide.

iii) write equation of chlorine and potassium fluoride.

25) what would you see if you use aqueous silver nitrate to distinguish halides ions. using the aqueous silver nitrate to distinguish halides ions. Using the aqueous silver nitrate, it is difficult to distinguish between chloride, bromide and iodide. How can aqueous ammonia be used to distinguish between these three ions.

26) with the aid of questions where possible, describe a chemical test you would carry out to distinguish between the following pairs of compounds. In each case state the conditions of reaction and observations that would made.

i) RbCl_{aq} and KCl aq.

ii) CaCl_2aq and BaCl_{aq} .

iii) BCl_3 aq and $\text{AlCl}_{3,2}$

