SECTION A–46 MARKS
ATTEMPT ALL QUESTIONS IN THIS SECTION.

1. Various concentrations of **X** and **Y** were reacted at a constant temperature. The table below shows the initial concentrations of **X** and **Y**, and their initial rates for the reaction.

Experiments	[X] mol/dm³	[Y] mol/dm³	Initial rate (mol/s)
1	0.2	0.2	3.5×10^{-4}
2	0.4	0.4	1.4×10^{-3}
3	0.8	0.4	5.6×10^{-3}

a) State the order of reaction with respect to **X** and **Y.** (@0½ marks)

i. **X:** .....

ii. **Y:** .....

b) Give **reasons** for your answers in **(a)** above. (02 marks)

.....

.....

.....

c) Determine the **overall order** of the reaction. (0½ marks)

.....

d) Calculate the **value for the rate constant** of the reaction. (01½ marks)

.....

.....

.....

.....

2. A solid **Q** contains **9.37%** by mass magnesium, **10.39%** nitrogen, **42.18%** water and the rest is oxygen.

a) (i). Calculate the empirical formula of solid **Q**. (02 marks)

……

……

……

……

……

……

……

……

(ii).Determine the molecular formula of **Q**. (01 mark)
(**RFM of Q = 256**)

……

……

……

b) Solution of **Q** reacts with **freshly prepared iron (II) sulphate** in the **presence of concentrated sulphuric acid** to form a **brown ring**. Identify **Q**. (0½ mark)

……

c) Write **equation for the reaction** that would take place if **Q** was heated. (01½ marks)

……

……

3. Name a **reagent** that can be used to **distinguish** between the following pairs of compounds and in each case, **state what would be observed** if each members of the pair was treated with the named reagent.

a). $CH_3\underset{\displaystyle CH_3}{\underset{|}{C}}HC{\equiv}CH_3$ and $CH_3CH_2\underset{\displaystyle CH_3}{\underset{|}{C}}HC{\equiv}CH$

Reagent (01 mark)

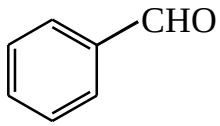
……

……

Observations (02 marks)

……

……

b).  and CH_3CHO

Reagent (01 mark)

……

……

Observations (02 marks)

……

……

4. Write equation for the reaction between aqueous sodium hydroxide solution and: (@01½ marks)

a) Chromium (III) oxide.

……

……

b) Beryllium oxide.

……

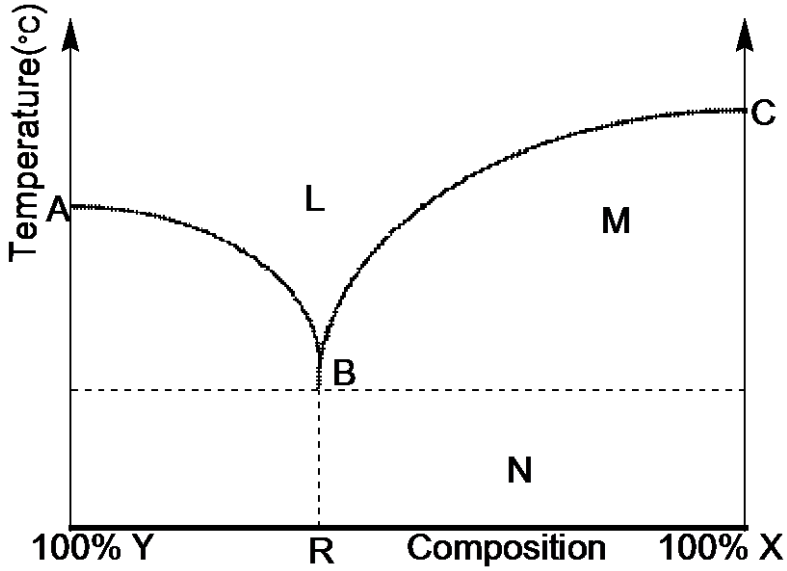
……

c) Tin (II) oxide.

……

……

5. The **temperature-composition diagram** for a system containing two components **X** and **Y** is shown below.



a) State what the following represents. (@0½ mark)

i. Regions: L: ……

M: ……

N: ……

ii. Points: A: ……

B: ……

C: ……

iii. Curves: AB: ……..

BC: ……..

b) State what would happen when a mixture of composition **R** is heated. (0½ mark)

……

……..

6. Complete the following equations and in each case, write a mechanism for the reaction.

a). $(CH_3)_2C=CHCH_3 \xrightarrow{HBr}$ …… (02½ marks)

Mechanism:

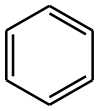
……

……

……

……

……

b).  + $CH_3CH_2COCl \xrightarrow[50°C]{AlCl_3}$ …… (02½ marks)

Mechanism:

……

……

……

……

……

7. When a current of **0.65A** was passed through copper (II) sulphate solution using platinum electrodes for **35 minutes**, **0.0143g** of hydrogen and **0.113g** of oxygen gases were evolved.
   a) Write **equation for the reaction** that took place at the: (@01 mark)
      i. Anode.

      ……

      ……

      ii. Cathode.

      ……

      ……

   b) Determine **the quantity of electricity** required to evolve **1mole** of gas at each electrode.
      i. At the anode. (02 marks)

      ……

      ……

      ……

      ……

      ii. At the cathode. (01 mark)

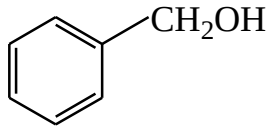
      ……

      ……

      ……

      ……

8. Write equation in each case show how the following conversions can be effected.

   a).  from Benzene (02½ marks)

……

……

……

……

……

b). CH_3CONH_2 from Chloroethane (02½ marks)

……

……

……

9. State what would be observed and write equations for the reaction that would take place when: (@02½ marks)
   a) Excess concentrated hydrochloric acid was added to lead (II) oxide.
      ……

      ……

      ……

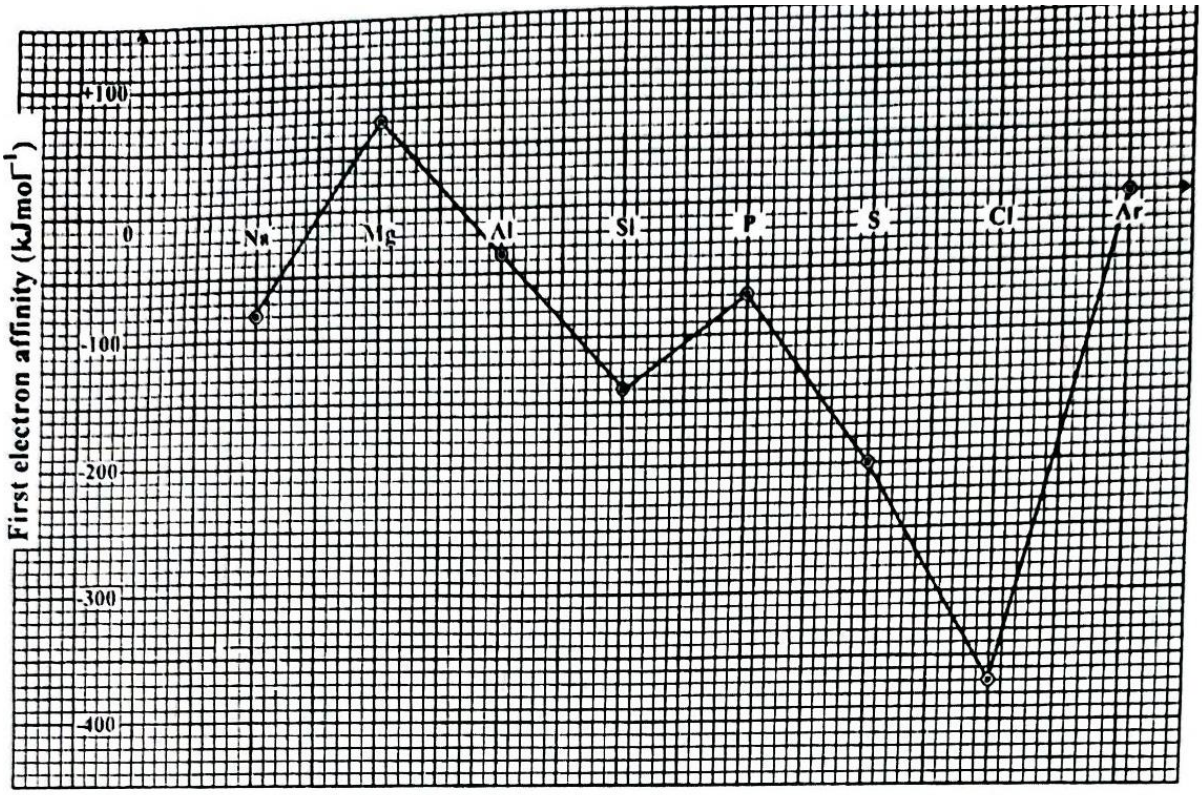
   b) Potassium iodide was added to copper (II) sulphate solution.
      ……

      ……

      ……

SECTION B-54 MARKS
ATTEMPT ALL QUESTIONS IN THIS SECTION.

10. The figure below shows the variation of the **1st electron affinity** of the elements in **Period 3** of the Periodic table.



Explain each of the following observations.

a) There is a general increase in the **1st electron affinity** from sodium to argon. (01½ marks)

……

……

……

b) The **1st electron affinity** of magnesium is higher than that aluminium. (04 marks)

……

……

……

……

……

c) The **1st electron affinity** of phosphorous is less than that of sulphur.
(03½ marks)

……

……

……

……

……

……

……

11. Silver chloride dissolves in water according to the following equations.

$$AgCl_{(s)} \rightleftharpoons Ag^{+}_{(aq)} + Cl^{-}_{(aq)}$$

a) Write the expression for the solubility product, Ksp of silver chloride.
(01 mark)

……

b) The electrolytic conductivity of a saturated solution of silver chloride in water at **25°C** is **$3.41 \times 10^{-6}\Omega^{-1}cm^{-1}$** and that of pure water is **$1.60 \times 10^{-6}\Omega^{-1}cm^{-1}$**.Calculate the **solubility product** of a saturated solution of silver chloride at **25°C**. (04½ marks)
(*The molar conductivities at infinite dilution of silver nitrate, potassium nitrate and potassium chloride are **133.4, 145.0** and **149.9$\Omega^{-1}cm^{2}mol^{-1}$** respectively ate **25°C***).

……

……

……

……

……

……

……

c) Ammonia solution was added to a solution containing silver chloride.

i. State how the **solubility** of silver chloride was affected. (01 mark)

……

……

ii. Explain your answer in (c)(i) above. (02½ marks)

……

……

……

……

……

12. Manganese is a **d-block element** in the Periodic Table.

a) Define the term **d-block element**. (01 mark)

……

……

……

b) (i). Write the electronic configuration of manganese. (0½ mark)

……

(ii). State the **common oxidation states** exhibited by manganese in its compounds. (01½ marks)

……

(iii). Write the **formulae of oxides** of manganese in each of the oxidation states you have stated in (b) (ii) above. (01½ marks)

……

c) A **black oxide**, **Y** of manganese was fused with a mixture of potassium hydroxide and potassium nitrate to give a compound which when treated with water gives a **green solution**. The **green solution** turned **purple** when acidified with sulphuric acid.
Identify:

i. **Y** (01 mark)

……

ii. The ion that gives the green solution its colour. (01 mark)

……

iii. The ion that gives the purple solution its colour. (01 mark)

……

d) Write ionic equation for the reaction leading to the formation of the purple solution. (01½ marks)

……

……

13. Compound **T**, **C_3H_6O** reacts with **2, 4-dinitrophenylhydrazine** to form a **yellow precipitate**.

a) Write the **names** and the **structural formulae** of all possible isomers of **T**. (03 marks)

……

……

b) **T** reacts with ammoniacal silver nitrate solution to form silver. Identify **T**. (01 Mark)

……

c) Write equation and indicate a mechanism for the reaction between **T** and 2, 4-dinitrophenylhydrazine under acidic condition. (05 marks)

……

……

……

……

……

……

……

……

……

……

14.(a). (i). Sketch a graph to show the pH change when hydrochloric acid is titrated with ammonia solution. (01½ marks)

……

……

……

……

……

……

……

……

(ii). Explain the **shape of your sketch graph** in (a) (i). (03½ marks)

……

……

……

……

……

……

……

……

……

……

(b). Calculate the **pH** of a resultant solution formed when **$10cm^3$** of a **0.1M** sodium hydroxide solution is added to **$25cm^3$** of a **0.1M** ethanoic acid at **25°C**. (04 marks)
(Dissociation constant of ethanoic acid at **25°C = 1.8×10^{-5} moldm^{-3}**)

……

……

……

……

……

……

……

……

……

15. Beryllium, magnesium, calcium and barium are some of the elements that belong to Group (II) of the Periodic Table.

a) State how the elements reacts with sulphuric acid and give the conditions for the reactions. (03 marks)

……

……

……

……

……

……

b) (i). State how the solubilities of the sulphates of Group (II) elements vary down the group. (01 mark)

……

(ii).Explain your answer in (b) (i). (02 marks)

……

……

……

……

c) Write equation for the reaction of:

i. Beryllium with sodium hydroxide solution. (01½ marks)

……

……

ii. Calcium carbide with water. (01½ marks)

……

……

16. In the manufacture of ammonia, nitrogen gas is catalytically hydrogenated to give ammonia according to the following equation.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \quad \Delta H = 92.5\ kJ$$

a) (i). Name the catalyst used in the reaction. (0½ mark)

……

(ii). Write the expression for the equilibrium constant, Kp for the reaction. (01 mark)

……

b) State what would happen to the position of the equilibrium if:

i. Pressure was increased. (01 mark)

……

ii. Temperature was increased. (01 mark)

……

c) When **3 moles** of hydrogen and **1 mole** of nitrogen were mixed and allowed to attain equilibrium at **100 atms** and **400°C**, the equilibrium mixture contained **25%** of ammonia by volume.
Calculate the:

i. Number of moles of nitrogen and hydrogen at equilibrium. (03 marks)

……

……

……

……

……

……

……

……

ii. Value of the equilibrium constant, Kp at 400°C. (02½ marks)

……

……

……

……

……

……

……

17.(a).Differentiate between addition and condensation polymers. (02 marks)

……

……

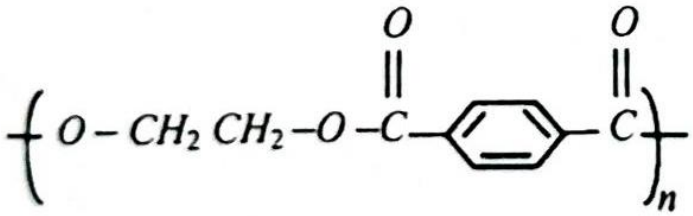
……

……

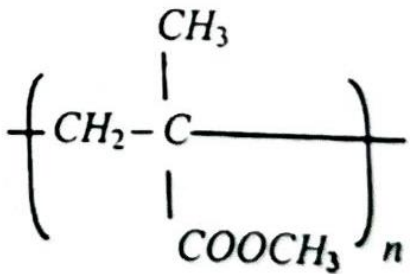
……

(b).The structure formulae of two polymers **R** and **T** are shown below.

R



T



Name the polymer. (@01 mark)

i. R: ……..

ii. T: ……

(c).Write the structural formula (e) of monomer(s) of the polymers R and T respectively. (03 marks)

(d). Give one use of: (@01 mark)

i. R: ……..

ii. T: ……..

♥ ===END===

WELCOME TO SENIOR SIX, YEAR 2019

This is the last page of the printed paper, Page 17