NAME…………………………………………….. INDEX NO……………………....................

233/1   **CANDIDATE'S SIGN………….…………….**
CHEMISTRY
PAPER 1   **DATE………..………………………………**
(THEORY)
TIME: 2 HOURS

CENTRAL KENYA NATIONAL SCHOOLS JOINT EXAM - 2015

Kenya Certificate of Secondary Education
CHEMISTRY
PAPER 1
(THEORY)
TIME: 2 HOURS

## INSTRUCTIONS TO CANDIDATES:
(i)   Write your **name** and **index number** in the spaces provided **above**.
(ii)   **Sign** and write the **date** of examination in the spaces provided **above**.
(iii)   Answer **ALL** the questions in the spaces provided.
(iv)   Mathematical tables and silent electronic calculators **may be** used.
(v)   All working **must be** clearly shown where necessary
(vi)   Candidates should check the question paper to ascertain that all the pages
       are printed as indicated and that no questions are missing

For Examiner's Use Only

Questions	Maximum Score	Candidate's Score
1 – 29	**80**	

Chemistry Paper 1   *Turnover*
1.   Three pure pigments were prepared and their spots placed on a filter paper as shown below. The

three pigments are A, B and C. A mixture F was also placed on the filter paper at the same time with the pure pigments. The filter paper was then dipped in ethanol solvent and left for some half an hour. The results were obtained as follows.
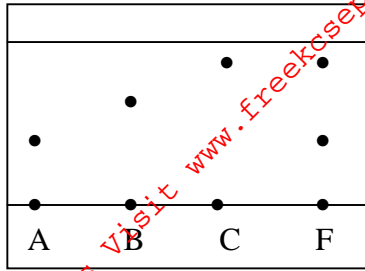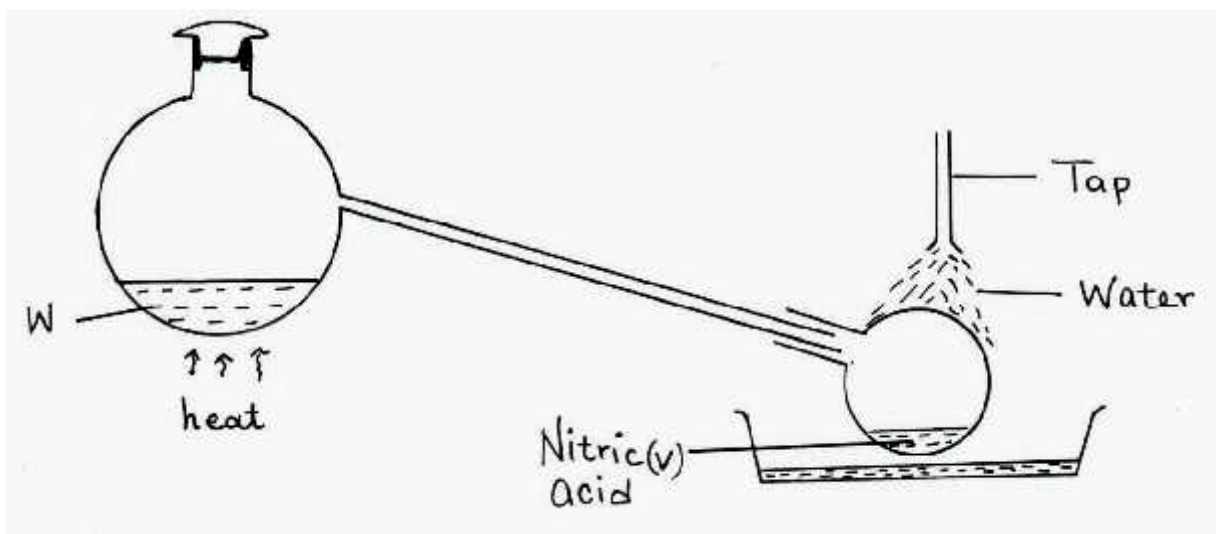

(i)   Which of the three pure pigments is most sticky? Give a reason for your answer. (1mk)

_____

_____

(ii) Which pure pigment is not present in the mixture **F**?   (1mk)

_____

(iii) Show on the diagram the baseline.   (1mk)

2.   Describe how a pure sample of lead (II) carbonate can be prepared in the laboratory starting with lead metal.   (3mks)

_____

_____

_____

_____

3.   The set up below was used to prepare nitric (V) acid in the laboratory.

(a)   Name the mixture **W**.   (1mk)

_____
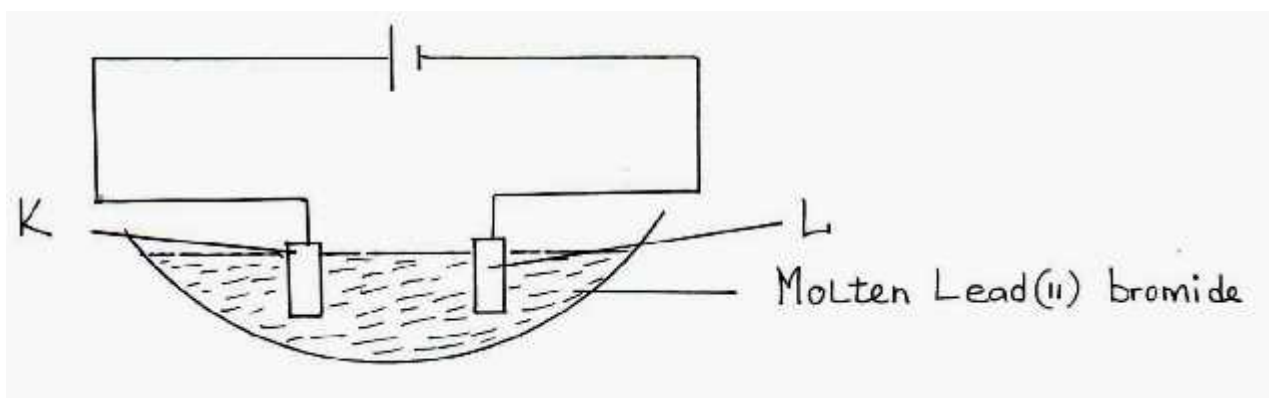
(b)   Write an equation for the reaction that takes place in flask A.   (1mk)

(c) Explain why nitric (V) acid produced appears yellow. (1mk)

_____

_____

_____

4. A mixture contains ammonium chloride aluminium oxide and sodium chloride. Describe how each solid substance can be obtained from the mixture. (3mks)

_____

_____

_____

_____

5. State the difference between the following salts;
Deliquescent and hygroscopic salts. (2mks)

_____

_____

_____

_____

6. Below is a set-up of apparatus used to investigate the effect of electric current on molten lead (II) bromide.
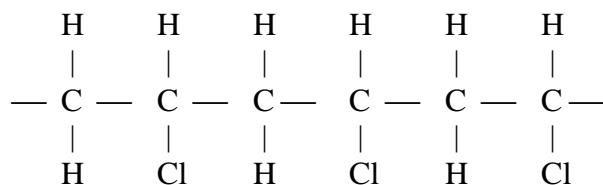

(a) Name electrode. (1mk)

K _____

L _____

(b) State the observation made at electrode **K**. (1mk)

_____

(c) Write an equation for the reaction taking place at electrode **L**. (1mk)

7. (a) Name the **two** types of polymerization.   (1mk)

_____

_____

   (b) A sample of a polymer has the following structure.

```
      H     H     H     H     H     H
      |     |     |     |     |     |
  — C — C — C — C — C — C —
      |     |     |     |     |     |
      H    Cl     H    Cl     H    Cl
```

   The polymer is found to have a molecular mass of 5050g. Determine the number of monomers
   in the polymer. (H = 1, Cl = 35.5, C = 12).   (1mk)

8. Study the information given in the table below and answer the questions that follows.

Bond	Bond energy KJ/mol
C – H	414
Cl – Cl	244
C – Cl	325
H - Cl	431

   (a) Calculate the enthalpy change for the reaction.
        $CH_{4(g)} + Cl_{2(g)} \rightarrow CH_3 Cl_{(g)} + HCl_{(g)}$ (2mks)

   (b) Sketch the energy level diagram.   (1mk)

Chemistry Paper 1   *4*
9.

⟶ Brown fumes + a gas that

(a)   Predict the cation and anion present, in solid **H**.

Cation _____   (½mk)

Anion _____   (½mk)

(b)   Identify solid **K**, solution **B** and white-precipitate.

Solid **K**   _____   (½mk)
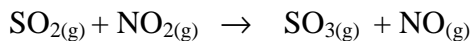
Solution **B** _____   (½mk)

White precipitate _____   (½mk)

(c)   Write the formula of the complex ion present in solution **T**.   (½mk)

10.   When 15cm³ of a gaseous hydrocarbon P was burnt in 100cm³ of oxygen, the resulting gaseous mixture occupied 70cm³ at room temperature and pressure. When the gaseous mixture passed through potassium hydroxide solution, it's volume decreased to 25cm³.

(a)   What volume of oxygen was used during the reaction?   (1mk)

_____

(b)   Determine the molecular formula of the hydrocarbon.   (2mks)

Chemistry Paper 1   5

11.   Sulphur (IV) oxide and nitrogen (IV) oxide reacts as shown below:

$$SO_{2(g)} + NO_{2(g)} \rightarrow SO_{3(g)} + NO_{(g)}$$

(i) Using oxidation numbers of either sulphur or nitrogen show that this is a redox reaction. (2mks)

_____

_____

_____

_____

(ii) Identify the reducing agent. (1mk)

_____

12. In an attempt to investigate the properties of halogens, a student bubbled chlorine gas through a solution of potassium bromide.

(a) State and explain what was observed. (1mk)

_____

_____

_____

(b) Write an ionic equation for the reaction. (1mk)

(c) Explain why iodine sublimes when heated to form a purple vapour. (1mk)

_____

_____

_____

13. The set-up below was used to investigate the products of burning methane gas. Study it and answer the questions that follow:
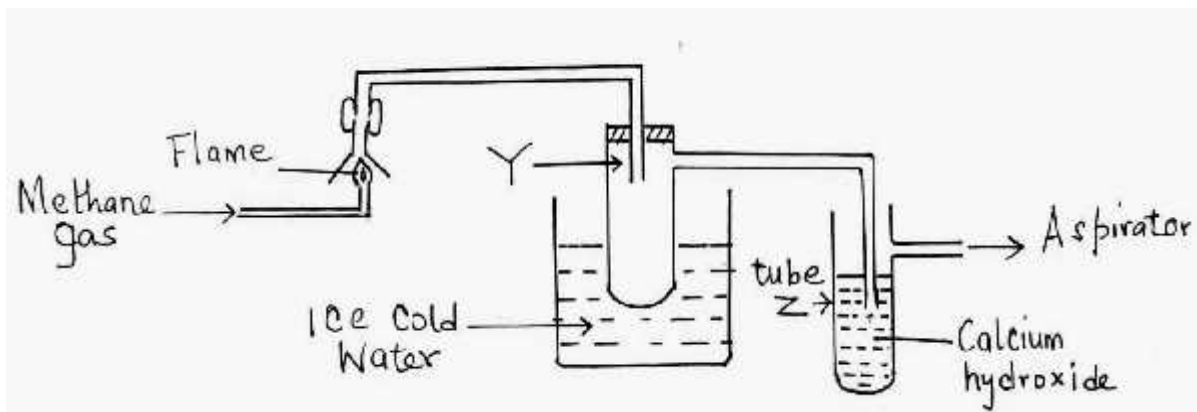
(a) What product will be formed in the test tube **Y**? (1mk)

(b)	State and explain the observations made in tube **Z**.	(2mks)

_____

_____

_____

_____

14.	Below are P^H values of some solutions.

Solution	Z	Y	X	W
P^H	6.5	13.5	2.2	7.2

(i)	Which solution is likely to be

I	Acidic rain.	_____	(½mk)
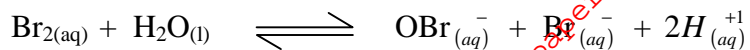
II	Potassium hydroxide	_____	(½mk)

(ii)	A basic substance **V** reacted with both solutions **Y** and **X**. What is the nature of **V**. (1mk)

_____

(iii)	Name **two** substances that show these characteristics in question (ii) above.	(1mk)

_____

_____

15.	In cold countries, salt is sprayed on the road to melt ice but in the long run it costs the motorists.

(a)	How does the salt help in melting ice?	(1mk)

_____

_____

_____

(b)	How does the salt affect the motorists?	(1mk)

_____

_____

_____

16.	The reaction below is in equilibrium.

$$Br_{2(aq)} + H_2O_{(l)} \rightleftharpoons OBr^-_{(aq)} + Br^-_{(aq)} + 2H^{+1}_{(aq)}$$

(a)   State and explain the effect on the equilibrium when dilute hydrochloric acid is added. (1mk)

_____

_____

_____
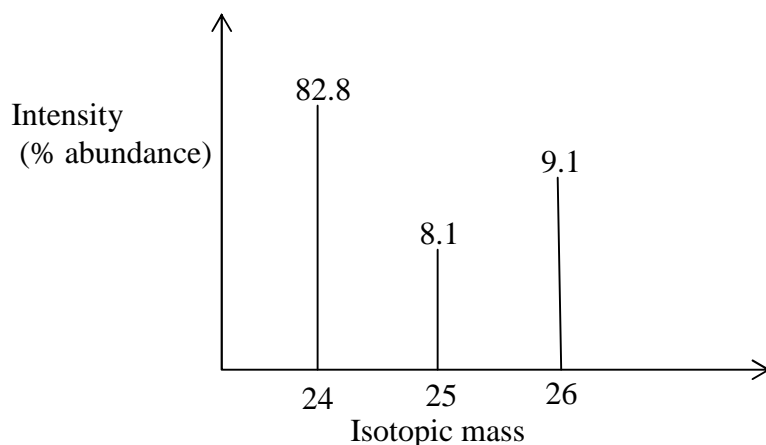
_____

(b)   What is the effect of increasing pressure in the reaction between hydrogen and chlorine? Explain.   (1mk)
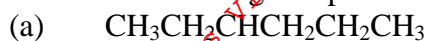
$$H_{2(g)} + Cl_{2(g)} \rightleftharpoons 2HCl_{(g)}$$

_____

_____

_____
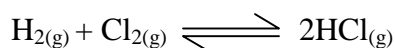
17.   (a)   Define Graham's law of diffusion.   (1mk)

_____

_____

_____

(c)   20cm³ of an unknown gas Q takes 12.6 seconds to pass through small orifice, 10cm³ of oxygen gas takes 11.2 seconds to diffuse through the same orifice under the same conditions of temperatures and pressure. Calculate the molecular mass of unknown gas Q (O = 16).
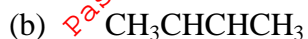   (2mks)

18.   The peaks below show the mass spectrum of element X.

Calculate the relative atomic mass of X.   (2mks)

19.   Name the following compounds using the IUPAC rules.
      (a) $CH_3CH_2CHCH_2CH_2CH_3$
                    |
                    CH_2CH_3 _____   (1mk)

      (b) $CH_3CHCHCH_3$ _____   (1mk)

      (c)   Compounds A and B have the same molecular formula $C_3H_6O_2$. Compound A liberates
            carbon (IV) oxide on addition of aqueous sodium carbonate while compound B does not
            compound B has a sweet smell. Draw the possible structures of:
            (i)   Compound A.   (2mks)

            _____

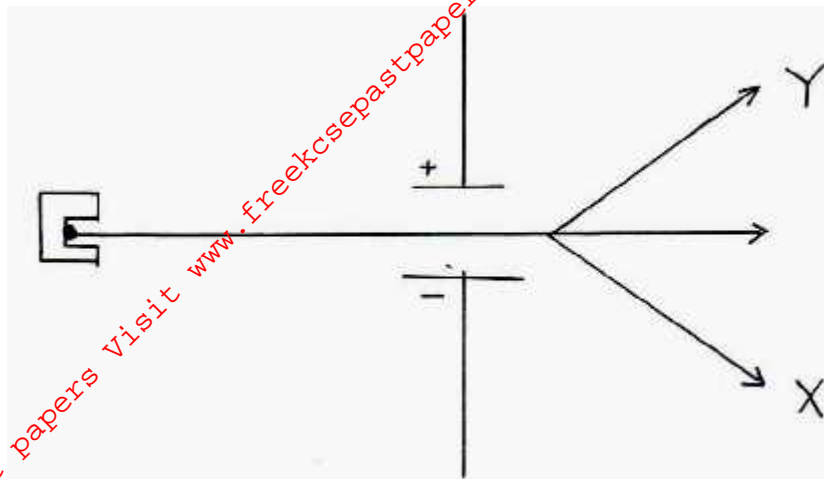   (ii) Compound B.

20.   (a)   Study the equation below and use it to determine the type of water hardness being removed.
                                                                                    (1mk)

            $Mg(HCO_3)_{2(aq)} \rightarrow \quad MgCO_{3(S)} + H_2O_{(l)} + CO_{2(g)}$

            _____

      (b)   State **one** disadvantage of water hardness.   (1mk)

            _____

            _____

21.   (a)   What is meant by the term half-life.   (1mk)

            _____

            _____

            _____

Chemistry Paper 1   9
      (b)   Study the diagram below and answer the questions that follow.

Identify particles **X**, **Y**. (1mk)

X _____

Y _____

(c) If 87.5% of a radioactive isotope decays in 66 years what is its half-life. (2mks)

_____

_____

_____

_____

22. A student reacted 0.2g zinc granules with 2M hydrochloric acid and volume of hydrogen gas produced was measured at various time intervals. A sketch graph of volume against time is as shown below.
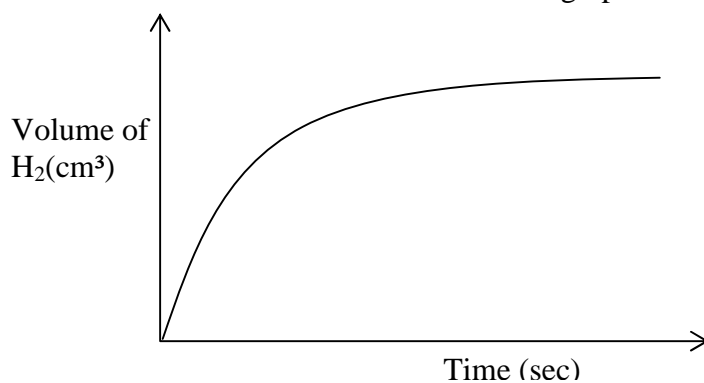

(i) Explain why the graph is steepest at the beginning. (1mk)

_____

_____

_____

(ii) On the same axis above, draw a sketch graph of the reaction when 0.2g zinc powder was used instead of zinc granular. (1mk)

(iii) State **two** other factors which affect the rate of the above reaction. (1mk)

_____

_____

_____

23.   (a)   Define the term enthalpy of combustion.   (1mk)

_____

_____

_____

   (b)   In an experiment to determine heat of combustion of methanol CH_3OH, a student used a set up like the one shown in the diagram below. Study the set up and the data below it and answer the questions that follow.
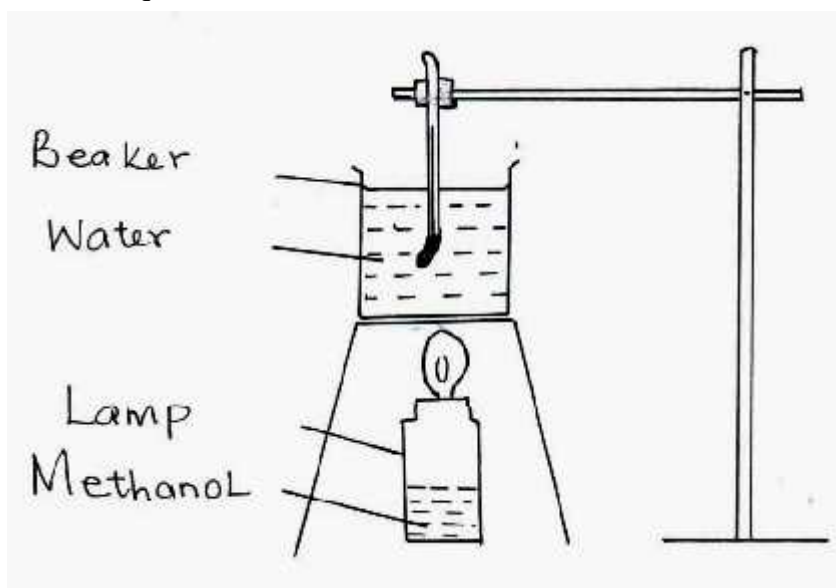
Volume of water $= 500cm^3$
Final temperature of water $= 27.0°C$
Initial temperature of water $= 20.0°C$
Final mass of lamp + methanol $= 22.11g$
Initial mass of lamp + methanol $= 22.98g$
Density of water $= 1.0g/cm^3$

Heat change = mass $\times$ temperature change $\times$ 4.2J/g/°C.
   (i)   Write an equation for the combustion of methanol.   (1mk)

   (ii)   Calculate the:
   (i)   number of moles of methanol used in the experiment (C = 12,) = 16, H = 1)
                                                                                   (½mk)

         (ii)   heat change in this experiment.   (½mk)

(iii)   molar heat of combustion of methanol.   (1mk)

24.   24cm³ of a solution of 0.1KOH were exactly neutralized by 30cm³ of a solution of sulphuric acid.
       Find the molarity of the acid.

25.   The flow chart below shows processes involved in extraction of zinc metal. Use it to answer the
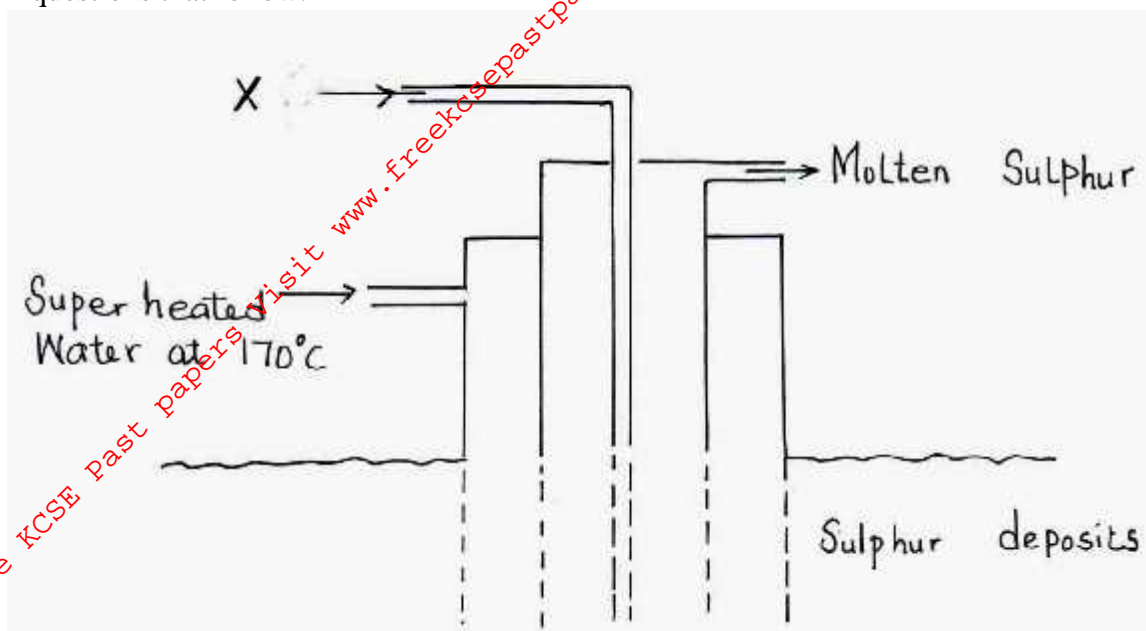   questions that follow.
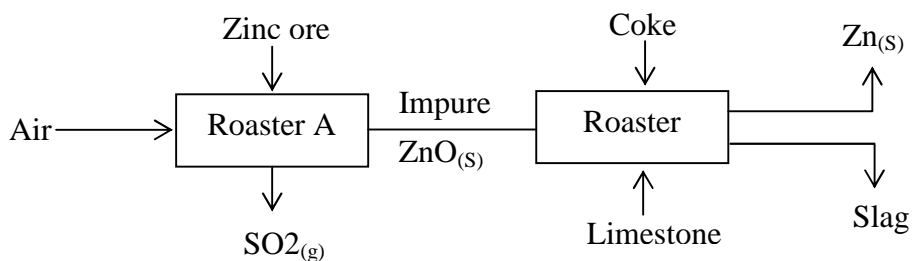
(a)   Name the main ore used in extraction of zinc.   (1mk)

_____

(b)   Write an equation for the reaction that takes place in a roaster **A**.   (1mk)

(c)   What is the function of limestone in roaster?   (1mk)

_____

_____

_____

26. The diagram below shows the Frash process used for extraction of sulphur use it to answer the questions that follow.
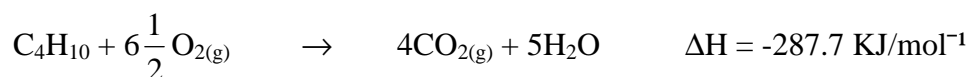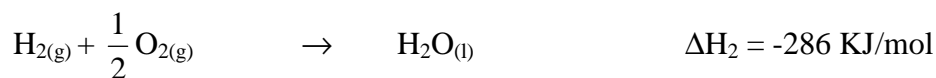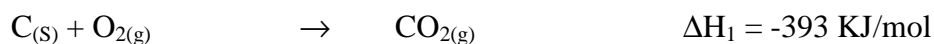

(i) Identify **X**. (1mk)

_____

(ii) Why is it necessary to use super heated water in this process? (1mk)

_____

(iii) State **two** physical properties of sulphur that makes it possible for it to be extracted by this method. (1mk)

_____

_____

_____

27. Use the information to answer the questions that follow.

$C_{(S)} + O_{2(g)} \quad \rightarrow \quad CO_{2(g)} \qquad \Delta H_1 = -393$ KJ/mol

$H_{2(g)} + \frac{1}{2} O_{2(g)} \quad \rightarrow \quad H_2O_{(l)} \qquad \Delta H_2 = -286$ KJ/mol

$C_4H_{10} + 6\frac{1}{2} O_{2(g)} \quad \rightarrow \quad 4CO_{2(g)} + 5H_2O \qquad \Delta H = -287.7$ KJ/mol⁻¹

(a) Define the term molar enthalpy of combustion of a compound. (1mk)

_____

_____

_____

(b)   Calculate the molar enthalpy of formation of butane C_4H_{10} from its elements in their normal states at standard temperature and pressure.   (2mks)

28.   Concentrated sulphuric acid is slowly added to a mixture of freshly prepared solution of iron (II) sulphate and potassium nitrate as below.

Concentrated sulphuric (VI) acid

Teat pipette

Mixture of iron (II) sulphate and potassium nitrate solution
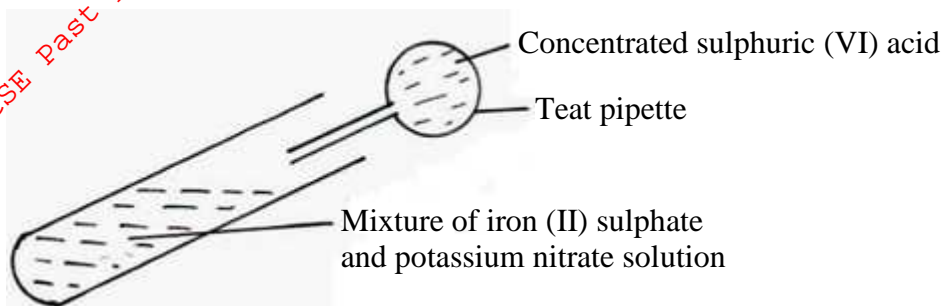
(i)   State the observation made.   (1mk)

_____

(ii)   Identify the complex salt formed.   (1mk)

_____

_____

29.   The table below gives some properties of three substances **I**, **J** and **K**. Study it and answer the questions that follow.

Substance	Mpt (°C)	Solubility in water	Electrical conductivity	
			Solid	Molten
I	1063	Insoluble	Conduct	Conduct
J	113	Insoluble	Doesn't	Doesn't
K	402	Sparingly soluble	Doesn't	Conduct and is decomposed

(a)   Suggest the type of structure in

(i)   **I** _____   (1mk)

(ii)   **K** _____   (1mk)

(b)   Explain why the molten **K** is decomposed by electric current but **I** is not decomposed.

_____

_____

_____