K.C.S.E. CHEMISTRY PAPER 233/1 2007

1   The diagram below shows a 'Jiko' when in use. Study it and answer the questions that follow.

(a)   Identify the gas formed at region A.   (1 mark)

        ....

(b)   State and explain the observation made at region B.   (2 marks)

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2   15.0 cm³ of ethanoic acid (CH_3COOH) was dissolved in water to make 500 cm³ of solution. Calculate the concentration of the solution in moles per litre. (C=12.0; H=1.0; O=16.0; density of ethanoic acid is 1.05 g/cm³).   (3 marks)

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3   Both chlorine and iodine are halogens.

(a)   What are halogens?   (1 mark)

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(b)   In terms of structure and bonding, explain why the boiling point of chlorine is lower than that of iodine.   (2 marks)

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The diagram below shows a Bunsen burner when in use.
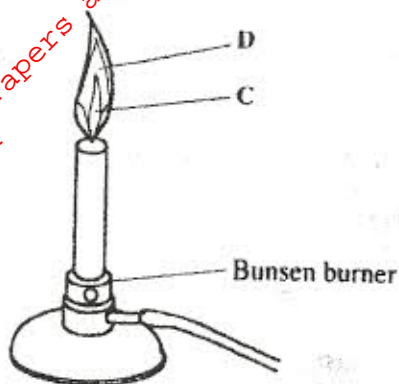
Name the regions labelled **C** and **D**. (2 marks)

C ....

D ....

When a student was stung by a nettle plant, a teacher applied an aqueous solution of ammonia to the affected area of the skin and the student was relieved of pain. Explain. (2 marks)

....

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In an experiment, a few drops of concentrated nitric acid were added to aqueous iron (II) sulphate in a test-tube. Excess sodium hydroxide solution was then added to the mixture.

(a) State the observations that were made when:

(i) concentrated nitric acid was added to aqueous iron (II) sulphate (1 mark)

....

(ii) excess sodium hydroxide was added to the mixture. (1 mark)

....

(b) Write an ionic equation for the reaction which occurred in (a)(ii) above. (1 mark)

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(a) Use the information given below to draw a labelled diagram of an electrochemical cell that can be constructed to measure the electromotive force between G and J. (2 marks)

$$G^{2+}_{(aq)} + 2e \longrightarrow G_{(s)}; \quad E^\theta = -0.74 \text{ V}$$
$$J^{2+}_{(aq)} + 2e \longrightarrow J_{(s)}; \quad E^\theta = -0.14 \text{ V}$$

(b) Calculate the E^θ value for the cell constructed in (a) above. (1 mark)

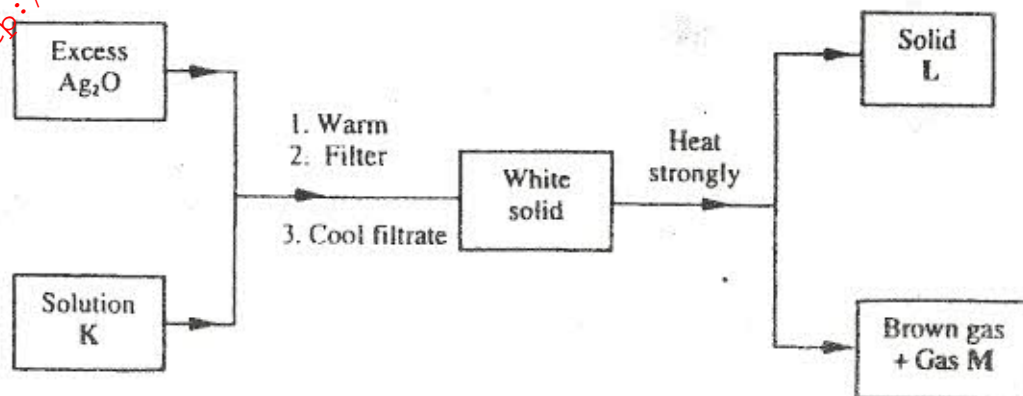.....................................   ....

8   Explain why there is a general increase in the first ionisation energies of the elements in period 3 of the periodic table from left to right.   (2 marks)

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9   Study the flow chart below and answer the question that follows.

Identify: (3 marks).

(a)   Solution K

    ....

(b)   Solid L

    ....

(c)   Gas M

    ....

10   The thermochemical equations for the formation of hydrogen peroxide under standard conditions are:

$$H_{2(g)} + O_{2(g)} \longrightarrow H_2O_{2(g)}; \Delta H_f^\theta = -133 kJmol^{-1}$$
$$H_{2(g)} + O_{2(g)} \longrightarrow H_2O_{2(l)}; \Delta H_f^\theta = -188 kJmol^{-1}$$
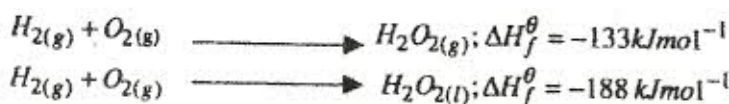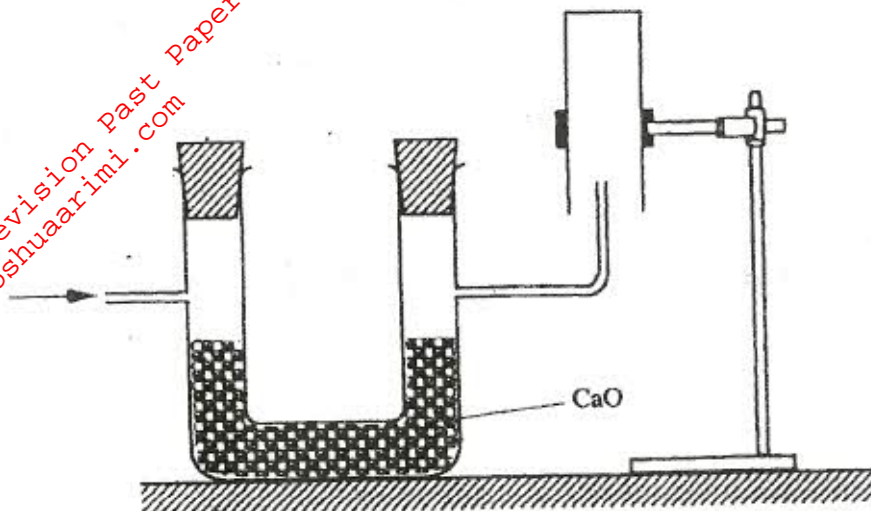
Write the thermochemical equation for the molar heat of vaporisation of hydrogen peroxide.   (2 marks)

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11   The set-up below was used to collect a dry sample of a gas.

— CaO

Give **two** reasons why the set-up cannot be used to collect carbon (IV) oxide gas. (2 marks)

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12   (a)   State the Charles' law.   (1 mark)

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(b)   The volume of a sample of nitrogen gas at a temperature of 291 K and 1.0×10^5 pascals was $3.5 \times 10^{-2} \, m^3$. Calculate the temperature at which the volume of the gas would be $2.8 \times 10^{-2} m^3$ at 1.0×10^5 pascals.   (2 marks)

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13   (a)   Name the process that takes place when:

(i)   crystals of zinc nitrate change into solution when exposed to air   (1 mark)

....

(ii)   an alcohol reacts with an organic acid in the presence of a catalyst to form a sweet smelling compound.   (1 mark)

....

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(b) Propane can be changed into methane and ethene as shown in the equation below;

$$CH_3CH_2CH_{3(g)} \xrightarrow{\text{High temperature}} CH_{4(g)} + C_2H_{4(g)}$$
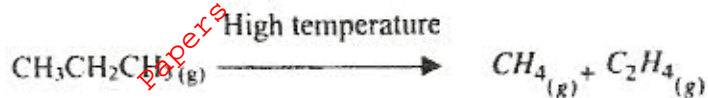
Name the process undergone by propane. (1 mark)

....

14 (a) Distinguish between nuclear fission and nuclear fusion. (2 marks)

....

(b) Describe how solid wastes containing radioactive substances should be disposed of. (1 mark)

....

15 (a) Explain why permanent hardness in water cannot be removed by boiling. (2 marks)

....

(b) Name **two** methods that can be used to remove permanent hardness from water. (1 mark)

....

16 The table below shows the tests that were carried out on solid N and the observations made.

	Test	Observations
I	Solid N was heated	Solid N turned from white to yellow.
II	Dilute hydrochloric acid was added to solid **N**.	A colourless solution was formed.
III	To the colourless solution obtained in test II, excess sodium hydroxide solution was added.	A white precipitate was formed which dissolved to form a colourless solution.

Write the formula of the anion in:

(a) solid **N** (1 mark)

....

(b) the colourless solution formed in test III. (1 mark)

....

17 The relative formula mass of a hydrocarbon is 58. Draw and name **two** possible structures of the hydrocarbon (C=12.0; H = 1.0). (3 marks)

....

....

55

18   Starting with sodium metal, describe how a sample of crystals of sodium hydrogen
      carbonate may be prepared.   (3 marks)

      ....

      ....

19   The flow chart below shows steps used in the extraction of zinc from one of its ores.
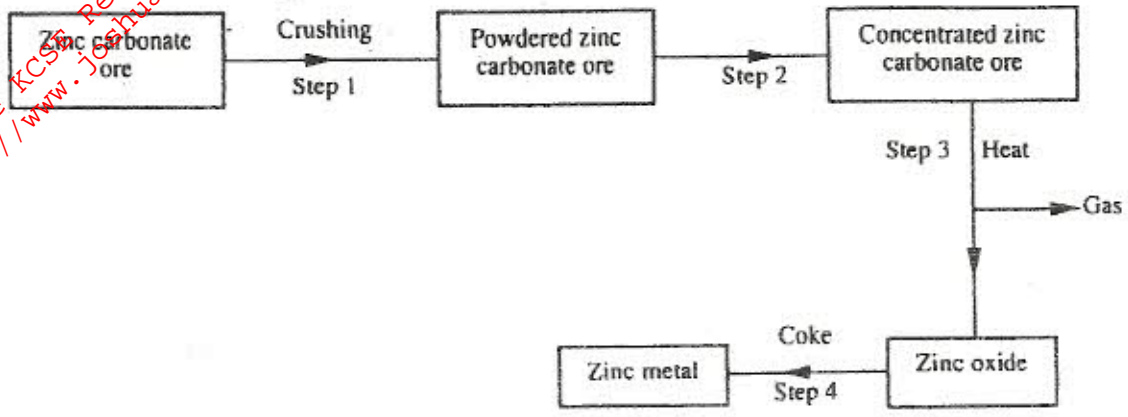
      (a)   Name the process that is used in step 2 to concentrate the ore.   (1 mark)

             ....

      (b)   Write an equation for the reaction which takes place in step 3.   (1 mark)

             ....

             ....

      (c)   Name **one** use of zinc other than galvanising.   (1 mark)

             ....

20   An alkanol has the following composition by mass: hydrogen 13.5%, oxygen 21.6% and
      carbon 64.9%.

      (a)   Determine the empirical formula of the alkanol (C=12.0; H = 1.0; O=16.0).
                                                                                  (2 marks)

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      (b)   Given that the empirical formula and the molecular formula of the alkanol are the
             same, draw the structure of the alkanol.   (1 mark)

             ....

             ....

21 (a) When brine is electrolysed using inert electrodes, chlorine gas is liberated at the anode instead of oxygen. Explain this observation. (2 marks)

    ....

    (b) Name the product formed at the cathode. (1 mark)

    ....

22 6.84g of aluminium sulphate were dissolved in 150 cm³ of water. Calculate the molar concentration of the sulphate ions in the solution. (Relative formula mass of aluminium sulphate is 342). (3 marks)

    ....

23 The table below shows the relative molecular masses and the boiling points of pentane and propan-1-ol.

	Relative molecular mass	Boiling point (°C)
Pentane	72	36
Propan-1-ol	60	97

    Explain why the boiling point of propan-1-ol is higher than that of pentane. (2 marks)

    ....

24 State and explain the observations made when excess ammonia gas reacts with chlorine gas. (3 marks)

    ....

25 The diagram below shows a student's set-up for the preparation and collection of hydrogen gas.
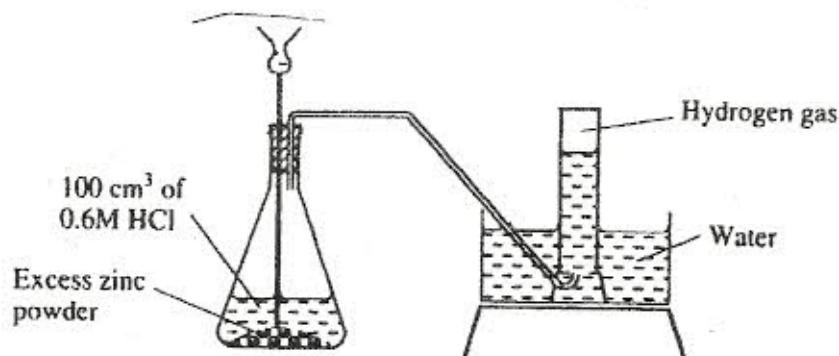
    (a) How would the final volume of hydrogen gas produced be affected if 80 cm³ of 0.75 M hydrochoric acid was used? (1 mark)

    ....

    (b) Give a reason why helium is increasingly being preferred to hydrogen in weather baloons. (1 mark)

    ....

57

26   The table below shows the number of valence electrons of the elements P, Q and R.

Element	P	Q	R
Number of valence electrons	3	5	2

(a)   Explain why **P** and **R** would not be expected to form a compound.   (1 mark)

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(b)   Write an equation to show the effect of heat on the carbonate of **R**.   (1 mark)

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....

(c)   Write the formula for the most stable ion of **Q**.   (1 mark)

....

27   The diagram below is a sketch of the graph of the non-catalysed decomposition of hydrogen peroxide.
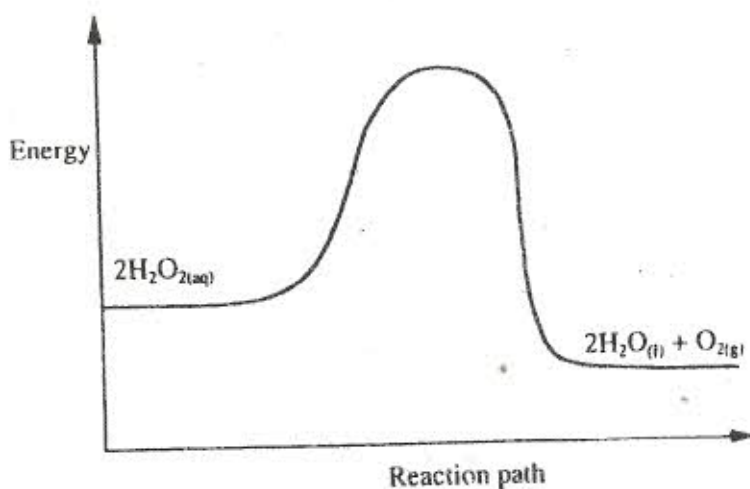
On the same axis, sketch the graph for the decomposition of hydrogen peroxide when manganese(IV)oxide is added.   (2 marks)

28   During the electrolysis of aqueous silver nitrate, a current of 5.0A was passed through the electrolyte for 3 hours.

(a)   Write the equation for reaction which took place at the anode.   (1 mark)·
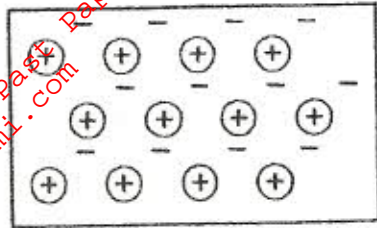
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(b)   Calculate the mass of silver deposited (Ag = 108; 1F = 96500 C).   (2 marks)

....

....

58

29   The diagram below is a section of a model of the structure of element T.

Key

(+)   Charged nucleus

—   An electron

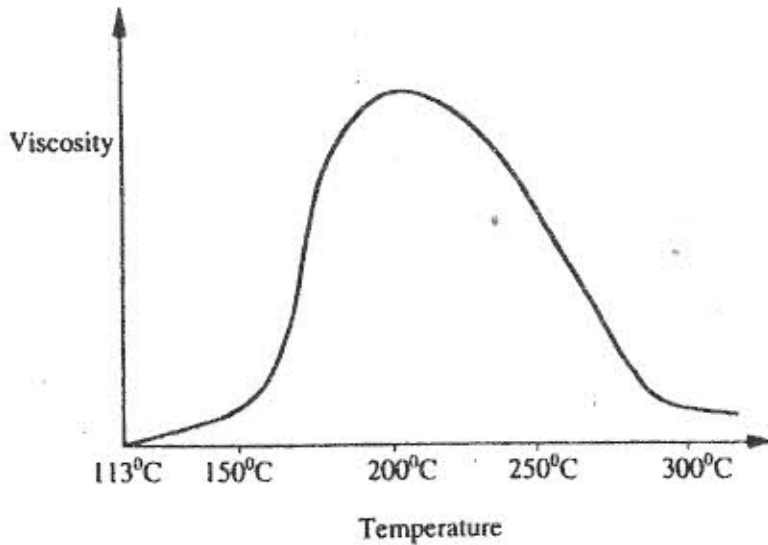(a)   State the type of bonding that exists in T.   (1 mark)

....

(b)   In which group of the periodic table does element T belong? Give a reason.
                                                                              (2 marks)

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30   Below is a sketch of a graph showing the change in viscosity (Ease of flow) with
       temperature when solid sulphur is heated.

       Describe what happens to the sulphur molecules when sulphur is heated from 150°C to
       about 200°C.   (2 marks)

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