Name --------------------------------------- index no -----------------------------------------

School --------------------------------------------- date --------------------------------------

Candidate’s signature ----------------------------

233/2

Chemistry

Paper 2

Theory

Time: 2 hours

Instructions to the candidates

1. Answer all questions in this paper in the spaces provided
2. Mathematical tables and electronic calculators may be used for calculation
3. All working must be clearly shown here necessary

For examiners use only

|  |  |  |
| --- | --- | --- |
| Question | Maximum score  | Candidates score  |
| 1 | 13 |  |
| 2 | 11 |  |
| 3 | 12 |  |
| 4 | 12 |  |
| 5 | 11 |  |
| 6 | 14 |  |
| 7 | 08 |  |
| Total  | 80 |  |

This paper consists of 12 printed pages.

Candidates should check the question paper to ensure that all

pages are printed as indicated and no questions are missing

1. A) Study part of the periodic table below. The letters do not represent the actual symbols. Use the letters to answer the questions that follows.



1. Which one element would from a divalent anion? (1 mark)

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1. Write formula of the compound formed when P reacts with L. (1 mark)

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1. Monovalent cation of X electrons configuration 2.8.8. Indicate its position in the periodic table above. (1 m ark)

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1. Identify most reactive metallic element (1 mark)

B) The table shows some properties and electron arrangements of common ions of elements represented by letters Q to X. Study the information provided then answer the questions that follow

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| --- | --- | --- | --- | --- |
| Element  | Formula of ion  | Ionic electron arrangement  | Atomic radius  | Ionic radius  |
| Q  | Q- | 2.8 | 0.072 | 0.136 |
| R | R+ | 2.8.8 | 0.231 | 0.133 |
| S | S3+ | 2.8 | 0.143 | 0.050 |
| T  | T2+ | 2.8.8 | 0.133 | 0.074 |
| U | U2+ | 2.8 | 0.160 | 0.064 |
| V | V+ | 2.8 | 0.186 | 0.095 |
| W | W3- | 2.8.8 | 0.110 | 0.190 |
| X | X- | 2.8.8 | 0.099 | 0.181 |

1. Give the atomic numbers of elements T and Q (2 marks)

 T --------------------------------------------------------------------------

 Q ------------------------------------------------------------------------

1. Select two non- metals that belong to the same period. (1 mark)

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1. Which two elements would react violently with water to produce hydrogen? (2 marks)

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 c) i) Why is the atomic radius of R larger than its ionic radius? (2 marks)

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 ii) Element S is suitable for making cooking pans. Explain (2 marks)

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1. A) Gives the names of the following compounds
2. CH3CHCHCH2CH3 (1 mark)

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1. CH3(CH2)2COOH (1 mark)

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 B) Ethane and ethane react with Bromine according to the equations given below.

1. C2H**6** (g) + Br2(g) C2H6Br(l) + HBr(g)
2. C2H4 (g) + Br2(g) C2H4Br2(l)

 Name the type of bromination reacting taking place in (i) and (ii) above.(1 mark)

1. ----------------------------------------------------------------------------------------------
2. ----------------------------------------------------------------------------------------------

 C) Study the diagram below and answer the questions that follow.



1. Write the equation for the complete combustion of butane.

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1. The Ph of substance K was found to be less than 7.

Explain the observation (2 marks)

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D) The polymerization of tetra fluorocarbon (2F4) is similar to that of ethane (C2H4)

1. What is meant by polymerization? (1 mark)

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1. Draw the structural formula of the polymer obtained from monomer C2H4 (1 mark)

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1. Sate any two advantages of synthetic polymers over natural polymers. (2 marks)

 CH3CH2CH2OH(aq) + CHCOOH(aq) R(aq) n+H2O(l)

1. Give the name of product R (1 mark)

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1. Name the type of reaction that produces R. (1 mark)

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1. Study the standard electrode potential for the half-cells given below and answer the questions that follow. The letters do not represent the actual symbol of the elements.

E° - volts

N+ (aq) + e- -2.92

J+(aq) +e- J(s) +0.52

K+ (aq) + e-  ½ K2(g)  0.00

M2+ (aq) + e- -0.44

1. Identify the strongest oxidizing agent. Give a reason for your answer (1 ½ marks)

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1. Which two half-cells would produce the highest potential difference when combined? (1 mark)

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1. Explain whether the reaction represented below can take place (2 marks)

M(s) + 2N+ (aq) M2+ (aq) + 2N(s)

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 B) 100cm3 of 2M sulphur (iv) acid was electrolyzed using the set –up represented diagram below.



1. Write an equation for the reaction that produces gas L. (1 mark)

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1. Describe how gas K can be identified (1 ½ marks)

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1. Explain the differences in;
2. Volume of gases produced at electrodes (1 mark)

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1. Brightness of the bulb if 1100cm3 of 2M ethanoic acid was used in place of 2MSulphur (vi) acid (2 marks)

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C) A current 0.5a was passed for 2 hours. Calculate the mass of lead deposited (Pb = 207, if =96500c) (2 marks)

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1. A) Below is a simplified diagram of a down’s cell used in manufacture of sodium. Study it and answer the questions that follow.



1. What materials is the anode made of? Give a reason (2 marks)

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1. What precaution is taken to prevent chlorine and sodium from recombining (1 mark)

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1. Write a ionic equation for the reaction in which chlorine gas is formed (1 mark)

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 B) In the Down’s cell, a certain salt is added to lower the melting point of sodium chloride from 800°C to 600° C.

a. Name the salt that is added (1 mark)

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1. State why it is necessary to lower melting point (1 mark

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 C) Explain why it’s not suitable to use aqueous sodium chloride for the manufacture of sodium in the Down’s process. (2 marks)

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 D) Sodium metal reacts with air to form two oxides. Give the formulae of the two oxides (2 marks)

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 E) State two uses of sodium metal. (2 marks)

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1. A) Define the standard enthalpy of formation of a substances (1 marks)

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 B) Use the thermo chemical equations below to answer the questions that follow.

1. C2H6(g) + 7/2 O2 2CO2(g) + 3H2O(g) H1 =- 1560 kjmol-1
2. C (graphite) + O2(g) CO2 (g) H2 =- 394 kjmol-1
3. H2(g) + ½ O2 (g) H2O (g) H3 =- 286 kjmol-1
4. Name two types of heat changes represented by H3 (2 marks)

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1. Draw an energy level diagram for the reaction represented by equation 1. (2 marks)
2. Calculate the standard enthalpy of formation of ethane (2 marks)

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1. When a sample of ethane was burnt, the heat produced raised the temperature of 500g of water by 21.5k (specific heat capacity of water 4.2 Jg-1k-1)

Calculate

1. Heat change for the reaction. (2 mark)

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1. Mass of ethane that was burnt (relative formula mass of ethane – 30)(1mark)
2. A. Define the term solubility (2 marks)

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B)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  Mass of Kcl(g)  | 20 | 20 | 20 | 20 | 20 | 20 |
| Volume of water (cm3) | 40.0 | 45.0 | 50.0 | 55.0 | 60.0 | 65.0 |
| Temperature at which crystals first appears (°C) | 77.0 | 56.0 | 40. | 26.0 | 15.0 | 8.0 |
| Solubility in g per 100g of water  |  |  |  |  |  |  |

1. Complete the table above by calculating the solubility of KCL in grammes per 100g of water. (3 marks)
2. Plot the graph of solubility in g/100g of water (y-axis) against temperature (x-axis) (3 marks)
3. From the graph determine solubility at 50° C. (1 mark)
4. If a saturated solution of potassium chloride is cooled from 70°C to 10°C. What mass of the crystal s would be obtained? (2 marks)
5. Calculate the concentration of the saturated at 50°C. (K-39.0, CL=35.5) (2 marks)

c) The set up below was used t remove hardness in water.



1. Identify the above method of removing water hardness. (1 mark)

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1. The above system eventually lack the ability to soften hard water. Explain it can be reactivated. (1 mark)

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1. State any advantage of hard water. (1 mark)
2. The following scheme represents the steps followed in the contact process, study it and answer the questions which follow.



1. Name three possible identities of solid A. (1 mark)

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1. Name two impunities removed by the purifier. (1 mark)

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1. Why is it necessary to remove impunities (1 mark)

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C) The following equation shows a reactor taking in the catalytic chamber/ converter.

2SO2(s) + O2(g) 2SO3(g) H° = - 197 KJmol-1

1. How would the following factors affect the production of sulphur (IV) oxide?
2. Increase in temperature (1 mark)
3. Decrease the pressure (1 mark)

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1. Name the catalyst which is commonly used in this process and why? (1 mark)

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1. Tate and explain one environmental effect of sulphur (Iv) oxide in the atmosphere. (2 marks)

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