P525/2

CHEMISTRY

Paper 2

June 2024

2½ hours

**DIVINE SECONDARY SCHOOL**

**UGANDA ADVANCED CERTIFICATE OF EDUCATION**

**END OF TERM 1 2024**

CHEMISTRY

Paper 2

2 hours 30 minutes

**INSTRUCTIONS TO CANDIDATES**

*Answer* **five** *questions, including* ***three*** *from section* ***A*** *and* ***any two*** *from section* ***B****.*

*Additional questions answered will* ***not*** *be marked.*

*Write the answers in the answer booklets provided.*

***Begin each question on a*****fresh page**

*Mathematical tables and graph papers are provided*

*Non-programmable scientific electronic calculators may be used*

***Use equations were necessary to illustrate your*****answer**

*[]*

**SECTION A**

Answer **three** questions in this section.

1. (a) The first ionization energies of an element B are shown below

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Ionization Energy/kJMol-1 | | | | | | | |
| 1st | 2nd | 3rd | 4th | 5th | 6th | 7th | 8th |
| 786 | 1580 | 3230 | 4360 | 16000 | 20000 | 23600 | 29100 |

(I) explain what is meant by the term *Fist ionization energy*? (02marks)

(ii) State the factors that determine the value of first ionization energy.(02marks)

(iii) To which group of the periodic table does element B belong,

Give reason for your answer. (03marks)

(b)(i) Explain the term *electronegativity*. (02marks)

(ii) State the factors that determine the value of electronegativity of an element.(03marks)

(c) Explain how the following factors affect the value of electronegativity of an element. (06marks)

(i) Atomic radius

(ii) Nuclear charge

(iii) The screening effect of the inner electrons

(d) Explain the difference between electronegativity and atomic radius.(02marks)

2. (a) Define the terms;

(i) hydrocarbon. (01 mark)

(ii) isomerism (01 mark)

(b) The table below shows the boiling points of straight chain alkanes.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Alkane | CH4 | C2H6 | C3H8 | C4H10 | C5H12 | C6H14 | C7H16 |
| Boiling point | -162 | -89 | -49 | -0.5 | 36 | 69 | 98 |
| Molecular mass(g) |  |  |  |  |  |  |  |

(i)Complete the table above. (3 ½ marks)

(ii)Plot a graph of boiling point against molecular mass of the alkanes. (03 marks)

(iii)Use your graph in (b)(i) to determine the molecular mass of octane. (01 mark)

(iv)Explain the trend in boiling points of alkanes. (2 ½ marks)

(c) A mixture of 10 cm3 of a gaseous hydrocarbon 100 cm3 of excess oxygen was exploded. The volume after explosion was 75cm3 and this was reduced to 35cm3 on treatment with potassium hydroxide solution.

(i) Deduce the molecular formula of the hydrocarbon. (2 ½ marks)

(ii) Write the structural formulae and IUPAC names of all the possible isomers of the hydrocarbon.

(02 marks)

(iii) State what is observed and write equation for the reaction when propene is passed through bromine liquid in presence of carbon tetrachloride . (3 ½ marks)

3. (a) State what is meant by the term an ideal gas. (02mark)

(b) Explain how liquefication of a gas can be affected by:

(i) pressure

(ii) temperature (05marks)

(c) Explain two a factors affecting the rate of diffusion (04marks)

(d) At constant temperature, a vessel contains two gases, A and B and pressure of A is 0.5x10-5mmHg and its mole fraction is 0.7.

(i)calculate the partial pressure of B. (03marks)

(ii) calculate the total pressure exerted by a mixture of the gases. (2.5marks)

(e) A solution containing 1.5% of a polymer was found to have an osmotic pressure of 3.6 × 10-4 atmospheres at 25oC. Calculate the molecular mass of the polymer. (3.5 marks)

**SECTION B**

Answer any **two** questions in this section.

4. (a) (i) What is meant by the term structural isomerism? (02 marks)

(ii)Describe the three types of structural isomerism, giving a suitable example in each case.

(06 marks)

(b) Complete the following equations and outline mechanisms for each of the following reactions

(i) (CH3)3CBr C2H5O-K+/C2H5OH /heat (04marks)

(ii) CH3CH=CH2  Br2/NaCl (04marks)

(iii) + CH2=CH2  H+ (04marks)

5. (a) Define the terms;

(i) first ionization energy (01 mark)

(ii) Atomic radius (01 mark)

(b) State and explain any three factors that affect the value of first ionization energy. (6 ½ marks)

(c) The table below shows the first ionisation energy of Period 3 elements of the Periodic Table.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Element | Na | Mg | Al | Si | P | S | Cl |
| Atomic number | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| First ionization energy (kjmol-1) | 502 | 745 | 587 | 791 | 1020 | 1000 | 1260 |

(i) Write equation to show the first ionisation energy of magnesium atom. (1 ½ marks)

(ii) Plot a graph of first ionisation energy against atomic number. (03 marks)

(iii) Explain the shape of the graph in c(ii) . (07 marks)

6. (a) What is meant by each of the following terms:

(i) Relative atomic mass (02 marks)

(ii) Relative abundance (02 marks)

(iii) Relative intensities (02 marks)

(b) Briefly describe how relative atomic mass of magnesium metal which consists of three isotopes can be determined using a mass spectrometer. (09 marks)

(c) A compound Q contains 64.9% carbon, 13.5% hydrogen and the rest being oxygen. 1.85g of Q in the vapour form occupied 969.8cm3 at 200oC.

(i) calculate the empirical formula of Q (03marks)

(ii) Determine the molecular formula of Q, (02marks)

(the molar gas constant, R= 8.31jK-1mol-1)