S.5 MID TERM EXAMINATIOINS

CHEMISTRY PAPER ONE

NAME……………………………………………………………………. STREAM………

Instructions

Answer all questions in section A and any six questions in section B

All answers should be written in the spaces provided.

SECTION A (46 marks) *answer all questions in this section*

1. (a) define the term osmotic pressure (2 marks)

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(b) the osmotic pressure of a solution containing 42g of a substance Y is 5.62×10^5 Nm^{-2} at 20^0C calculate the relative molecular mass of Y (3 marks)

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2. (a) what is meant by the term chain isomerism   (1 mark)

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(b) pentane exhibits chain isomerism, write the structures and IUPAC names of any three chain isomers of pentane   (3 marks)

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3. soap can be be manufactured from vegetable oil.

(a) state any other natural substance that can substitute vegetable oil as a raw material in the manufacture of soap   (1 mark) ………………………………………………………………………………………………

(ii) state one substance that reacts with vegetable oil to form soap.   (1 mark)

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(iii) write an equation for the reaction leading to the formation of soap.   (1 mark)

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(b) briefly explain why an aqueous solution of soap is alkaline   (3 marks)

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4. chlorine has two isotopes: Cl-35 and Cl-37.

(a) what is meant by the term isotope? (2 marks)

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(b) calculate the abundance of the two isotopes if the relative atomic mass of chlorine is 35.5

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5.(a) state Raoult's law (2 marks)

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(b) the vapour pressure of pure water at 25°C is 3167 Pa. the vapour pressure of the solution of 4g of a sugar solution in 100g of water at the same temperature is 3154.5 Pa. what is the relative molecular mass of sugar? (4 marks)

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6. (a) what is meant by the term electronegativity? (1 mark)

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(b) i) state any three factors that affect electronegativity of an atom (1 ½ marks)

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(c) the table below shows period 3 elements and their electronegativities.

Element	Na	Mg	Al	Si	P	S	Cl
Electronegativity	0.9	1.2	1.5	1.8	2.1	2.5	3

(i)   State how electronegativity varies across the period. Explain your answer (3 marks)

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7. (a) what is meant by boiling point elevation constant? (2 marks)

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(b) a solution contains 50g of ethane-1,2-diol in 40g of water. Calculate the boiling of the solution (K_b of water is 0.52°Cmol^{-1}Kg^{-1}) (4 marks)

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8. (a) differentiate between an electrophilic addition and electrophilic substitution reaction. (2 marks)

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(b) write an equation to show an

(i) electrophilic addition reaction (1 mark)

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   (ii)   electrophilic substitution reaction (1 mark)

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9. (a) what is meant the following terms?

(i)reversible reaction (2 marks)

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(ii) chemical equilibrium (1 mark)

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(b) explain the term dynamic equilibrium as applied to chemical equilibria. (2 marks)

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SECTION B: 54 MARKS *(answer any six questions in this section)*

10. The table below shows atomic radius the first ionization energies of some elements in period 3 of the periodic table.

Element	Na	Mg	Al	Si	P	S	Cl
Radius (nm)	0.186	0.160	0.143	0.117	0.110	0.104	0.099
First ionization energy (Kjmol^{-1})	496	738	577	787	1060	1000	1251

a) i) state how the atomic radius of the elements varies across the period (1 mark)

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ii) explain your answer in a(i) above (3 marks)

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b) explain how the atomic radius affects the first ionization energy (2 marks)

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c) explain why the first ionization energy of aluminum is lower than that of magnesium (3 marks)

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11. (a) what is meant by the term polymerization? (1 mark)

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b) differentiate between a natural and synthetic polymer (2 marks)

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c) give two examples of

i)   addition polymers (2 marks)

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ii)   condensation polymers (2 marks)

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d) an aqueous solution containing 1.5% nylon 6,6 was found to exert osmotic pressure of 4.1×10^{-2} atm at $25^{\circ}C$. Calculate the molar mass of nylon 6,6   (2 marks)

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12. a) one of the limitations of the method of determining relative molecular mass by freezing point method is that the solute should not associate or dissociate in solution

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i)   state three other limitations of determining molecular mass by freezing point method. (1 ½ marks)

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ii)   explain how association of a solute in solution affects the molecular mass determined by freezing point method (3 ½ marks)

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iii)   a solution containing 0.142g of naphthalene in 20.25g of benzene caused a

lowering of freezing point of 0.284°C. calculate the molar mass of naphthalene (cryoscopic constant K_f of benzene is 5.15 oCmol-1Kg-1)
(4 marks)

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13. A mass spectrometer is used to determine relative atomic masses of substances.

a) briefly explain how each of the following steps are involved in the operation of a mass spectrometer.

i) ionization (1mark)

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ii)   acceleration (1 mark)

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iii) deflection (1 mark)

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iv)detection (1 mark)

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b) an element Q has the following percentage isotopic constituencies.

Isotopic mass	Relative abundance (%)
54	5.84
56	91.68
57	2.17
58	0.31

i) Determine the relative abundance of isotopes of Q.   (3 marks)

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ii) conclude the relative atomic mass of Q.   (2 marks)

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C)state two advantages of using a mass spectrometer over the depression of freezing point of determining relative atomic masses   (2 marks)

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14. complete the following equations and in each case outline a mechanism for the reaction.

(3 marks each)

a) $CH_3CH = CH_2$ + $Br_2(l) \xrightarrow{\quad CCl_4 \quad}$

b) $CH_3CH_2CH_2OH \xrightarrow[\quad 180^0C \quad]{\quad ConcH_2SO_4 \quad}$

c)

$\xrightarrow[\quad AICl_4 \quad]{\quad CH_3Cl \quad}$
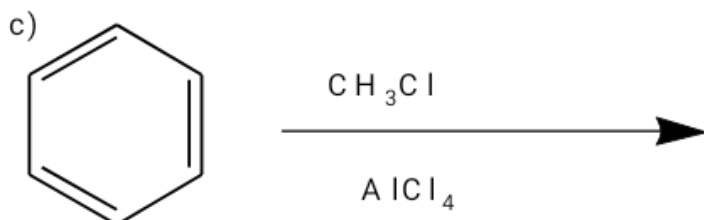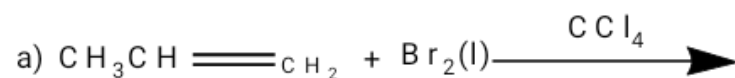
15. When 20cm^3 of a hydrocarbon of form (C_xH_y) was exploded in 200cm^3 of excess oxygen, 130cm^3 of residual gases remained at room temperature. When the residual gases were passed through concentrated sodium hydroxide, 40 cm^3 of the residual gases remained.

a) Write an equation for the reaction. (1 mark)

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b) determine the molecular formula of the hydrocarbon. (4 marks)

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c) identify three isomers of the hydrocarbon and write the IUPAC name of the isomers.

(3 marks)

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d) suggest one use of the hydrocarbon. (1 mark)

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END