

SECTION A-46 MARKS
ATTEMPT ALL QUESTIONS IN THIS SECTION.

1. Beryllium, Magnesium & Calcium are group (II) elements.

a) Write the general outer configuration of the elements.

(01 mark)

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b) Each of these elements reacts with carbon to form a carbide.

Write equation for the reaction between each carbide with water.

(04½ marks)

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2. Aluminium and phosphorus form compounds in the oxidation states of +3.

a) Briefly explain in terms of electronic configuration why aluminium conducts electricity while all the common allotropes of phosphorus do not.

(03 marks)

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b) Write equations for the reaction between each element with aqueous sodium hydroxide solution. (@01½ marks)

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3. (a). Complete the following nuclear reactions below. (@01 mark)



b) It takes 5 days for 0.0250mg of Bismuth-214 to disintegrate in to 0.0125mg of Bismuth-210. Calculate the time required for 0.0160mg Bismuth-214 to change in to 0.0010mg Bismuth-210. (03 marks)

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4. (a) Draw the structure and name the shape of the following anions. (03 marks)

Ions/Anions	Structure	Name of shape
SO_3^{2-}		
SO_4^{2-}		
$\text{S}_2\text{O}_3^{2-}$		

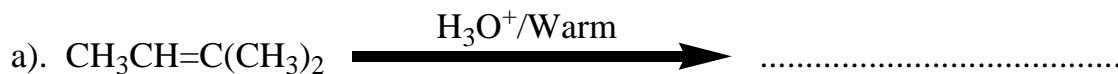
- b) Name the reagent(s) that can be used to distinguish between SO_3^{2-} and SO_4^{2-} ions. State what would be observed.

(02 marks)

Reagent(s):

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Observation(s):
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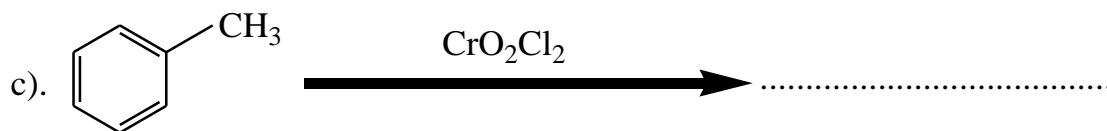
5. Complete the following equations and give the IUPAC names of the main organic products. (@01 mark)



Name of organic product:.....



Name of organic product:.....



Name of organic product:.....



Name of organic product:.....

6. Phenol was added to bromine water.

a)(i) State what was observed. (01 mark)

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(ii) Write equation for the reaction. (0½ mark)

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b) Name the reagent that can be used to distinguish between phenol and cyclohexanol. State what is observed if the reagent is treated with each compound. (@01 mark)

Reagent(s):

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Observation(s):

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c) Write equation showing how phenol can be prepared from benzene diazonium chloride. (02 marks)

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7.(a) State Graham's law of gaseous diffusion. (01 mark)

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b) Nickel forms a carbonyl, $[\text{Ni}(\text{CO})_n]$. Deduce the value of n if carbon monoxide gas diffuses 2.46 times faster than the carbonyl compound. (03 marks)

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c) State the: (@0½ mark)

(i) Oxidation state of nickel in the compound.

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(ii) Coordination number of nickel in the compound.

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8. State what would be observed and write an equation between the following compounds and the reagent commonly used in identifying organic compounds. (@02 marks)

a) Neutral iron (III) chloride and phenol.

Observation(s):

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Equation:

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- b) Sodium nitrite in presence of concentrated hydrochloric acid and ethylmethanamine.**

Observation(s):

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Equation:

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- c) Fehling's solution and ethanal.**

Observation(s):

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Equation:

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9. A compound, Z contains 19.15% nitrogen, 43.5% oxygen and the rest being manganese.

a) (i) Calculate the empirical formula of compound, Z. (02 marks)

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(ii) 10.0g of compound, Z in 1,000.0g of water lowered to freezing point of water by 0.127°C . Calculate the molecular formula of compound, Z. (02 marks)

$[K_f \text{ 4 water} = 1.86^{\circ}\text{C/mol/kg}]$

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b)Compound,Z was dissolved in water to form a pink solution and divided in to two portions. State what would be observed and write equation for the reaction that took place when:

(i)To the first portion, Acidified potassium manganate (VII) solution was added. (02 marks)

Observation(s):

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Equation:

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(ii) To the first portion, concentrated nitric acid and lead (IV) oxide was added & the mixture was boiled.(02 marks)

Observation(s):

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Equation:

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SECTION B-54 MARKS

ATTEMPT ANY SIX QUESTIONS IN THIS SECTION.

10. Compound,F contains 62.1% carbon, 10.3% hydrogen and the rest being oxygen.

a)Calculate the empirical formula of compound, F. (03 marks)

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b)Compound,F steam distills at a temperature 98°C and pressure of $1.01 \times 10^5 \text{Nm}^2$.If the vapour pressure of water at the same temperature is $9.5 \times 10^4 \text{Nm}^2$.Calculate the molecular mass of compound, F if the distillate contained 16.67% by mass of compound, F. (02 marks)

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c) Compound, F formed a grey precipitate when ammoniacal silver nitrate solution. Write equation and outline a mechanism for the reaction between compound, F and sodium hydrogen sulphite solution. (03 marks)

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11. When heated, carbon dioxide gas decomposes according to the equation below. $2\text{CO}_2(\text{g}) \rightleftharpoons 2\text{CO}(\text{g}) + \text{O}_2(\text{g})$ $\Delta H = -\text{ve}$. If at a certain temperature and 1 atmospheric pressure, 60% of the original carbon dioxide gas remained undissociated.

a) Calculate the equilibrium constant, K_p for the reaction. (05 marks)

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b) State and explain the effect of:

(i) Increasing the pressure to 2 atmospheres on the equilibrium concentration of oxygen gas. (02 marks)

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(ii) Carrying out the decomposition at a lower temperature on the value of the equilibrium constant, K_p . (02 marks)

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12. a) Write the name and formula of any one ore from which Aluminium can be extracted. (01 mark)

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b) (i).Describe how the ore is purified. (04 marks)

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(ii) Describe the reaction of aluminium metal with acids.
(04 marks)

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13. Nitrogen reacts with hydrogen in a mole ratio of 1:3 to form ammonia gas.

a) Write:

(i) Equation for the reaction that takes place.
(01½ marks)

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(ii) The expression for the equilibrium constant, K_c .
(0½ mark)

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b) State the condition (s) used to obtain maximum yield of ammonia during its manufacture by Haber process.

(01½ marks)

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c) The percentage of ammonia in the equilibrium mixture of gases was found to be 15% at 600°C. Calculate the equilibrium constant (K_c) for the reaction at 600°C.

(04 marks)

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d) State what would happen to the equilibrium position of the reaction in a (i) above when hydrogen chloride gas is added to the equilibrium mixture. Give a reason for your answer.

(01½ marks)

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14. (a) Explain what meant by the following terms. (@02 marks)

(i) Lattice energy

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(ii) Standard heat of formation of a substance.

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(b).the standard heat of formation of phosphorus trichloride is - 306KJ/mol.The bond dissociation energy and enthalpy of atomization of chlorine and phosphorus are 314 & 242kJ/mol respectively.

(i) Draw a Born-Haber cycle for the formation of phosphorus trichloride. (02 marks)

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(ii) Use your cycle to calculate the P-Cl bond energy.

(02 marks)

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(iii) Calculate the standard heat of formation of ethane if the standard heat of combustion of graphite, hydrogen and ethane are -403 , -285 & $-1,395$ kJ/mol respectively.

(03 marks)

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15. Compare the reactivity of hydrides of group (VII) elements with concentrated sulphuric acid.

a)(i) Write equation (s) for the reaction (s) which take place if any. (04 marks)

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(ii) Give a reason for the difference in reactivity shown by the hydrides in a (i) above. (01 mark)

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b) The bond lengths of the hydrides of group (VII) elements are given in the table below.

Hydrides	HF	HCl	HBr	HI
Bond length (Å°)	0.86	1.28	1.42	1.60

(i) State the trend in variation of bond length of the hydrides. (01 mark)

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(ii) Explain your answer in b (i) above. (03 marks)

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16. Write equations to show how the following conversions can be effected.

a) Methylbenzoate from benzene. (03 marks)

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b) 2-hydroxypropanoic acid from ethyne. (03 marks)

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c) 1-phenylethanol from phenol. (03 marks)

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17. (a) Define the term osmotic pressure. (01 mark)

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(b) Explain why determination of molar mass of polymer, osmotic pressure is preferred than boiling point elevation method. (01 mark)

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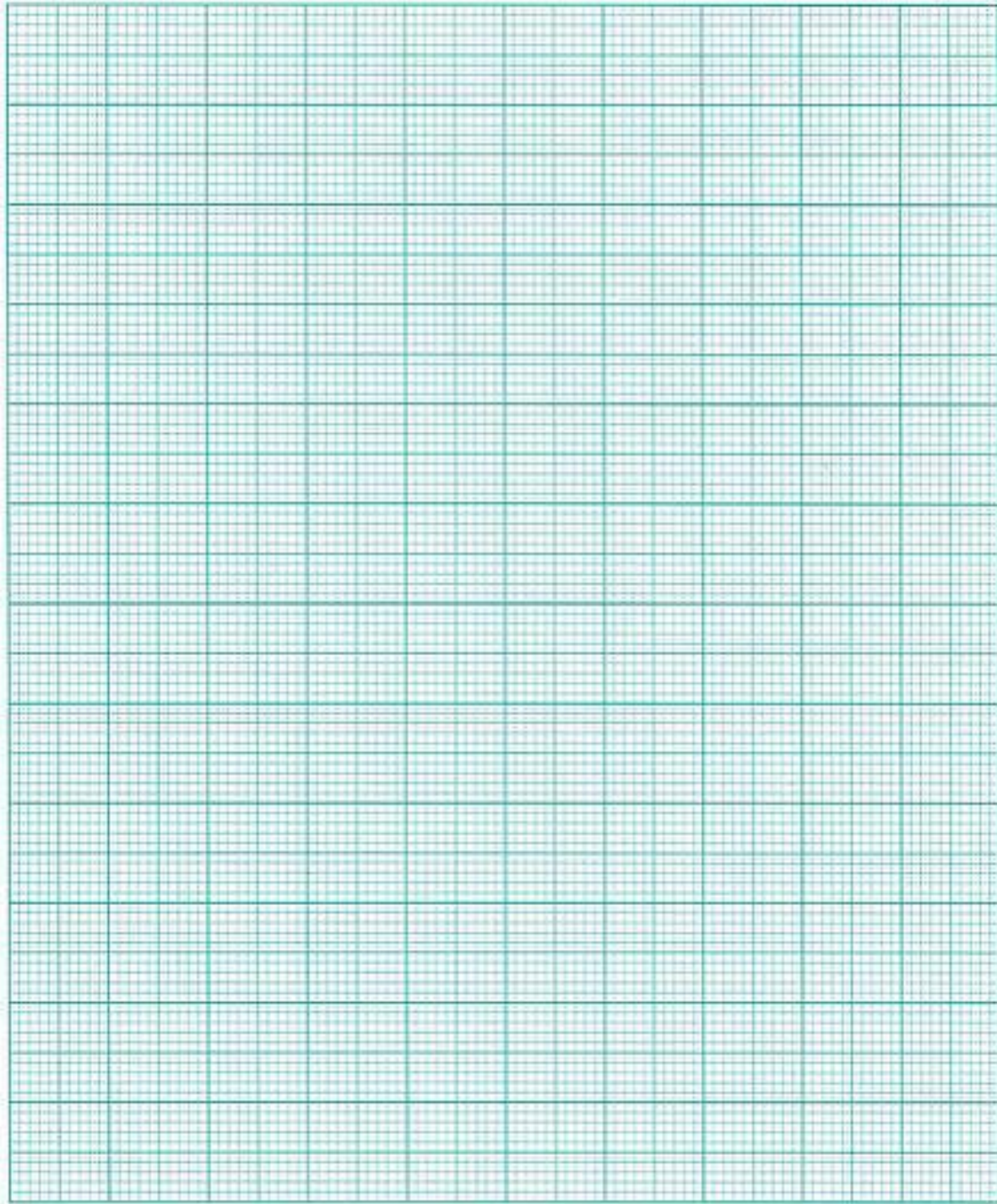
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(c) The Osmotic pressure of various concentrations of solute X in methylbenzene at 25°C are given in the table below.

Concentration (g/dm ³)	1.0	2.0	3.0	4.0	5.0	6.0
Osmotic pressure (Nm ⁻²)	23	37	53	75	92	109

(i) Plot a graph of osmotic pressure against concentration. (03 marks)



(ii) Use the graph to determine the molecular mass of X. [Universal gas constant, $R = 8.314 \text{ J/K/mol}$] (04 marks)

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THE PERIODIC TABLE

1	2											3	4	5	6	7	8
1.0 H 1															1.0 H 1	4.0 He 2	
6.9 Li 3	9.0 Be 4											10.8 B 5	12.0 C 6	14.0 N 7	16.0 O 8	19.0 F 9	20.2 Ne 10
23.0 Na 11	24.3 Mg 12											27.0 Al 13	28.1 Si 14	31.0 P 15	32.1 S 16	35.4 Cl 17	40.0 Ar 18
39.1 K 19	40.1 Ca 20	45.0 Sc 21	47.9 Ti 22	50.9 V 23	52.0 Cr 24	54.9 Mn 25	55.8 Fe 26	58.9 Co 27	58.7 Ni 28	63.5 Cu 29	65.7 Zn 30	69.7 Ga 31	72.6 Ge 32	74.9 As 33	79.0 Se 34	79.9 Br 35	83.8 Kr 36
85.5 Rb 37	87.6 Sr 38	88.9 Y 39	91.2 Zr 40	92.9 Nb 41	95.9 Mo 42	98.9 Tc 43	101 Ru 44	103 Rh 45	106 Pd 46	108 Ag 47	112 Cd 48	115 In 49	119 Sn 50	122 Sb 51	128 Te 52	127 I 53	131 Xe 54
133 Cs 55	137 Ba 56	139 La 57	178 Hf 72	181 Ta 73	184 W 74	186 Re 75	190 Os 76	192 Ir 77	195 Pt 78	197 Au 79	201 Hg 80	204 Tl 81	207 Pb 82	209 Bi 83	209 Po 84	210 At 85	222 Rn 86
223 Fr 87	226 Ra 88	227 Ac 89															
			139 La 57	140 Ce 58	141 Pr 59	144 Nd 60	147 Pm 61	150 Sm 62	152 Eu 63	157 Gd 64	159 Tb 65	162 Dy 66	165 Ho 67	167 Er 68	169 Tm 69	173 Yb 70	175 Lu 71
			227 Ac 89	232 Th 90	231 Pa 91	238 U 92	237 Np 93	244 Pu 94	243 Am 95	247 Cm 96	247 Bk 97	251 Cf 98	254 Es 99	257 Fm 100	256 Md 101	254 No 102	260 Lw 103

♥ ===END===

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