

Name

Signature SECTION.....

P525/1

CHEMISTRY

Paper 1

$2\frac{3}{4}$ hours.

CHEMISTRY PAPER 1

2 hours 45 minutes.

INSTRUCTIONS TO STUDENTS

- Answer **ALL** questions in Section **A** and **Six** questions from Section **B**.
- All questions must be answered by writing clearly your answers and workings in the spaces provided.
- Silent non-programmable scientific electronic calculators may be used.
- The Periodic Table with relative atomic masses and atomic numbers of different elements is attached at the end of the booklet.
- Illustrate your answers with equations where applicable.
- Molar gas constant, R , = $8.31 \text{ J kg}^{-1} \text{ mol}^{-1}$.
- Molar gas volume at s.t.p is 22.4 litres.

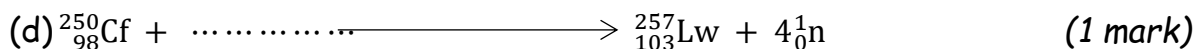
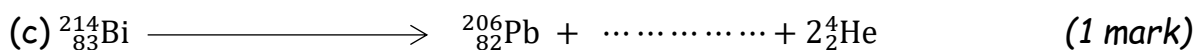
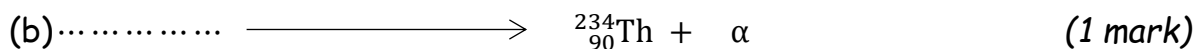
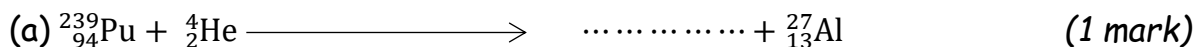
FOR EXAMINER'S USE ONLY

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total

SECTION A (46 MARKS)

Attempt all questions in this section

1. Complete the following equations for nuclear reactions.



2. Complete the equation and write the mechanism for the reaction (04 marks)



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3. State what would be observed and write equation(s) for the reaction(s) that would take place when to a solution of cobalt(II) chloride is added,
(a) aqueous sodium hydroxide drop-wise until in excess. (3½ marks)

Observation

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Equation(s)

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(b) Concentrated hydrochloric acid

(2½ marks)

Observation

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Equation(s)

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4. (a) 10cm³ of a hydrocarbon P (C_xH_y) was exploded in 90cm³ of oxygen. On cooling to room temperature, the residual gases occupied 70cm³, when the residual gases were passed through potassium hydroxide solution, the volume reduced to 40cm³.

(i) Write the equation for the reaction between P and oxygen (1 marks)

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(ii) Determine the molecular formula of P (3 marks)

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(b) Write equations to show how P can be prepared from propan-2-ol (2 marks)

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5. (a) 2.0g of phosphorus raises the boiling point of 37.4g of carbon disulphide by 1.003°C , whereas 4.65g of Sulphur raises the boiling point of 100g of carbon disulphide by 0.42°C .

(i) Calculate the boiling point constant for carbon disulphide
(molar mass of Sulphur is 256) (3 marks)

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(ii) Molar mass of phosphorus in carbon disulphide. (2 marks)

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(b) Determine the molecular formula of phosphorus.

(1 marks)

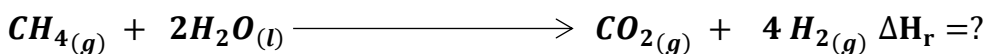
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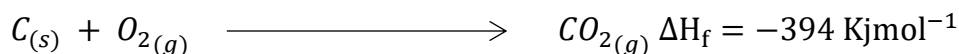
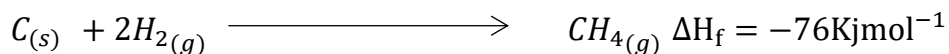
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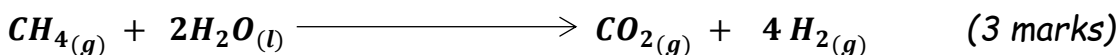
6. Methane reacts with steam according to the following equation:



The enthalpy of formation of methane, water, and carbon dioxide are -76 , -242 , and -394 kJ mol^{-1}



(a) Calculate the enthalpy of reaction



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(b) State whether the reaction above is feasible, give a reason for your answer.

(1 mark)

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7. (a) When red lead, Pb_3O_4 was reacted with nitric acid a solid was formed.
Write the equation for the reaction. **(1½ marks)**

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- b) The mixture from (a) was filtered and residue warmed with concentrated hydrochloric acid

- (i) State what was observed **(3marks)**

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- (ii) Explain your answer in b(i)

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- (iii) Write equation for the reaction **(1½ marks)**

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8. (a) (i) State the conditions for the reaction between Benzene and Sulphuric acid. **(1 mark)**

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- (ii) Outline the mechanism for the reaction in a(i) **(2 marks)**

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(b) Write equation(s) to show how the product in a(ii) can be converted to hydroxybenzene. (2 marks)

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9. When a current of 6 A was passed through copper (II) sulphate solution using platinum electrodes, 7.5g of copper were deposited.

(a) Write equation for the reaction that took place at the (i) anode (01 mark)

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(ii) Cathode (01 mark)

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(b) Calculate time taken for the copper to be deposited. (IF = 96500C) (03 marks)

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SECTION B (54 MARKS)

Attempt any six questions from this section

10. (a) Silver ethanedioate is sparingly soluble in water. Write:
(i) equation for the solubility of silver ethanedioate in water. (1½ marks)

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- (ii) the expression for the solubility product, K_{sp} of silver ethanedioate. (½ mark)

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- (b) The solubility product, K_{sp} , of silver ethanedioate is $5.3 \times 10^{-12} \text{ mol}^3 \text{ l}^{-3}$ at 25°C. Calculate the concentration of the following ions in a saturated solution of silver ethanedioate.
(i) Silver ions. (2½ marks)

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- (ii) Ethanedioate ions (½ mark)

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- (c) Calculate the mass of silver nitrate should be added to the saturated solution in (b) in order to reduce the concentration of the ethanedioate ions to a fifth of its original value. (2½ marks)

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(d) Sodium ethanedioate solution was added to the solution in (b). State how the concentration of the silver ions was affected and give a reason for your answer. (1½ marks)

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Reason.....

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11. State what would be observed and write the equation for the reaction that would take place when;

(a) Potassium iodide solution is added to copper(II) sulphate solution. (02 marks)

Observation

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Equation

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(b) Manganese(IV) oxide is heated with excess Potassium hydroxide in presence of air. (2½marks)

Observation

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Equation

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c) sodium nitrite is added to acidified potassium manganate(VII) solution

Observation (02 marks)

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Equation

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d) a mixture of Propanal and Fehlings solution is heated

Observation (02 marks)

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Equation

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12. Name one reagent that can be used to distinguish between the following pairs of compounds. In each case state what would be observed if each member of the pair is treated with the reagent you have named.

(a) $\text{CH}_3\text{C} \equiv \text{CCH}_3$ and $\text{CH}_3\text{CH}_2\text{C} \equiv \text{CH}$

Reagent

(1 mark)

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Observations.

(2 marks)

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(b) $\text{C}_6\text{H}_5\text{COOH}$ and $\text{C}_6\text{H}_5\text{OH}$

(03 mark)

Reagent

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Observation

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(c) CH_3COONa and $\begin{array}{c} \text{COONa} \\ | \\ \text{COONa} \end{array}$

Reagent

(1 mark)

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Observations.

(2 marks)

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13. The results of the hydrolysis of 2 - bromo - 2 - methyl propane by hot aqueous sodium hydroxide is shown in the table below

Concentration of $(\text{CH}_3)_3\text{Br}$ / mol dm^{-3}	Concentration of OH^- ions mol dm^{-3}	Rate of hydrolysis / $\text{mol dm}^{-3} \text{ s}^{-1}$
0.100	0.500	0.0020
0.100	0.250	0.0020
0.050	0.250	0.0010
0.250025	0.250	0.0005

(a) Deduce the order of reaction with respect to:

(i) 2 - bromo - 2 - methyl propane

(01 mark)

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(ii) The hydroxide ion

(01 mark)

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(b) Write the rate equation for the reaction (01 mark)

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(c) Draw the energy diagram for the reaction (03 marks)

d) Write a mechanism for the reaction (03 marks)

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14. Write equations to show how the following compounds can be synthesized and in each case state the conditions for the reaction.

(a)  $\text{CH} = \text{CH}_2$ from $\text{C}_6\text{H}_5\text{COCH}_3$ (3 marks)



15. The table below shows the atomic radius and first ionisation energy of some elements in period 3 of the periodic table.

Element	Na	Mg	Al	Si	P	S	Cl
Atomic radius	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 atomic radius of the elements varies across the period.

(1 mark)

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(ii) Explain your answer in a(i)

(3 marks)

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(b)(i) Explain how atomic radius affects the ionization energy.

(2 marks)

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(ii) Why the first ionisation energy of aluminium is lower than that of magnesium.

(3 marks)

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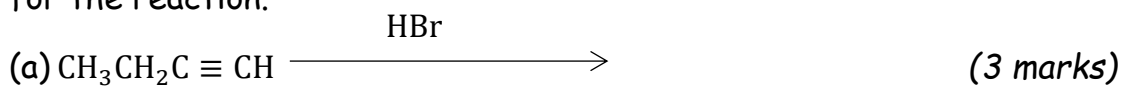
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16. Complete the following equations and in each case outline a suitable mechanism for the reaction.



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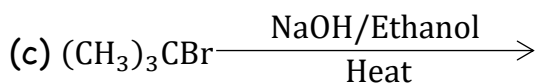
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17.(a) Draw the structure and name of the shape of the following oxy anions of nitrogen. (3 marks)

OXY ANION	STRUCTURE	SHAPE
NO_2^-		
NO_3^-		

b. (i) Name the reagent(s) that can be used to distinguish between the oxy anions in (a). (1½ marks)

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(ii) State what would observed if a solution of each oxy anions is separately treated with the reagent (s) you have named in b(i) .

(2 marks)

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(iii) Write three equation(s) if any reactions(s) that would take place when a solution of each oxy anions is treated separately with the reagents(s) you have named in b(i). ($1\frac{1}{2}$ 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	65.4 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	145 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 Mv 101	254 No 102	260 Lw 103

END