

Name:

Combination:

Date: Signature:

P 525/1
CHEMISTRY
Paper 1
2 ¼ Hours
July 2017

RESOURCEFUL MOCK II EXAM
S.6 CHEMISTRY Paper 1
2 hours 45 minutes

INSTRUCTIONS TO CANDIDATES:

- Answer **all** questions in Section **A** and six questions in Section **B**.
- All questions must be answered in the spaces provided.
- The Periodic Table, with relevant atomic masses, is supplied at the end of the paper.
- Mathematical tables (3 – figure tables) are adequate or non- programmable scientific electronic calculators may be used.
- ***Illustrate your answers with equations where possible.***
- Molar volume of gas at s.t.p is 22.4 litres.
- Standard temperature = 273K
- Standard Pressure = 101325 Nm^{-2}

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)

Answer all questions from this section.

1. (a) State what is observed and write equation for the reaction that takes place in each case when:

(i) Concentrated hydrochloric acid is added to aqueous Copper(II) sulphate until in excess. (2 ½ marks)

Observation:

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Equation:

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(ii) Aqueous potassium iodide is added to aqueous Copper (II) sulphate solution. (2½ marks)

Observation

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Equation:

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(b) Explain your observation in (a)(i) above. (1 mark)

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2. (a) State **two** conditions under which steam distillation may not occur. (2 marks)

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(b) When a mixture of X and carbon disulphide was steam distilled, it boils at 65°C and 760mmHg pressure. The distillate contained 43.5% by mass of carbon disulphide. Calculate the vapour pressure of water at this temperature. (3 marks)

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3. (a) Complete the following reactions and name the main product. (1½ marks)



Name of product



Name of main organic product

(b) Write the mechanism for the reaction that takes place in (a) (i). (2 ½ marks)

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4. Calcium hydroxide is sparingly soluble in water.

(a) Write the;

(i) equation for solubility of calcium hydroxide.
(marks)

(1 ½

(ii) expression for the solubility product
of calcium hydroxide. (½ mark)

(b) 10g of calcium hydroxide was shaken with a 0.05 mol dm^{-3} aqueous solution of sodium hydroxide. Calculate the percentage of calcium hydroxide that dissolved. State any assumption(s) made. (4 ½ marks)

Solubility product, K_{sp} for calcium hydroxide is $5.5 \times 10^{-6} \text{ mol}^3 \text{ dm}^{-9}$

5. (a) Write equations for the reactions of beryllium and aluminium with concentrated solutions of potassium hydroxide.

(i) Beryllium;

(1 ½ marks)

(ii) Aluminium

(1 ½ marks)

(b) State how the chemical properties of the chlorides of beryllium and aluminium differ from that of the other chlorides of group II metals. (2 marks)

(c) Explain why the molar mass of aluminium(III) chloride appears to vary between 133.5 and 267 depending on the temperature. (1 mark)

6. Name the reagent(s) that can be used to distinguish between the following compounds. In each case state what is observed when the compounds of each pair are separately treated with the reagent.

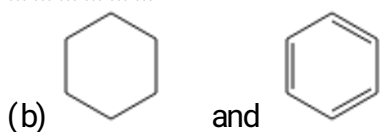
(a) 2,2- dimethyl propanal and Ethanal.

(2 marks)

Reagent:

Observation:

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(2 marks)

Reagent:

Observation:

7. (a) Explain what is meant by the term ebullioscopic constant. (1 mark)

(b) 1.2g of iodine raised the boiling point of 32 cm³ of solvent X by 0.40°C. Calculate the ebullioscopic constant for solvent X. (Density of X is 0.75g cm⁻³) (3 marks)

----- 8. In each case name the complex, name the shape and state the co-ordination number of the central metal ion.
(4 ½ marks)

Formula of Complex	Name of Complex	Name of shape	Co- ordination number
$\text{Zn}(\text{OH})_4^{2-}$			
$\text{Fe}(\text{CN})_6^{4-}$			
$\text{Cu}(\text{NH}_2\text{CH}_2\text{CH}_2\text{NH}_2)_2^{2+}$			

9. The table below shows the first four successive ionization energies of elements T and Q.

Element	Ionization Energy			
T	799	2420	3660	25,000
Q	494	4560	6940	9540

(a)(i) State the group to which each of the elements T and Q belong;

T (½ mark)

Q (½ mark)

(ii) Explain your answers in (a) (i) above. (2 marks)

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(b) Explain why the second ionization energy for each element is greater than the first ionization energy. (1 ½ marks)

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SECTION B: (54 Marks)

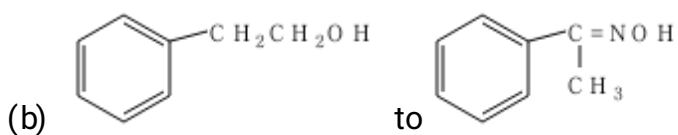
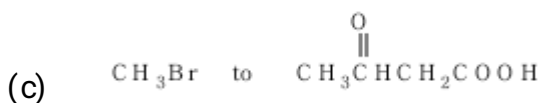
Answer six (6) questions from this section.

10. Show by use of equations and conditions of reactions how the following conservations can be effected. (3 marks each)

(a) CH_3COOH to $\text{CH}_3\text{CH}_2\text{COOH}$

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[illegible][illegible]

11. State what would be observed and write equation(s) for the reaction(s) which take place in one of the following cases.

(a) Zinc powder was added to aqueous sodium nitrate solution in excess sodium hydroxide and the mixture heated.

Observation:

(1 ½ mark)

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Equation

(2 ½ marks)

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(b) Lead(IV) oxide was added to a mixture of concentrated nitric(V) acid and manganese(II) sulphate solution and the mixture heated.

Observation:

(1 ½ marks)

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Equation

(2 ½ marks)

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(c) 2–3 drops of 2,4–dinitrophenyl hydrazine was added to a dilute solution of ethanal and mixture warmed.

Observation:

(1 ½ marks)

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Equation:

(2 ½ marks)

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12. (a) Describe briefly how soap can be manufactured from a vegetable oil. (Your answer should include a general equation for the reaction that takes place)

(4

marks)

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..... (b) 9.5g of a vegetable oil containing hexadecanoic acid

(C₁₅H₃₁COOH) was used to manufacture soap. Calculate the mass of soap formed formed. (4 marks)

[illegible]

(c) State one disadvantage of using soaps rather than detergents as a cleansing agent. (1 mark)

13(a) (i) Explain what is meant by the term electrolytic conductivity. (1 mark)

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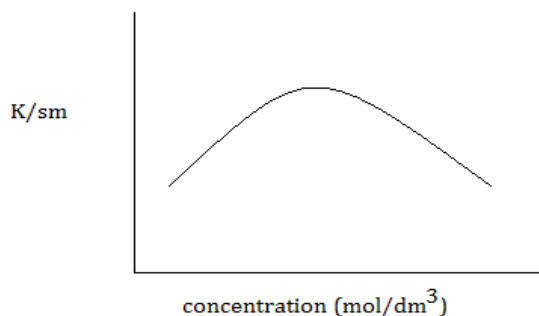
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..... (ii) State three factors that can affect electrolyte conductivity.
(1½ marks)

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(b) The graph showing how the electrolytic conductivity of carbonic acid varies with concentration is shown below.



Explain the shape of the graph.
(marks)

(2

(c) The molar conductivities of some ions at infinite dilution are given in the table below:

Ion	Molar conductivity ($\text{Scm}^2\text{mol}^{-1}$)
Na^+	50
H^+	350
Cl^-	76
OH^-	200

Calculate the electrolyte conductivity of a 0.02M hydrochloric acid solution.

 $(1 \frac{1}{2})$

marks)

(d) The solution in (c) was titrated with 1M sodium hydroxide solution and conductivity of the resultant solution measured during the titration. Assuming that the conductivity of water is negligible, calculate the electrolytic conductivity of the resultant solution when the acid has been;

(i) half neutralized.

(1 ½ marks)

... (ii) exactly neutralized.

(1 mark)

(e) State one other application of conductivity measurements. (½ mark)

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14. (a) An organic compound P contains 23.7% nitrogen and 15.3% hydrogen by mass. Calculate;

(i) the empirical formula of P. (2 marks)

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(ii) the molecular formula of P. (Vapour density of P is 29.5) (1½ marks)

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(b) P reacts with nitric(III) acid forming nitrogen gas and a compound Q. Q reacts with acidified dichromate(VI) solution on warming forming compound R, which reacts with Iodine and aqueous potassium hydroxide solution forming a yellow precipitate.

(c) Write the equation for the reaction between;

(i) P and nitric(III) acid. (1 mark)

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(ii) Q and acidified dichromate(VI) solution. (1 mark)

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(d) Write the equation and suggest a possible mechanism for the reaction between R and dilute sodium hydroxide. (3 ½ marks)

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15. A 20 cm³ sample of 0.2M ethanoic acid was titrated against 0.15M sodium hydroxide. K_a of ethanoic acid is 1.85 x 10⁻³ moldm⁻³.

(a) Sketch the pH titration curve. (1 ½ marks)

(b) Stating any assumptions made, calculate the pH of the solution;

(i) before addition of sodium hydroxide. (2 ½ marks)

(ii) at half neutralization. (3 ½ marks)

(iii) at complete neutralization.

(2 ½ marks)

16. Methanoic acid (HCOOH) and water are miscible in all proportions. They form a maximum boiling point mixture containing 77% methanoic acid which boils at 108°C .

(a) Sketch a labelled boiling point - composition diagram for mixtures of methanoic acid and water. (3 marks)

(b) Explain the factors that lead to methanoic acid and water forming a maximum boiling point mixture. (3)

marks)

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(c) Describe briefly what happens when a mixture containing 40% methanoic acid is distilled. (2 marks)

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(d) Give one method by which pure methanoic acid can be obtained from the maximum boiling point mixture. (1 mark)

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17. Explain each of the following observation(s). Illustrate your answer with equations where applicable?

(a) Both ammonia solution and ammonium chloride are needed in order to precipitate manganese (II) sulphide (MnS) using hydrogen sulphide. (3 ½ marks)

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(b) Ammonium nitrate readily dissolves in water even though its enthalpy of solution is positive. (3 marks)

[illegible]

(c) Aluminium ions form a white precipitate with aqueous ammonia solution but in the presence of ammonium nitrate no precipitate forms. (2 ½ marks)

[illegible]

THE PERIODIC TABLE

1	2											3	4	5	6	7	8
1 H 1.0																7 I 1.0	2 He 4.0
3 Li 6.9	4 Be 9.0											5 B 10.8	6 C 12.0	7 N 14.0	8 O 16.0	9 F 19.0	10 Ne 20.2
11 Na 23.0	12 Mg 24.3											13 Al 27.0	14 Si 28.1	15 P 31.0	16 S 32.1	17 Cl 35.4	18 Ar 40.0
19 K 39.1	20 Ca 40.1	21 Sc 45.0	22 Ti 47.9	23 V 50.9	24 Cr 52.0	25 Mn 54.9	26 Fe 55.8	27 Co 58.9	28 Ni 58.7	29 Cu 63.5	30 Zn 65.7	31 Ga 69.7	32 Ge 72.6	33 As 74.9	34 Se 79.0	35 Br 79.9	36 Kr 83.8
37 Rb 85.5	38 Sr 87.6	39 Y 88.9	40 Zr 91.2	41 Nb 92.9	42 Mo 95.9	43 Tc 98.9	44 Ru 101	45 Rh 103	46 Pd 106	47 Ag 103	48 Cd 112	49 In 115	50 Sn 119	51 Sb 122	52 Te 128	53 I 127	54 Xe 131
55 Cs 133	56 Ba 137	57 La 139	72 Hf 178	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	81 Tl 204	82 Pb 207	83 Bi 209	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)															
			57 La 139	58 Ce 140	59 Pr 141	60 Nd 144	61 Pm (145)	62 Sm 152	63 Sm 150	64 Eu 152	65 Tb 159	66 Dy 162	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
			89 Ac (227)	90 Th 232	91 Pa 231	92 U 238	93 Np 237	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf 251	99 Es (254)	100 Fm (257)	101 Mv (256)	102 No (254)	103 Lw

E N D