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Riverside Secondary School
2018 Prelim
4E Chemistry

Paper 1 [40 MARKS]

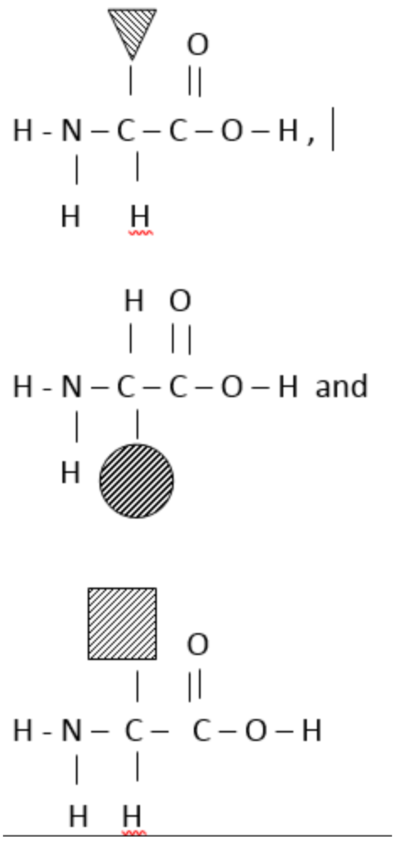
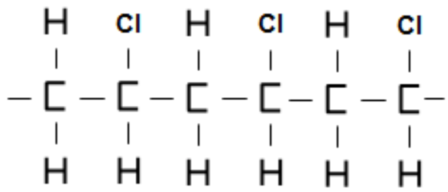
1.	B	11.	B	21.	D	31.	A
2.	C	12.	C	22.	B	32.	B
3.	B	13.	D	23.	A	33.	A
4.	B	14.	B	24.	C	34.	D
5.	B	15.	A	25.	D	35.	C
6.	A	16.	A	26.	B	36.	A
7.	C	17.	A	27.	B	37.	C
8.	D	18.	C	28.	A	38.	A
9.	D	19.	D	29.	B	39.	C
10.	C	20.	B	30.	D	40.	C

Suggested answers:

Section A

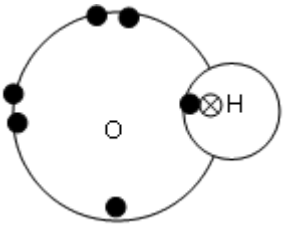
No.	Suggested answer	Remarks	Marks
A1	(a) silicon dioxide [1] (b) zinc oxide [1] (c) sulfur dioxide [1] (d) copper(II) oxide and zinc oxide [1]		4
A2	(a) calcium ion [1] two chloride ions [1] (b) negative electrode: $Ca^{2+}(l) + 2e^- \rightarrow Ca(l)$ [1] positive electrode: $2Cl^-(l) \rightarrow Cl_2(g) + 2e^-$ [1] (c) hydrogen (gas) [1] and chlorine (gas) [1] (d) - giant ionic / crystal lattice structure [1] - strong ionic bond between Ca^{2+} and Cl^- ions [1]	do not penalise if all electrons drawn max: 1 mark if no or wrong state symbols	2 2 2 2
A3	(a) Copper(II) nitrate [1] (b) (i) No. of mole of HNO_3 = $\frac{25}{1000} \times 16 = 0.4\ mol$ [1]		1

	Vol of NO_2 = $\frac{0.4}{2} \times 24 = 4.8dm^3$ [1]		3
	(ii) concentration: 8 mol/dm^3 [1] volume: 25 cm^3 [1]	allow any other combination as long as concentration is lower than 16 mol/dm^3 and combined with volume that will give 0.2 mol of acid.	2
	(c) (i) (light) blue precipitate [1] dissolve in excess to give a dark blue solution [1]		2
	(ii) blue precipitate which is insoluble in excess aqueous sodium hydroxide [1]		1
A4	(a) activation energy [1] enthalpy change [1] reactants and products [1]		3
	(b) reacting particles move faster [1] more reacting particles with energy greater or equal to activation energy [1] higher frequency of effective collision between reacting particles [1]	must specify reacting particles as carbon dioxide and water molecules at least once max 2 marks if not mentioned	3
A5	(a) The percentage ammonia decreases as temperature increases [1] but increases as pressure increases. [1]		2
	(b) (i) 1000 atm, 100 °C [1]		1
	(ii) low temperature → slow reaction [1] high pressure → dangerous as can cause explosion / expensive to maintain the pressure as it require certain material [1]		2
A6	(a) (i) It is a <u>macromolecule / giant molecule</u> formed by <u>joining many small molecules</u> called the monomers.		1

	(ii)  (iii) chromatography [1] (b)  (c) In the manufacture of proteins, the different <u>monomers join together with the elimination of water</u> but in the formation of polymer **N**, the <u>monomers merely join together without loss of any small molecules. [1]</u>		3 1
A7	(a) (i) Extinguish a lighted splint with a pop sound [1] formula: $LiO_2CCH_2CHOHCO_2Li$ [1] (ii)		2 1

	(b) (i) (ii) phosphoric(V) acid [1] 300 °C and 60 atm [1]		1 2
A8	(a) Ar of silicon = $\frac{92.21}{100}\times 28 + \frac{4.7}{100}\times 29 + \frac{3.09}{100}\times 30$ = 28.1 (shown) [1] (b) $SiO_2 + 2C \rightarrow 2CO + Si$ [1] (c) Error 1: silicon cannot be used as an electrode [1] Explanation 1: It does not have delocalised mobile electrons to carry charges. [1] Error 2: It does not have the same structure as graphite [1] Explanation: Each silicon atom is bonded to 4 oxygen atoms and each oxygen atom is bonded to 2 silicon atoms to form a tetrahedral structure while in graphite, each carbon atom is covalently bonded to 3 other carbon atoms in layers of hexagon. [1]		1 1 4

Section B

No.	Suggested answer	Remarks	Marks
9	(a) photo – light / ultraviolet light / sun [1] dissociation – breakdown/decompose/break up/split/separate [1]		2
	(b) •C*l* + O_3 → •ClO + O_2 [1] Chlorine radicals react with ozone molecule to form chlorine oxide and oxygen.[1]		2
	(c) Redox reaction [1] Fe^{2+} is oxidised as its oxidation state increases from +2 to +3 in Fe^{3+}. [1] H_2O_2 is reduced as the oxidation state of oxygen decreases from -1 in H_2O_2 to -2 in OH^- .[1]		3
	(d)  [1] correct no. of shared electrons [1] correct no. of electrons	Ignore inner shell	2 2
	(e) Vitamin C: carboxyl group [1] tocopherol: hydroxyl group [1]		
10	(a) Labelled diagram for chromatography [2] 1. Place a small spot of dark blue solution on the start line of the chromatography paper. [1] 2. Place the chromatography paper in suitable solvent such that the start line is above the solvent level. [1] 3. Allow the solvent to travel up the paper to dissolve the spot for separation to occur. Once the solvent reaches the solvent front, remove the paper and allow it to dry. [1] 4. There will be more than 1 spot formed on the chromatogram upon separation. [1]	A labelled diagram may replace step 1 and 2	4 2

(b) (i) It contains a hydroxyl group / It is a reducing agent / it can be oxidised [1]

(ii) It is a dibasic acid / has 2 carboxyl group / is a dicarboxylic acid [1]

(c)

Element	C	H	O
%	26.7	2.2	71.1
Ar	12	1	16
No. of moles / mol	$\frac{26.7}{12}$ = 2.23	$\frac{2.2}{1}$ = 2.2	$\frac{71.1}{16}$ = 4.44
Simplest ratio	1	1	2

[1] – no. of moles
[1] – empirical formula: CHO_2

Mr of CHO_2 = 12 + 1 + 2(16) = 45

Molecular formula = $C_2H_2O_4$ [1]

3

(a) Procedure: student only carried out one titration [1]

recording: burette reading should be recorded to nearest 0.05 cm^3 or to 2 decimal place [1]

2

(b) (i) The <u>colourless</u> <u>potassium iodide</u> solution turns <u>brown</u>. [1]

$Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$ [1]
state symbols not required

2

(ii) No. of mole of sodium thiosulfate

= 0.005 x 0.0093

= <u>0.0000465 mol</u> [1]

Fr the eq,

2 mol $S_2O_3^{2-}$: 1 mol of I_2

0.0000465 mol $S_2O_3^{2-}$: <u>0.00002325mol of I_2</u>[1]

Fr the eq

0.00002325 mol of I_2 : 0.00002325 mol of Cl_2

3

	Concentration of Cl_2 = 0.00002325 / 0.1 = 0.0002325 mol/dm^3 = 0.000233 mol/dm^3 to 3 s.f [1]		1
	(c) (i) $Ca(ClO)_2$ [1] (ii) Chlorine dioxide is oxidised as the oxidation state of chlorine increases from +4 (in ClO_2) to +5 ($HClO_3$). [1] Chlorine dioxide is reduced as the oxidation state of chlorine decreases from +4 (in ClO_2) to +1 (HClO). [1]		2
OR			
11	(a) W, Z, Y, X [1]		1
	(b) Effervescence [1] Hydrogen gas is produced in the reaction. [1]		2
	(c) - Place a fixed mass of each metal in excess acid of same volume and concentration.[1] - Measure the volume of gas collected in 10 seconds using a gas syringe [1] - Metal M will produce the 4th highest volume in 10 s [1]	Accept: fixed vol, measure time, Accept: time taken for reaction to complete	3
	(d) (i) Y [1] W and Z is most reactive metal and will be extracted by electrolysis. [1] X is the least reactive and hence occurs uncombined. [1]	Allow ECF from (a)	3
	(ii) zinc [any metal below zinc, above silver] [1]		1