



EDGEFIELD SECONDARY SCHOOL
2022 PRELIMINARY EXAM
Secondary 4 Express

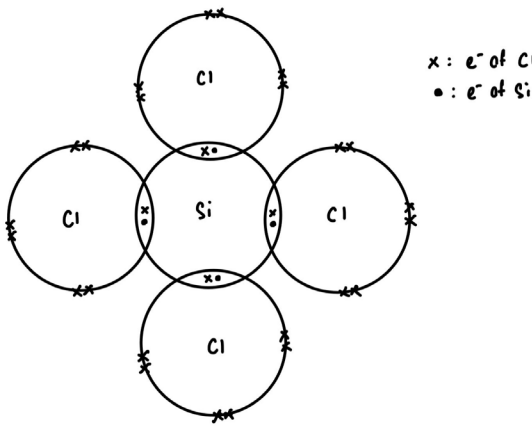
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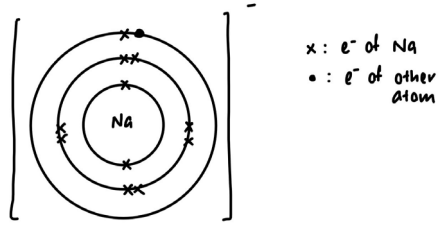
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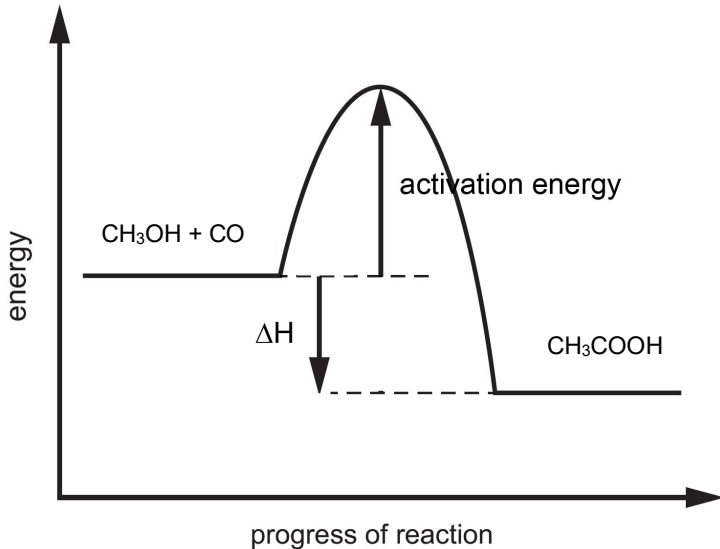
August 2022

Answer scheme

Paper 2 (80 marks)					
Qn.		Answers	Marks		
A1	a)	A	1	5	
	b)	D	1		
	c)	B	1		
	d)	F	1		
	e)	I	1		
A2	a)	water and salts have different boiling points (1) water evaporates AND salts / residues / impurities / solids left in flask (1) water condenses / turns to liquid in the condenser (1)	3	10	
	b)	i) Mg^{2+} and Cl^- ii) $1.26/95 = 0.01325 \text{ mol (1)}$ $0.01325 \times 2 = 0.0265 \text{ mol/ dm}^3 \text{ (1)}$ iii) white ppt/ solid/ deposit	2		
	c)	i) $\text{Ba}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) \text{ (1)}$ ii) conc of $\text{SO}_4^{2-} = 1.24/96 = 0.0129 \text{ mol/dm}^3 \text{ (1)}$ mol of $\text{SO}_4^{2-} = 0.129 \times 50/1000 = 6.46 \times 10^{-4} \text{ mol (1)}$ mol of $\text{BaSO}_4 = 6.46 \times 10^{-4} \text{ mol}$ mass of $\text{BaSO}_4 = 6.46 \times 10^{-4} \times 233 = 0.150 \text{ (1)}$ c) mass of SO_4^{2-} in 50 cm^3 seawater = $1.24 \times 50/1000 = 0.062 \text{ g (1)}$ mol of $\text{SO}_4^{2-} = 0.062/96 = 6.46 \times 10^{-4} \text{ mol (1)}$ mol of $\text{BaSO}_4 = 6.46 \times 10^{-4} \text{ mol}$ mass of $\text{BaSO}_4 = 6.46 \times 10^{-4} \times 233 = 0.150 \text{ (1)}$ - Many students failed to notice that the concentration is given in g/dm^3 so attempted to find moles of SO_4^{2-} by multiplying $1.24 \times 50/1000$.	3		

A3	a)	2.8.4	1	8
	b)	$\text{Si} + 2\text{Cl}_2 \rightarrow \text{SiCl}_4$ - Many students attempted to give the state symbols but got it wrong (not penalised) - Do note that state symbols are not required unless stated in qns. Wrong state symbols may be penalised.	2	
	c)	does not conduct electricity (1) low melting point / low boiling point (1) Low density is not accepted since density depends on the actual state of the substance i.e. solid, liquid or gas. e.g. iodine has SMS but density is not low.	2	
	d)	 minus one mark for any mistake: missing legend/ non-bonding electrons	2	
A4	a)	Dividing % by mass by atomic mass $\text{N} = 12.0/14$ $\text{H} = 3.4/1$ $\text{O} = 41.0/16$ $\text{V} = 43.6/51$ Dividing correctly by smallest to give correct ratio: $\text{N} = 0.857$ $\text{H} = 3.4$ $\text{O} = 2.56$ $\text{V} = 0.855$ Empirical formula: $\text{H}_4\text{NO}_3\text{V}$ (order of elements not considered in marking)	1 1 1	8
	b)	coloured Accept: can act as catalysts	1	
	c)	NH_4^+ (1) VO_3^- (1)	2	
	d)	(Y is an) oxidising agent (1) the oxidation number of iodine increases / iodide loses electrons / Y gains electrons (1) Reject: Y is an OA since it reacts with KI which is an RA (need to elaborate) Y is an OA since it oxidises KI to I_2 (how do you know?)	2	

	e)	i) Ammonia (1) ii) $2\text{NH}_4\text{VO}_3 \rightarrow \text{V}_2\text{O}_5 + \text{H}_2\text{O} + 2\text{NH}_3$ (1)	2	
A5	a)	$\text{C}_2\text{H}_4\text{O}$ (1) Reject $\text{C}_{12}\text{H}_{24}\text{O}_6$	1	9
	b)		1	
	c)	$2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$ - Many students attempted to give the state symbols but got it wrong (not penalised) - Do note that state symbols are not required unless stated in qns. Wrong state symbols may be penalised.		
	d)	sodium chloride has giant ionic lattice structure (1) a lot of energy required to overcome the strong electrostatic forces of attraction between oppositely charged ions. (1) chlorine has simple molecular structure (1) a small amount of energy is required to overcome the weak intermolecular forces of attraction between chlorine molecules. (1)	4	
	e)	At 600 °C it is solid so ions cannot move / at 600 °C ions are in fixed position in a solid (1) NOTE: reference needed to solid as well as lack of movement of ions At 1000 °C it is molten/ liquid so ions can move / at 1000 °C it is molten/ liquid so ions are mobile / At 1000 °C it is molten/ liquid because the ions are free (1) NOTE: reference needed to temperature, liquid/ solid as well as movement of ions	2	

A6	a)	 energy CH₃OH + CO activation energy ΔH CH₃COOH progress of reaction - reactants labelled on left and products labelled on the right AND <u>product level below reactant level</u> (1) - enthalpy change labelled and shown by <u>downward</u> arrow value (1) - <u>activation energy</u> shown as upward arrow from left hand energy level to energy 'hump' above the highest energy levels of both products and reactants (1)	3	9
	b)	(i) CO binds irreversibly to haemoglobin in blood; blocks oxygen uptake in blood. Reject: death, breathing difficulties - Many students missed out on the keyword: irreversibly. (ii) H₂O (iii) Pd oxidation states +2 to 0; (1) C oxidation states +2 to +4; (1) (iv) palladium has been reduced since OS decreased (1) C has been oxidized since OS increased. (1) e.c.f. from (iii)	6	
	c)	- Extraction of iron	2	
B7	a)	sodium > barium > magnesium > nickel > copper (Nickel spelt wrongly - zero marks)	1	10
	b)	- the more reactive the metal, the more negative is the reduction potential OR - the less reactive the metal, the more positive is the reduction potential	1	

	c i)	- +0.80 V (1) - silver is less reactive than copper; hence reduction potential will be more positive than copper (1)	2										
	c ii)	Ag ⁺ (aq) + e ⁻ ⇌ Ag(s) (no state symbols - minus 1 mark)	2										
	d)	<table border="1"><thead><tr><th>metal</th><th>chromium</th><th>tin</th></tr></thead><tbody><tr><td>aqueous solution of nickel(II) ions</td><td>✓</td><td></td></tr><tr><td>dilute nitric acid</td><td>✓</td><td>✓</td></tr></tbody></table> Each row - correct answer(s) - [1]	metal		chromium	tin	aqueous solution of nickel(II) ions	✓		dilute nitric acid	✓	✓	2
	metal	chromium	tin										
	aqueous solution of nickel(II) ions	✓											
dilute nitric acid	✓	✓											
e i)	The more positive/ less negative the electrode potential, the lower is the ion in the electrochemical series.	1											
ii)	positive: chlorine gas/ Cl ₂ 2Cl ⁻ (l) → Cl ₂ (g) + 2e ⁻ negative: iron/ Fe Fe ³⁺ (l) + 3e ⁻ → Fe(l) Each row - correct answer(s) - [1]	2											
B8	a i)	concentration of ethanoate = 0.45 mol / dm ³ (1) mass = 0.45 × 59 × 200/1000 = 5.31 g (1)	2	10									
	a ii)	concentration of ethanoate ions at 300 s = 0.17 mol / dm ³ (1) [0.16 mol / dm ³ accepted] average rate = 0.17/300 = 5.67 × 10 ⁻⁴ (mol/dm ³ / s) or 5.33 × 10 ⁻⁴ (mol/dm ³ / s) [1]	1										
	a iii)	rate of reaction decreases with time / reaction slows down (1) gradient becomes less steep with time (1)	2										
	a iv)	concentration of reactants decreases (1) no. of particles per unit volume decreases (1) frequency of collision decreases + frequency of effective collision decreases (1)	3										
	b)	ethanol has a simple molecular structure (1) Only stating covalent bond not accepted. Need to mention simple covalent bond. no free mobile electrons (1)	2										
B9 EITHER	a)	fractional distillation (1) cracking (1)	1	10									

	b)	Electrolysis of dilute aqueous sodium chloride solution will produce oxygen gas at the anode and not chlorine gas.	1	
	c)	$ \begin{array}{c} \text{Cl} \quad \text{Cl} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array} $ (1)	1	
	d)	hydrogen chloride [hydrochloric acid not accepted]	1	
	e)	$ \begin{array}{ccccccc} \text{Cl} & \text{H} & \text{Cl} & \text{H} & \text{Cl} & \text{H} \\ & & & & & \\ -\text{C} & -\text{C} & -\text{C} & -\text{C} & -\text{C} & -\text{C}- \\ & & & & & \\ \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \end{array} $ Accept: chlorine atoms at bottom. correct repeating unit (1) 3 repeat units with continuation bonds at ends (1) No ending lines from the carbon atoms on both ends - minus [1]	2	
	d i)	max mass = 2250 tonnes	1	
	d ii)	% yield = $2175/2250 \times 100$ (1) = 96.7% (1)	2	
B9 OR	a)	alcohol and carboxylic acid [both need to be correct to get 1 mark]	1	10
	b)	$2\text{HOCH}_2\text{COOH} + \text{Na}_2\text{CO}_3 \rightarrow 2\text{HOCH}_2\text{COONa} + \text{CO}_2 + \text{H}_2\text{O}$ correct products (1) correct coefficients (1)	2	
	c)	- oxygen has been removed from oxalic acid - hydrogen has been added to oxalic acid ALLOW oxidation number of carbon decreases	1	
	d i)	- condensation polymer Any of the following: - because water has been removed - monomer does not have a carbon-carbon double bond - has ester linkage which is formed by condensation) [both need to be correct to get 1 mark]	1	
	d ii)	- Terylene	1	
	e i)	- Less landfill/ pollution - Fewer air pollution/ less poisonous fumes - Small mammals/ birds not trapped/ harmed	1	

	e ii)	- plastic bags - any other valid answers Plastics not accepted	1	
	e iii)	$ \begin{array}{cccccccc} \text{CH}_3 & \text{H} & \text{CH}_3 & \text{H} & \text{CH}_3 & \text{H} & \text{CH}_3 & \text{H} \\ & & & & & & & \\ -\text{C} & -\text{C} & -\text{C} & -\text{C} & -\text{C} & -\text{C} & -\text{C} & -\text{C}- \\ & & & & & & & \\ \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \end{array} $ correct repeating unit (1) 3 repeat units with continuation bonds at ends (1) No ending lines from the carbon atoms on both ends - minus [1]	2	

		Marks for Assessment Objectives								
SUBJECT: Chemistry		Paper 1			Paper 2 Section A			Paper 2 Section B		
STANDARD: Sec 4E										
		40 marks			50 marks			30 marks		
Topic		Q	K/U	HI/SP	Q	K/U	HI/SP	Q	K/U	HI/SP
1	Kinetic Particle Theory and Experimental Techniques									0
2	Separation and Purification Techniques				2	3				3
3	Elements, Compounds and Mixtures									0
4	Atomic Structure				3a		1			1
5	Ionic bonding				2bi, 5bde,	4	2			6
6	Covalent and metallic bonding				3c, 5d	4	2	8b	2	8
7	Writing equations				2c, 3b, 4e, 6aii		5			5
8	Acids and bases				1d	1				1
9	Salts									0
10	Mole Concept and Chemical Calculations				2bii, 2cii, 4a, 5a		8	8ai, 9ei(f), 9or(b)		15
11	Periodic Table				4b, 5c	2				2
12	Metals				6c	1		7a,b,d		5
13	Qualitative analysis				1a,b, 2biii, 4c	3	2			5
14	Air and atmosphere				6b	1				1
15	Oxidation and reduction				1c, 4d, 6aiii,iv,	1	6	9or(c)		8
16	Energy changes				6ai		3			3
17	Speed of reaction							8aii-iv,	4	6
18	Ammonia									0
19	Electrolysis				1e	1		7c,e, 9ei(b)		7
20	Intro to Organic Chem							9ei(a), 9or(a)	2	3
21	Alkanes and Alkenes							9ei(c,d)	1	3
22	Alcohols and Carboxylic Acids									0
23	Macromolecules						2	9ei(e), 9or(d,e)	3	10
Sub Total			0	0		21	31		12	28
Total		0			52			40		

Weightings of Assessment Objectives for this paper

	% K/U	%HI/SP
Paper 2 Section A	40	60
Paper 2 Section B	30	70
Total	24	42

Knowledge with Understanding(45%)

The subject content defines the factual knowledge that candidates may be required to recall and explain. Questions testing those objectives will often begin with one of the following words: define, state, describe, explain or outline.

Handling Information and Solving Problems(55%)

These assessment objectives cannot be precisely specified in the subject content because questions testing such skills may be based on information which is unfamiliar to the candidate. In answering such questions, candidates are required to use principles and concepts that are within the syllabus and apply them in a logical, reasoned or deductive manner to a novel situation. Questions testing these objectives will often begin with one of the following words: predict, suggest, calculate or determine.