Chemistry

Standard level

Paper 2

Markscheme

Question	Answers	Total
1 (a)	C: $40.00 / 12.01 = 3.33$ H: $6.70 / 1.01 = 6.63$ O: $63.31 / 16.00 = 3.33$ CH ₂ O \checkmark	3
1 (b)	60 / 30 = 2 $C_2H_4O_2 \checkmark$	2
2 (a)	$Zn(s) + 2HNO_3(aq) \rightarrow Zn(NO_3)_2(aq) + H_2(g)$	1
2 (b)	Zn: 3.00 / 65.38 = 0.0459 mol HNO₃: 1.00 × (50.0 / 1000) = 0.0500 mol HNO₃ is limiting reactant ✔	2
2 (c)	$(0.0500 / 2) \times 22.7 = 0.568 \text{dm}^3$	2
2 (d)	Particles must collide with: Correct orientation \checkmark $E \ge E_a \checkmark$	2
2 (e)	Rate of reaction increases 🖌 Frequency of collisions between reactant particles increases 🖌	2
2 (f)	Activation energy, Ea Kinetic energy	1

3 (a)	Group number determines the number of	1
	valence electrons / electrons in outer shell 🗸	•
3 (b)	$1s^2 2s^2 2p^6 3s^2 \checkmark$	2
	s block 🖌	-
3 (c)	Chlorine has higher nuclear charge 🗸	2
	And smaller atomic radius 🗸	2
	s orbital 🗸 p orbital 🗸	
3 (d)	\bigcirc \bigcirc	2
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4 (a)	$[SO_3]^2$	
	$K = \frac{1}{[SO_2]^2[O_2]}$	1
	· ·	
((b)	K > 1 🗸	2
4 (D)	[Products] > [Reactants] at equilibrium ✔	2
4.(c)	Yield of SO_2 decreases \checkmark	2
4 (C)	More gaseous molecules on reactants side 🗸	2
4 (d) (i)	$SO_3(g) + H_2O(I) \rightarrow H_2SO_4(aq)$	1
	Strong acid 🗸	2
4 (d) (ii)	Completely ionises in solution 🗸	2
4 (e) (i)	HCO ₃ [−] ✓	1
4 (e) (ii)	$\begin{bmatrix} : \ddot{O} : \\ I \\ . \dot{O} : \\ . \dot$	1
4 (e) (iii)	Trigonal planar 🖌	2
	Three electron domains around central atom \checkmark	
5 (a)	Any two from:	
	Same general formula	
	Differ by CH ₂	1
	Same functional group	
	Gradation in physical properties	
	Similar chemical reactions	

5 (b)		1
5 (c)	Heat and distillation / excess of alcohol 🗸	1
5 (d)	Ethanol has hydrogen bonding between its molecules / ethanal has dipole-dipoles forces between its molecules Hydrogen bonding is stronger than dipole-dipole forces	2
5 (e)	Bonds broken: 3196 kJ Bonds formed: 3237 kJ $\Delta H = 3196 - 3237 = -41 \text{ kJ mol}^{-1} \checkmark$	2
5 (f) (i)	Radical substitution 🖌	1
5 (f) (ii)		2
5 (g)	Diamond does not conduct electricity (no delocalised electrons) 🗸 Graphite conducts electricity (has delocalised electrons) 🗸	2
6 (a)	Cathode: $Li^+(I) + e^- \rightarrow Li(I) \checkmark$ Anode: $2CI^-(I) \rightarrow CI_2(g) + 2e^- \checkmark$	2
6 (b)	Electron flow in wires 🖌 Ion flow in electrolyte 🖌	2
6 (c)	Electrostatic attraction between oppositely charged ions 🗸	1
6 (d)	Li⁺ has smaller ionic radius than Na⁺ ✔	1