

## Cherry Hill Tuition AQA Chemistry AS. Paper 8 Mark Scheme

Question	Marking Guidance	Mark	Comments
1(a)	<b>Award in either order for curve</b> M1 curve is steeper than original and starts at the origin M2 curve levels at the top line on the graph	2	"Steeper" requires line to be on the left of the original line, starting from the origin
1(b)	<b>Award in either order for curve</b> M1 curve is shallower than original and starts at the origin M2 curve levels at the first line on the graph	2	"Shallower" requires line to be on the right of the original line, starting from the origin
1(c)	M1 curve would be steeper than original M2 curve levels at the <u>same original volume</u> of O <sub>2</sub>	2	"Steeper" requires line to be on the left of the original line, starting from the origin
1(d)	M1 The (concentration / amount of) <u>H<sub>2</sub>O<sub>2</sub> or reactant</u> falls / decreases / used up OR The number of <u>H<sub>2</sub>O<sub>2</sub> or reactant</u> molecules/ particles falls / decreases M2 The <u>rate</u> of reaction / <u>rate</u> of decomposition / <u>rate</u> of formation of oxygen / <u>frequency of collisions</u> / (effective) collisions in a given time decreases / is slower	2	Mark independently
1(e)(i)	$2\text{H}_2\text{O}_2 \longrightarrow 2\text{H}_2\text{O} + \text{O}_2$	1	Ignore state symbols Accept only this equation or its multiples Extra species must be crossed through
1(e)(ii)	hydrogen bromide / it does not appear in the overall equation OR hydrogen bromide / it is not <u>used up</u> in the reaction / <u>unchanged</u> at the end of the reaction OR hydrogen bromide / it is regenerated / re-formed (in Step 2)	1	
2 (a)(i)	Corrosive or diagram to show this hazard symbol	1	Ignore irritant, acidic, toxic, harmful
(a)(ii)	$\left( \frac{120.5}{86 + 71} \times 100 \right)$ =76.75(%) or 76.8(%)	1	Allow answers > 3 sig figs

3)

Question	Marking Guidance	Mark	Comments
(a)	N <sup>3-</sup> / N <sup>-3</sup>	1	
(b)	F <sup>-</sup> fluoride	1	Ignore fluoride/F Penalise FI
(c)	Li <sub>3</sub> N / NLi <sub>3</sub>	1	
(d)	$\frac{81.1}{40.1} \quad \frac{18.9}{14}$ (=2.02    = 1.35) 1.5        1        or        3 : 2 Ca <sub>3</sub> N <sub>2</sub>	1 1 1	M1 for correct fractions M2 for correct ratio If Ca <sub>3</sub> N <sub>2</sub> shown and with no working award 3 marks If Ca <sub>3</sub> N <sub>2</sub> obtained by using atomic numbers then lose M1
(e)	$3\text{Si} + 2\text{N}_2 \rightarrow \text{Si}_3\text{N}_4$	1	Accept multiples

4)

Question	Marking Guidance	Mark	Comments
(a)	Mol Pb = $8.14 / 207(2)$ (= 0.0393 mol) Mol HNO <sub>3</sub> = $0.0393 \times 8 / 3 = 0.105$ mol Vol HNO <sub>3</sub> = $0.105 / 2 = 0.0524$ (dm <sup>3</sup> )	1 1 1	M1 and M2 are process marks Allow mark for M1 x 8/3 or M1 x 2.67 Accept range 0.0520 to 0.0530 No consequential marking for M3 Answer to 3 sig figs required
(b)	101000 (Pa) and $638 \times 10^{-6}$ (m <sup>3</sup> ) $n = pV/RT$ ( $= \frac{101000 \times 638 \times 10^{-6}}{8.31 \times 298}$ ) <u>0.026(0)</u> (mol)	1 1 1	Can score M2 with incorrect conversion of p and V If T incorrect lose M1 and M3 If answer correct then award 3 marks Allow answers to 2 sig figs or more 26.02 = 1 If transcription error lose M3 only
(c)(i)	$2\text{Pb}(\text{NO}_3)_2(\text{s}) \rightarrow 2\text{PbO}(\text{s}) + 4\text{NO}_2(\text{g}) + (1)\text{O}_2(\text{g})$	1	Allow multiples Allow fractions
(c)(ii)	Decomposition not complete / side reactions / by-products / some (NO <sub>2</sub> ) escapes / not all reacts / impure Pb(NO <sub>3</sub> ) <sub>2</sub>	1	Ignore reversible / not heated enough / slow
(c)(iii)	Hard to separate O <sub>2</sub> from NO <sub>2</sub> / hard to separate the 2 gases	1	Allow mixture of gases Not 'all products are gases'

5)

Question	Marking Guidance	Mark	Comments
(a)	$\frac{(82 \times 2) + (83 \times 2) + (84 \times 10) + (86 \times 3)}{17} = \frac{1428}{17} = 84.0$  The A <sub>r</sub> in the Periodic table takes account of the <u>other isotopes / different amounts of isotopes</u> (or words to that effect regarding isotopes)	1 1 1  1	M1 for the top line M2 is for division by 17 Not 84 No consequential marking from M1 or M2 Ignore units Award independently Comparison implied Isotope(s) alone, M4 = 0
(b)	(Beam of electrons from) an electron gun / high speed / high energy electrons Knocks out electron(s) (to form a positive ion) $\text{Kr}(\text{g}) + \text{e}^- \rightarrow \text{Kr}^+(\text{g}) + 2\text{e}^-$ <b>OR</b> $\text{Kr}(\text{g}) \rightarrow \text{Kr}^+(\text{g}) + \text{e}^- / \text{Kr}(\text{g}) - \text{e}^- \rightarrow \text{Kr}^+(\text{g})$ The <sup>84</sup> Kr isotope Has 2 electrons knocked out / gets a 2+ charge	1  1 1  1 1	State symbols must clearly be (g)   One mark for identifying the 84 isotope One mark for the idea of losing 2 electrons (from this isotope)

Question	Marking Guidance	Mark	Comments
6 (a)(i)	$\text{Cu} + 4\text{HNO}_3 \longrightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{NO}_2 + 2\text{H}_2\text{O}$	1	Or multiples Ignore state symbols
(a)(ii)	<b>M1</b> $\text{HNO}_3$ (+) <b>5</b> <b>M2</b> $\text{NO}_2$ (+) <b>4</b>	2	Ignore working out M1 Credit (V) M2 Credit (IV)
(a)(iii)	$\text{HNO}_3 + \text{H}^+ + \text{e}^- \longrightarrow \text{NO}_2 + \text{H}_2\text{O}$ OR $\text{NO}_3^- + 2\text{H}^+ + \text{e}^- \longrightarrow \text{NO}_2 + \text{H}_2\text{O}$	1	Or multiples Ignore state symbols Ignore charge on the electron unless incorrect and accept loss of electron on the RHS
(b)(i)	<b>In either order</b>  <b>M1</b> <u>Concentration(s) (of reactants and products) remain(s) constant / stay(s) the same / remain(s) the same / do(es) not change</u>  <b>M2</b> <u>Forward rate = Reverse / backward rate</u>	2	For M1 accept [ ] for concentration NOT "equal concentrations" and NOT "concentration(s) <u>is/are</u> the same" NOT "amount" Ignore "dynamic" and ignore "speed" Ignore "closed system" It is possible to score both marks under the heading of a single feature
(b)(ii)	<b>M1</b> The (forward) reaction / to the right is <u>endothermic</u> or <u>takes in / absorbs heat</u> OR The reverse reaction / to the left is <u>exothermic</u> or <u>gives out / releases heat</u>  <b>M2</b> depends on correct M1 and must refer to temperature/heat The <u>equilibrium shifts / moves</u> left to right to <u>oppose the increase in temperature</u>	2	M2 depends on a correct statement for M1  For M2, the <u>equilibrium shifts/moves</u> to <u>absorb the heat</u> OR to <u>lower the temperature</u> OR to <u>cool the reaction</u>
(b)(iii)	<b>M1</b> refers to number of moles There are <u>fewer moles</u> (of gas) on the left OR <u>more moles</u> (of gas) on the right. OR there is <u>one mole</u> (of gas) on the left <u>and 2 moles</u> on the right.  <b>M2</b> depends on correct M1 and must refer to pressure The <u>equilibrium shifts / moves</u> right to left to <u>oppose the increase in pressure</u>	2	M2 depends on a correct statement for M1  For M2, the <u>equilibrium shifts/moves</u> to <u>lower the pressure</u> .

Question	Marking Guidance	Mark	Comments
7 (a)	<p>One from</p> <ul style="list-style-type: none"> <li>Ti is not produced</li> <li>TiC / <u>carbide</u> is produced OR titanium reacts with carbon</li> <li>Product is brittle</li> <li>Product is a poor engineering material</li> </ul>	1	Penalise "titanium carbonate" Ignore "impure titanium" Credit "titanium is brittle"
(b)	Heat (energy) change at constant pressure	1	QoL
(c)	The <u>enthalpy change</u> in a reaction is independent of the route taken (and depends only on the initial and final states)	1	Credit "heat change at constant pressure" as an alternative to "enthalpy change"
(d)	<p><b>M1</b> The <u>enthalpy change</u> / <u>heat change at constant pressure</u> when <u>1 mol</u> of a compound / substance / product</p> <p><b>M2</b> is formed from its (constituent ) <u>elements</u></p> <p><b>M3</b> with <u>all reactants and products</u> / <u>all substances in standard states</u>            OR <u>all reactants and products</u> / <u>all substances in normal states under standard conditions</u> / 100 kPa / 1 bar <u>and</u> any specified T (usually 298 K)</p>	3	For M1, credit correct reference to molecule/s or atom/s  Ignore reference to 1 atmosphere
(e)(i)	Na / it is not in its <u>standard state</u> / <u>normal state under standard conditions</u> OR <u>Standard state</u> / <u>normal state under standard conditions</u> for Na is solid / (s)	1	QoL Ignore "sodium is a liquid or sodium is not a solid"
(e)(ii)	<p><b>M1</b> <math>\Delta H_r = \sum \Delta H_f(\text{products}) - \sum \Delta H_f(\text{reactants})</math></p> <p><b>M2</b> <math>\Delta H_r = 4(-411) - (-720) - 4(+3)</math>  <math>= -1644 + 720 - 12</math>            (This also scores M1)</p> <p><b>M3</b> <math>= -936 \text{ (kJ mol}^{-1}\text{)}</math></p>	3	Correct answer gains full marks Credit 1 mark for + 936 (kJ mol <sup>-1</sup> ) Credit 1 mark for - 924 (kJ mol <sup>-1</sup> ) i.e. assuming value for Na(l) = 0 For other incorrect or incomplete answers, proceed as follows <ul style="list-style-type: none"> <li>check for an arithmetic error (AE), which is either a transposition error or an incorrect multiplication; this would score 2 marks (M1 and M2)</li> <li>If no AE, check for a correct method; this requires either a correct cycle with 2Cl<sub>2</sub> and 4Na OR a clear complete statement of M1 which could be in words and scores <u>only M1</u></li> </ul>
(e)(iii)	Reducing agent OR reductant OR reduces TiCl <sub>4</sub> OR electron donor	1	Ignore "reduces titanium"