

2003 Chemistry

Higher

Finalised Marking Instructions

Higher Chemistry

General information for markers

The general comments given below should be considered during all marking.

- 1 Marks should **not** be deducted for incorrect spelling or loose language as long as the meaning of the word(s) is conveyed.

Example: Answers like 'distiling' (for 'distillation') and 'it gets hotter' (for 'the temperature rises') should be accepted.

- 2 A right answer followed by a wrong answer should be treated as a cancelling error and no marks should be given.

Example: What is the colour of universal indicator in acid solution?

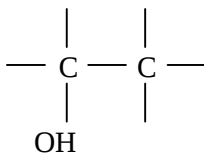
The answer 'red, blue' gains no marks.

- 3 If a right answer is followed by additional information which does not conflict, the additional information should be ignored, whether correct or not.

Example: Why can the tube not be made of copper?

If the correct answer is related to a low melting point, 'It has a low melting point and is coloured grey' would **not** be treated as having a cancelling error.

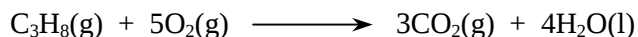
- 4 Full marks are usually awarded for the correct answer to a calculation on its own; the part marks shown in the marking scheme are for use when working is given. An exception is when candidates are asked to 'Find, by calculation,'.
5 A half mark should be deducted in a calculation for each arithmetic slip.
- 6 A half mark should be deducted for incorrect or missing units **only when stated in the marking scheme**. No marks should be deducted for incorrect or missing units at intermediate stages in a calculation.
- 7 Where a wrong numerical answer (already penalised) is carried forward to another step, no further penalty is incurred provided the result is used correctly.
- 8 Ignore the omission of one H atom from a full structural formula provided the bond is shown.
- 9 With structures involving an –OH or an –NH₂ group, a half mark should be deducted if the 'O' or 'N' are not bonded to a carbon, i.e. OH–CH₂ and NH₂–CH₂.
- 10 When drawing structural formulae, a half mark should be deducted if the bond points to the 'wrong' atom, eg



- 11 A symbol or correct formula should be accepted in place of a name **unless stated otherwise in the marking scheme**.
- 12 When formulae of ionic compounds are given as answers it will only be necessary to show ion charges if these has been specifically asked for. However, if ion charges are shown, they must be correct. If incorrect charges are shown, no marks should be awarded.

- 13 If an answer comes directly from the text of the question, no marks should be given.

Example: A student found that 0.05 mol of propane, C₃H₈ burned to give 82.4 kJ of energy.

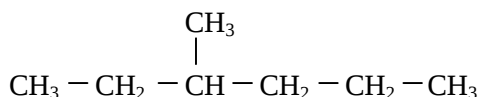


Name the kind of enthalpy change which the student measured.

No marks should be given for 'burning' since the word 'burned' appears in the text.

- 14 A guiding principle in marking is to give credit for (partially) correct chemistry rather than to look for reasons not to give marks.

Example 1: The structure of a hydrocarbon found in petrol is shown below.



Name the hydrocarbon.

Although the punctuation is not correct, '3, methyl-hexane' should gain the full mark.

Example 2: A student measured the pH of four carboxylic acids to find out how their strength is related to the number of chlorine atoms in the molecule. The results are shown.

Structural formula	pH
CH ₃ COOH	1.65
CH ₂ ClCOOH	1.27
CHCl ₂ COOH	0.90
CCl ₃ COOH	0.51

How is the strength of the acids related to the number of chlorine atoms in the molecule?

Although not completely correct, an answer such as 'the more Cl₂, the stronger the acid' should gain the full mark.

- 15 Unless the question is clearly about a non-chemistry issue, eg costs in industrial chemistry, a non-chemical answer gains no marks.

Example: Why does the (catalytic) converter have a honeycomb structure?

A response such as 'to make it work' may be correct but it is not a chemical answer and the mark should not be given.

- 16 When it is very difficult to make a decision about a partially correct answer, a half mark can be awarded.
- 17 When marks have been totalled, a half mark should be rounded up.

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Marking Scheme

Section A

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

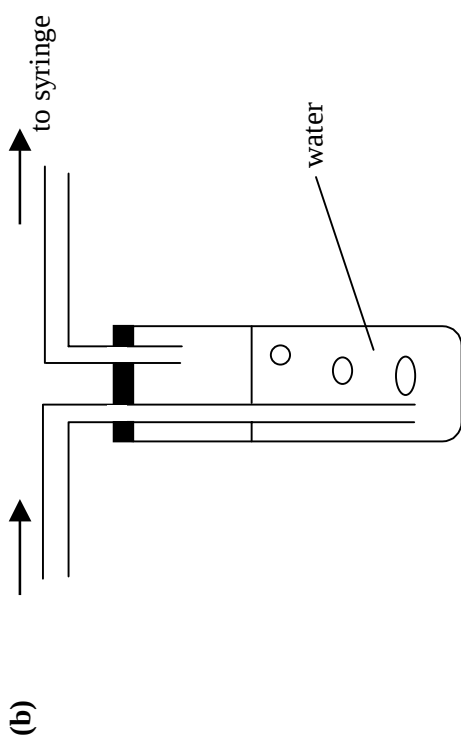
Mark Scheme		Worth ½	Worth 0
2.	(a) Strong or rigid or durable or tough or hard or hard to puncture (b) amide link or peptide link	1 1 (2) polyamide or polypeptide	light or does not burn amino group or amine group

Mark Scheme		Worth ½	Worth 0
3.	(a) plotting points correctly and joining with a line 1 (b) $^{210}\text{Po} \longrightarrow ^{206}\text{Pb} + \text{He (or } \alpha \text{)}$ or $^{210}\text{Po} \xrightarrow{\alpha} ^{206}\text{Pb}$ 1 (c) 210 g contain 6×10^{23} (atoms) (½) 105 g contain $\frac{1}{2} \times 6 \times 10^{23}$ (atoms) $= 3 \times 10^{23}$ (½) (3)	points not joined or one point not plotted correctly or points joined by straight line numbers on rhs any wrong subscript or superscript 6×10^{23} in 1 mol	

Mark Scheme	Worth ½	Worth 0
4. (a) any suggestion that iron formed is molten or in liquid state or answer implies that iron flows down into crack 1 (b) $\Delta H \text{ required} = \Delta H_1 - \Delta H_2$ $= (-1676) - (-825)$ $= -851 \text{ kJ (mol}^{-1}\text{)}$ (½) (½) (2)		iron is formed (in question) or exothermic or rail melts, etc

5.	Mark Scheme	Worth ½	Worth 0
(a)	synthesis gas or syn. gas		synthetic gas
(b)	oxidation or dehydrogenation		
(c)	(i)	$\begin{array}{c} \text{O} \\ \parallel \\ \text{H}_2\text{N} - \text{C} - \text{NH}_2 \end{array}$	$\begin{array}{c} \text{O} \\ \parallel \\ \text{NH}_2 - \text{C} - \text{NH}_2 \end{array}$
	(ii) thermosetting	$\begin{array}{c} \text{H} & & \text{H} \\ & \diagdown & / \\ & \text{NCON} \\ & / & \diagdown \\ \text{H} & & \text{H} \end{array}$	thermoshardening
		1	
		1	
		1	
		1	
		(4)	

Mark Scheme	Worth $\frac{1}{2}$	Worth 0
6. (c) 1 mol C₂H₅OH = 46 g (½) $46 \text{ g} \xrightarrow{\frac{70}{100} \times 130 \text{ g}} \text{ (½)}$ $3.6 \text{ g} \xrightarrow{\frac{70}{100} \times 130 \times \frac{3.6 \text{ g}}{46}} \text{ (½)}$ $= \underline{7.12 \text{ g}} \text{ (½)}$ or 1 mol C₂H₅OH = 46 g (½) $46 \text{ g} \xrightarrow{130 \text{ g}}$ $3.6 \text{ g} \xrightarrow{130 \times \frac{3.6}{46} = 10.174 \text{ g}} \text{ (½)}$ actual yield = $10.174 \times \frac{70}{100}$ (½) $= \underline{7.12 \text{ g}} \text{ (½)}$ (-½ for wrong or no units) (5)		

Mark Scheme	Worth ½	Worth 0
7. (a) moles of Mg = $\frac{4.0}{24.3} = 0.165 \text{ mol } (\frac{1}{2})$ moles of acid = $\frac{4 \times 50}{1000} = 0.2 \text{ moles } (\frac{1}{2})$ mole ratio = 1 mol Mg : 2 mol acid Not enough HCl(aq). Therefore Mg in excess (1) 2 (b)  1 (c) rate – slower $(\frac{1}{2})$ volume – same $(\frac{1}{2})$ 1 (4)		System not sealed

Mark Scheme	Worth ½	Worth 0
9. (a) total volume not kept constant (changes, increases) or changes concentration of all reactants – not just potassium iodide or more than one variable changed 1 (b) use more accurate measuring cylinders (or syringes) for smaller volumes in step 1 or start timer while adding hydrogen peroxide (when half of the peroxide has been added) or put white tile/paper below beaker or repeat experiment 1 (any two) (2)		

Mark Scheme	Worth $\frac{1}{2}$	Worth 0
10. (a) rate of forward reaction equals rate of backward reaction or concentrations of reactant(s) and product(s) are constant 1 (b) iodine will go from chloroform layer (bottom layer) into the KI layer (top layer) to restore equilibrium or equilibrium moves to left (rate of backward reaction increases) 1 (c) 0.3 g of iodine is dissolved in chloroform ($\frac{1}{2}$) therefore, concentration = $\frac{0.3}{0.01} = 30 \text{ g l}^{-1} \text{ } (\frac{1}{2})$ (units not necessary) 1 (3)		rates are constant

Mark Scheme			Worth ½	Worth 0
11.	(a) line should go up to + 75 (½) line should then go down to – 26 (½) 1 (b) (i) heterogeneous 1 (ii) same starting level lower peak (½) same finishing level (½) 1 (c) (i) $\frac{36 - 24}{10} = 1.2 \text{ cm}^3 \text{ s}^{-1}$ 1 (-½ for wrong or no units)			

Mark Scheme		Worth ½	Worth 0
11	(c) (ii) 1 mol O₂ from 2 mol of H₂O₂ (½) 1 mol H₂O₂ = 34 g (½) 24 litres O₂ from 2 x 34 g of H₂O₂ (½) 0.04 litres from $\frac{68 \times 0.04}{24} = 0.113 \text{ g (½)}$ (- ½ for wrong or no units) 2 (6)		

Mark Scheme	Worth ½	Worth 0
12. (a) propane molecules are held together by <u>weak forces</u> or ethanol molecules are held together by <u>strong forces</u> (1) the intermolecular forces in propane are <u>van der Waals' forces</u> (½) the intermolecular forces in ethanol are <u>hydrogen bonds</u> (½) van der Waals' forces are due to momentary displacement of electrons between atoms (½) (½) hydrogen bonding arises because the O-H bond is highly polarised (there is a large difference in the electronegativities of O and H) (½) the small positive charge on H and small negative charge on O strongly attract (½) (4)		

Mark Scheme		Worth ½	Worth 0
13.	(a) $[\text{H}^+(\text{aq})] = 1 \times 10^{-8} \text{ mol l}^{-1}$ (units not necessary) 1 (b) this must be the salt of a strong alkali (or base) and a weak acid or alkali stronger than acid 1 (c) HCN or CNH 1 (3)		

	Mark Scheme	Worth ½	Worth 0
14.	(a) Seawater (sodium chloride), carbon dioxide, ammonia (- ½ for any omission) or correct formulae 1 (b) $\text{CaCO}_3 \longrightarrow \text{CaO} + \text{CO}_2$ $\Delta H = +ve$ (½) $\text{C} + \text{O}_2 \longrightarrow \text{CO}_2$ $\Delta H = -ve$ (½) 1 (c) $\text{Ca(OH)}_2 + 2\text{NH}_4\text{Cl} \longrightarrow \text{CaCl}_2 + 2\text{H}_2\text{O} + 2\text{NH}_3$ 1	use of exothermic/ endothermic	

Mark Scheme		Worth ½	Worth 0
14.	(d) magnesium carbonate is insoluble or magnesium carbonate forms a precipitate (e) CO₂ or NH₃ or NH₄Cl recycled (reused) or coke added to limestone to provide energy by reacting with O₂ from air (or by burning) or calcium chloride produced as by-product or (some) reactants found naturally (easily obtained, cheap) or continuous process (any two, 1 mark each)	1 2 (6) recycling occurs or no waste products or non-polluting or by-products are useful	

Mark Scheme			Worth ½	Worth 0
15.	(a) hydrolysis (hydrolysing) 1 (b) (i) $\begin{array}{c} \text{NH}_2 \\ \\ \text{H} - \text{C} - \text{H} \\ \\ \text{COO}^- \end{array}$ 1 (ii) ACB on rhs (ignore distances; order must be correct) ABC, BAC, CAB on rhs or CBA on lhs (worth 1 mark) 2 (4)		BCA or CBA on rhs	digestion or denaturing

Mark Scheme		Worth ½	Worth 0
16.	(a) $Q = It = 0.5 \times 14 \times 60 \left(\frac{1}{2}\right) = 420 \text{ C} \left(\frac{1}{2}\right)$ $2\text{H}^+ + 2\text{e}^- \longrightarrow \text{H}_2$ $n = 2 \left(\frac{1}{2}\right)$ $2 \times 96\,500 \text{ C} \longrightarrow 1 \text{ mol H}_2 \left(\frac{1}{2}\right)$ $420 \text{ C} \longrightarrow 0.052 \text{ litres}$ $2 \times 96\,500 \text{ C} \longrightarrow \frac{2 \times 96\,500}{420} \times 0.052 \left(\frac{1}{2}\right)$ $= \underline{23.895 \text{ litres} \left(\frac{1}{2}\right)}$ $(-\frac{1}{2} \text{ for wrong or no units}) \quad \mathbf{3}$ (b) add variable resistor (to keep current constant) or use platinum electrodes $\mathbf{1}$ (4)	add a device to keep constant current	

[END OF MARKING INSTRUCTIONS]