



2011 Chemistry

Intermediate 2

Finalised Marking Instructions

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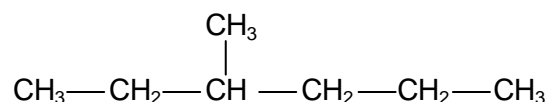
Intermediate 2 Chemistry

General information for markers

The general comments given below should be considered during all marking. It should be noted that these are general marking principles and may be superseded by decisions made at the Markers' Meeting.

1. Markers are reminded to read candidate responses **in their entirety**. If the candidate shows a clear understanding of the chemistry but does not use the exact words of the Marking Instructions they should still be given credit.
2. Markers are reminded that **no** comments are to be written on scripts. Comments such as 'ARITH', 'ERROR' and 'BOD' (Benefit of doubt) are **not** acceptable.
3. 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 not completely correct, the answer '3, methyl-hexane' should gain the full mark ie ignore wrong use of commas and dashes.

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.

4. 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 "hydrolic acid" (for "hydrochloric acid") and "it gets hotter" (for "the temperature rises") should be accepted.

However the example below would not be acceptable, as an incorrect chemical term, which the candidate should know, has been given.

Example: If the correct answer is "ethene", and the candidate's answer is "ethane", this should not be accepted.

5. 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.

6. If a right answer is followed by additional information which does not conflict, the additional information should be ignored, whether correct or not.
7. Full marks should be awarded for the correct answer to a calculation on its own; the part marks shown in the Marking Instructions are for use when working is given.
8. A half mark should be deducted in a calculation for each arithmetic slip.
9. A half mark should be deducted for incorrect or missing units **only when stated in the Marking Instructions.**
10. A half mark should be deducted for transcription errors.
11. Where a wrong numerical answer (already penalised) is carried forward to another step, no further penalty is incurred provided the end result is used correctly.
12. Ignore the omission of one H atom from a full structural formula provided the bond is shown.
13. A symbol or correct formula should be accepted in place of a name **unless stated otherwise in the Marking Instructions.**
14. If an answer comes directly from the text of the question, no marks should be given.

Example: Why do ionic compounds, like copper chloride, conduct electricity when in solution?

No marks for “because they are ionic” since the word “ionic” appears in the text.

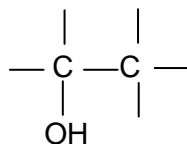
15. Unless the question is clearly about a non-chemistry issue, eg costs in industrial chemistry, a non-chemical answer gains no marks.

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. 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, ie OH – CH₂ and NH₂ – CH₂.

17. When drawing structural formulae, a half mark should be deducted if the bond points to the 'wrong' atom, eg



18. When formulae of ionic compounds are given as answers it will only be necessary to show ion charges if these have been specifically asked for. However, if ion charges are shown, they must be correct. If incorrect charges are shown, no marks should be awarded.
19. When it is very difficult to make a decision about a partially correct answer, a half mark can be awarded.
20. When marks have been totalled, a half mark should be rounded up.

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Marking Scheme

Section A

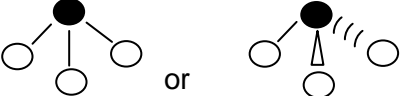
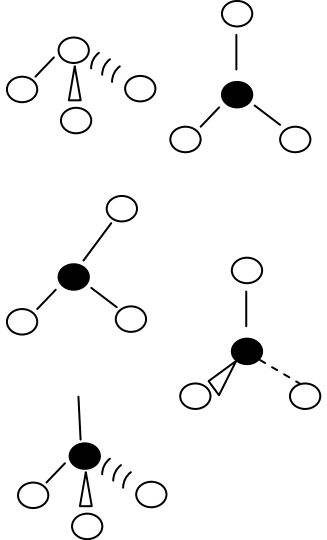
1	B	11	C	21	A
2	D	12	C	22	B
3	A	13	B	23	D
4	D	14	B	24	A
5	A	15	A	25	D
6	A	16	D	26	D
7	D	17	C	27	B
8	C	18	D	28	D
9	A	19	B	29	C
10	C	20	C	30	C

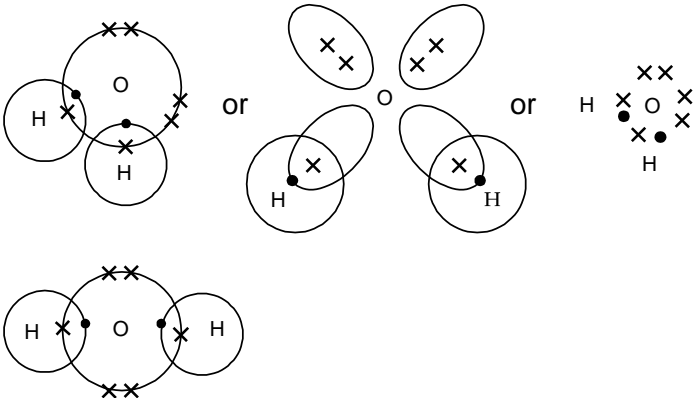
Marking Instructions

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Section B

Question	Acceptable Answer	Mark	Worth ½	Worth 0
1 (a)	1 st – covalent network (accept covalent lattice) 2 nd – ionic lattice 3 rd – metallic lattice 4 th – discrete covalent/covalent molecular ½ mark each accept abbreviations if obvious	2		
(b)	SiO ₂ O ₂ Si Simplest ratio	1 or 0		SiO ² /SiO2/incorrect symbol for Si and/or O Si ₈ O ₁₆ , Si ₂ O ₄ ion charges shown

Question	Acceptable Answer	Mark	Worth ½	Worth 0
<p>2 (a)</p>	 <p>or</p> <p>Use professional judgement to establish pyramidal shape</p> <p>Accept symbols, colours other way around</p>	<p>1 or 0</p>		<p>(all black/white atoms)</p> 

Question	Acceptable Answer	Mark	Worth ½	Worth 0
(b)	 <p>At least one of the symbols must be shown Mixture of dots and crosses are acceptable All dots or crosses acceptable Accept Lewis dot diagram Ignore inner electrons on oxygen Allow for 1 slip for misplaced electron (professional judgement) Accept electron pair on line of touching circles Non shared electrons do not need to be in pairs</p>	1 or 0		Electrons missing One of the pair of shared electrons not in the overlap No symbols shown at all

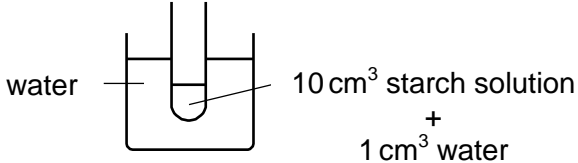
Question	Acceptable Answer	Mark	Worth ½	Worth 0
3 (a)	$2\text{H}_2\text{O}_2(\text{aq}) \rightarrow \text{O}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$ or any multiple ignore state symbols in transcription	1 or 0		transcription error even if balanced correctly
(b)	to a syringe/ downward displacement of water into a test-tube or measuring cylinder arrangement must work in practice (check sealed delivery tubes etc.) do not penalise delivery tube being too high labelling not required	1 or 0		sealed test-tube test-tube on bottom of trough delivery tube above level of water in test tube initially
(c)	relights a glowing/smouldering splint or taper ignore pop test and result both required	1 or 0		relights burning splint glowing splint

Question	Acceptable Answer	Mark	Worth ½	Worth 0
(d)	<p>34 g → 12l 1.7 g → $1.7/34 \times 12$ ½ mark = 0.6 ½ mark 0.6 on own – 1 mark</p> <p>OR</p> <p>No moles = $1.7/34 = 0.05$ Vol = 0.05×12 ½ mark = 0.6 ½ mark</p> <p>OR</p> <p>$34/1.7 = 20$, then $12/20$ ½ mark = 0.6 ½ mark</p>	1	<p>½ for correct working but no final answer -½ for arithmetic error</p>	<p>$1.7/34 = 0.05$ $34/1.7 = 20$ Correct answer but through incorrect method</p>

Question	Acceptable Answer	Mark	Worth ½	Worth 0
4 (a)	<p>(i) (catalyst) in same state/form/physical state as reactants ignore 'only reacts with chemicals' in same physical state</p> <p>(ii) RuCl_2 $\text{Ru}^{2+}(\text{Cl})_2$ Cl_2Ru Ru_1Cl_2 If ionic formula used it must be fully correct</p>	<p>1 or 0</p> <p>1 or 0</p>		<p>Same state as products Same state as each other</p> <p>$\text{RuCl}_2/\text{RuCl}_2^2/$incorrect symbol for Ru and/or Cl formula with partial ionic formula $\text{Ru}^{2+}\text{Cl}_2^-$</p>
(b)	<p>(i) both labels and units correct ½ scale on X and Y axis ½ plotting of points ½ joining of points ½</p> <p>-½ if not used at least half the graph paper -½ if line not through origin Max of 1 mark if bar graph or spike graph (labels, units and scale) or if both scales taken from table</p> <p>Allow ½ box tolerance on plotting of points for each Allow 1 plotting error Axes can be reversed 0,0 does not need to be marked on scale</p> <p>(ii) Must check reading from graph ± 0.5 tolerance No graph drawn 34-35</p>	<p>2</p> <p>1 or 0</p>		

Question	Acceptable Answer	Mark	Worth $\frac{1}{2}$	Worth 0
(iii)	$\frac{2 \cdot 2 - 1 \cdot 2}{10}$ $= 0.1$ Or 1/10 0.1 on its own – 1 mark correct use of data from candidates graph if incorrectly drawn	1	$\frac{1}{2}$ for correct working but no correct final answer $-\frac{1}{2}$ for arithmetic error	

Question	Acceptable Answer	Mark	Worth ½	Worth 0															
5 (a)	Precipitation (ignore spelling)	1 or 0																	
(b)	<p>1 mole $(\text{NH}_4)_2\text{SO}_4 = 132 \text{ g}$ ½</p> <p>Moles of $(\text{NH}_4)_2\text{SO}_4 = \frac{13200}{132} = 100 \text{ moles}$ ½</p> <p>Moles of $(\text{NH}_4)_2\text{CO}_3 = 100$ ½</p> <p>Moles of $(\text{NH}_4)_2\text{CO}_3 = 100 \times 96$ $= 9600 \text{ g}/9.6 \text{ kg}$ ½</p> <p>OR</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 30%;">$(\text{NH}_4)_2\text{CO}_3$</td> <td style="width: 30%;">$(\text{NH}_4)_2\text{SO}_4$</td> <td style="width: 40%;"></td> </tr> <tr> <td>1 mole</td> <td>1 mole</td> <td>½</td> </tr> <tr> <td>96 g</td> <td>132 g</td> <td>½</td> </tr> <tr> <td>$\frac{13200}{132} \times 96$</td> <td>13200 g</td> <td></td> </tr> <tr> <td>$= 9600 \text{ g}/9.6 \text{ kg}$</td> <td></td> <td>1</td> </tr> </table> <p>-½ for 9600 kg</p> <p>9600 g or 9.6 kg on its own – 2 marks</p> <p>accept working in grams and conversion to kg at end $13.2/132 = 0.1$ $0.1 \times 96 = 9.6 \text{ kg}$</p> <p>no ½ mark for GFM $(\text{NH}_4)_2\text{CO}_3 = 96 \text{ g}$</p>	$(\text{NH}_4)_2\text{CO}_3$	$(\text{NH}_4)_2\text{SO}_4$		1 mole	1 mole	½	96 g	132 g	½	$\frac{13200}{132} \times 96$	13200 g		$= 9600 \text{ g}/9.6 \text{ kg}$		1	2	<p>-½ per arithmetic mistake</p> <p>-½ for incorrect conversion to kg penalise once only</p> <p>-1 if used atomic numbers</p> <p>-1 if incorrect chemical or formula is used in calculation</p>	
$(\text{NH}_4)_2\text{CO}_3$	$(\text{NH}_4)_2\text{SO}_4$																		
1 mole	1 mole	½																	
96 g	132 g	½																	
$\frac{13200}{132} \times 96$	13200 g																		
$= 9600 \text{ g}/9.6 \text{ kg}$		1																	

Question	Acceptable Answer	Mark	Worth ½	Worth 0
6 (a)	To neutralise the acid, cancel out the acid, use up all/ excess acid Move pH to 7 any suggestion of neutralisation	1 or 0		Move pH closer to 7 Increase pH Slightly neutralise Stop the reaction Stop reaction working Catalyst
(b)	 <p>water</p> <p>10 cm³ starch solution + 1 cm³ water</p> <p>Both labels for 1 mark</p> <p>accept 11 cm³ starch (solution) ignore reference to 'warm' water</p>	1		10 cm ³ starch solution

Question	Acceptable Answer	Mark	Worth ½	Worth 0
7	1. oil/crude oil/naptha 2. styrene (phenylethene) 3. poly(ethenol)/polyethenol 1 mark for each correct answer	3		hydrocarbons from nature poly(ethanol) polyethanol

Question	Acceptable Answer	Mark	Worth ½	Worth 0
8 (a)	Presence of carbon monoxide/ CO present/ 5% CO present Carbon monoxide with nitrogen oxides does not cancel	1 or 0		oxygen left nitrogen oxides mixture of poisonous gases (not cancelling)
(b)	any value less than 3% accept 0%	1 or 0		
(c)	causes acid rain Sulphur dioxide reacts and produces/causes acid rain	1 or 0	poisonous gas/poisons air/toxic gas correct effect of acid rain	causes pollution harmful gas sulphur could poison the catalytic converter greenhouse gases (does not cancel if given as additional info) sulphuric rain sulphur causes problem

Question	Acceptable Answer	Mark	Worth ½	Worth 0
9 (a)	Photosynthesis (ignore spelling if recognisable)	1 or 0		
(b)	Enzyme/ Biological catalyst Enzyme + yeast or other named enzyme (non cancelling)	1 or 0		any named enzyme yeast catalyst
(c)	CH ₃ — CH ₂ — OH/CH ₃ --CH ₂ OH CH ₃ CH ₂ OH/CH ₃ CH ₂ --OH CH ₃ CH ₂ (OH)	1 or 0		C ₂ H ₅ OH/C ₂ H ₆ O Full structural formula given Mix of partially full and shortened structural formula but bond between O and H can be shown
(d)	$\frac{9 \times 1.25}{3.8} = 2.96$ $2.96/2.9605/2.961/2.9605263$ on its own – 1 mark 3.0 or/3 with working	1	½ for correct working but no final or correct answer -½ for arithmetic error	2.9 or 3.0 or 3 without working

Question	Acceptable Answer	Mark	Worth ½	Worth 0
<p>10 (a) (i)</p>	$\begin{array}{c} \text{H} \quad \text{COOH} \\ \quad \\ \text{C} = \text{C} \\ \quad \\ \text{H} \quad \text{H} \end{array}$ <p>allow one slip – missing H atom OR missing C – H bond but not C=O or – O – H ignore brackets around correct monomer</p>	<p>1 or 0</p>	<p>as per general marking instruction no 17 bond to O and not C</p>	<p>COOH if expanded must be correct</p> <p>Repeating unit and monomer shown with no indication of steps involved (professional judgement)</p>
<p>(ii)</p>	<p>Polar covalent</p>	<p>1 or 0</p>	<p>polar</p>	<p>Covalent Any reference to networks Hydrogen bonding</p>
<p>(b)</p>	<p>It partially ionises/ It partially dissociates Doesn't dissociate easily Doesn't fully dissociate</p>	<p>1 or 0</p>		<p>acid with low H⁺ ion conc ions only partially ionise doesn't fully breakdown</p>

Question	Acceptable Answer	Mark	Worth ½	Worth 0
11 (a)	amine/ amino	1 or 0		amide (link) ammonia amine link (cancelling)
(b)	octyl ethanoate accept oxyl/oxyloctyl/octile (professional judgement)	1 or 0		Any reference to numbers in the name
(c) (i)	colourless to orange/brown/red/yellow/any combination must be correct way round both colours required for 1 mark	1 or 0		clear pink
(ii)	16.0/ 16	1 or 0		16.2 cm ³

Question	Acceptable Answer	Mark	Worth ½	Worth 0
(iii)	<p>moles of Br₂ = 0.5 × 0.016 = 0.008 ½</p> <p>moles of C₁₀H₁₆ = $\frac{0.008}{2}$ = 0.004 ½</p> <p>concentration of C₁₀H₁₆ = $\frac{0.004}{0.02}$ ½</p> <p> = 0.2 ½</p> <p>Correct answer but no working = 2 marks</p> <p> Or 0.2025 (if 16.2 used)</p> <p> = 0.20/0.203 if rounded</p> <p>Allow follow through for incorrect answer above.</p> <p>$\frac{20 \times c_1}{1} = \frac{16 \times 0.5}{2}$ 1 mark</p> <p>40 × c₁ = 8 c₁ = 0.2 1 mark</p> <p>(-½ if incorrect ratio is used)</p>	2	<p>-½ per arithmetic mistake</p> <p>-½ for using cm³ and not litres if first method is used</p>	

Question	Acceptable Answer	Mark	Worth ½	Worth 0
12 (a)	reduction reduced	1 or 0		Redox Redox and reduction (cancelling)
(b) (i)	Positive negative + - both required for 1 mark	1 or 0		right left
(b) (ii)	Decolourise/bleaching of pH/litmus paper (any colour) Red to pink/blue to paler blue	1 or 0		smell/colour of gas (not cancelling)

Question	Acceptable Answer	Mark	Worth $\frac{1}{2}$	Worth 0
13 (a)	(solution) C Last one/bottom one	1 or 0		
(b)	any value above 4.4 and below 6.0 (not inclusive) must acknowledge both parameters number within range	1 or 0		value below 6.0 value above 4.4

Question	Acceptable Answer	Mark	Worth ½	Worth 0
14 (a)	(metal) 3 0-9	1 or 0		(Metal) C
(b)	(metal) 2 and (metal) 3 0-2 and 0-9 allow for follow through for incorrect answer in (a) (metal) 3 and students answer in (a)	1 or 0		any other combination
(c)	0/ 0-0 zero	1 or 0		No voltage
(d)	glucose is covalent/(discreet)molecular it is covalent/ contains no ions/ not ionic there are no ions so electrons/electricity cannot flow (mention of 'in solution' cancels)	1 or 0	doesn't conduct/ doesn't complete circuit/ doesn't allow electricity to flow/ doesn't allow electrons to flow	contains no free ions/ ions not free to move/ can't move can't let ions pass through /glucose would not carry ions electrons can't flow in solution above all cancelling is an insulator/not good conductor (non cancelling) only non metals in glucose (non cancelling)

Question	Acceptable Answer	Mark	Worth ½	Worth 0
15 (a)	(pH) will rise towards 7/ (pH) will rise/ (pH) becomes less acidic/ increases/ becomes neutral	1 or 0		Decreases gets stronger/ gets weaker
(b)	Ca ₁₀ (PO ₄) ₆ F ₂ F can be in brackets(F) ₂ Accept any order of symbols Ignore charges Use professional judgment for size of numbers in formula	1 or 0		wrong symbol used superscript numbers

[END OF MARKING INSTRUCTIONS]