2009 Chemistry

Intermediate 2

Finalised Marking Instructions

Intermediate 2 Chemistry

General information for markers

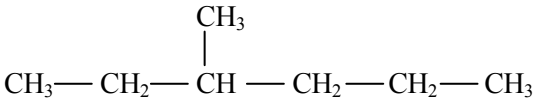
The general comments given below should be considered during all marking. It should be noted that these are general marking principles and may be superseded by decisions made at the Markers Meeting.

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_3COOH	1.65
$CH_2ClCOOH$	1.27
$CHCl_2COOH$	0.90
CCl_3COOH	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 Cl_2, 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.

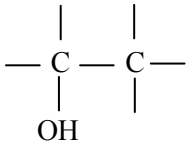
15. Unless the question is clearly about a non-chemistry issue, eg costs in industrial chemistry, a non-chemical answer gains no marks.

    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 – NH_2 group, a half mark should be deducted if the 'O' or 'N' are not bonded to a carbon, ie OH – CH_2 and NH_2 – CH_2.

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.

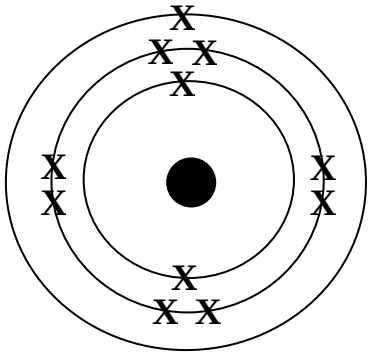
2009 Chemistry Intermediate 2

Marking Scheme

Section A

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

Section B

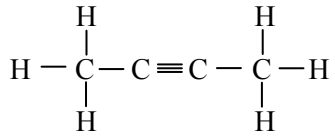
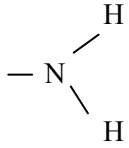
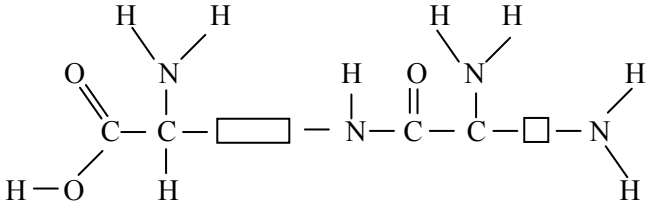
Question	Acceptable Answer	Mark	Worth ½	Worth 0
1 (a)	11 13 both required	**1 or 0**		
(b) (i)	 Electrons don't have to be put in pairs Cross or dot or e for electron is acceptable Electrons can be between orbitals	**1 or 0**		
(ii)	The attraction/pull/electrostatic force to the positively charged nucleus (and the (negatively charged) electrons) Attraction/pull/electrostatic force between (positive) protons and ……	**1 or 0**		Attraction to the nucleus Any mention of ions Strong bonds

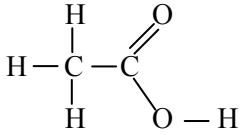
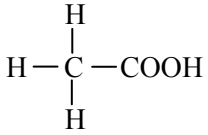
Question	Acceptable Answer	Mark	Worth ½	Worth 0
2 (a)	Potassium permanganate Water (Conc.) Sulphuric acid **All three for 1 mark**	**1 or 0**		
(b) (i)	As the atomic number increases the melting point increases **OR** As the atomic number decreases the melting point decreases (boiling point accepted)	**1 or 0**		As the atomic number increases the melting point decreases (or reverse) Directly proportional
(ii)	470°C ± 20 check candidates script for correct extrapolation if outwith range (1/2 box tolerance)	**1 or 0**		

Question	Acceptable Answer	Mark	Worth ½	Worth 0
3 (a)	Exothermic	**1 or 0**		combustion
(b) (i)	Both labels + units (correct abbreviations acceptable) Both scales Plotting points Joining points Allow ½ box tolerance on plot Any scaling error do not award ½ mark Allow one plotting error Minus ½ for wrong extension of line If bar or spike graph maximum 1 mark (labels and units must be correct) Axes can be reversed Compression symbol required if non linear graph	½ ½ ½ ½		
(ii)	13 g 13 g ± 1 if no graph value must be consistent with the graph check result from candidate's graph - allow ½ box tolerance	**1 or 0**		
(c)	Reduces heat loss from beaker to the surroundings Trap heat in Keep heat in Locks in heat Keeps it warm Insulator (and doesn't conduct heat) Doesn't conduct heat	**1**	It doesn't conduct	Wouldn't get hot to touch Absorbs heat Heat resistant Won't melt Holds the temperature in

Question	Acceptable Answer	Mark	Worth ½	Worth 0
4 (a)	Fe_2O_3 (s) + $\underline{3}CO(g) \longrightarrow \underline{2}Fe$ (*l*) + $\underline{3}$ CO_2 (g) or multiples of	**1 or 0**		
(b)	CO_2 (g) + C (s) ⟶ 2 CO (g) 1 mole ⟶ 2 moles 12 g ⟶ 56 g 1200 kg ⟶ 5600 kg **OR** number of moles of carbon = 1200000 / 12 = 100000 moles of CO = 2 x 100000 = 200000 mass of CO = 200000 x 28 = 5600000 g **or** 5600 kg minus ½ for arithmetic error eg incorrect conversion of g to kg minus 1 for chemical error eg use of atomic numbers or calculating using CO_2	½ ½ **1** ½ ½ **1**		
(c)	To provide oxygen (for the reaction which takes place in zone 1) To make CO_2 For complete combustion Air contains oxygen It produces more heat because oxygen is blown in with the air To burn carbon So combustion can occur	**1 or 0**		To cool the iron down To allow flame to burn To produce waste gases To heat the reaction
5 (a)	(As gases have) different boiling points Different boiling or melting points Each will evaporate at different temperatures	**1 or 0**		Different melting points (won't negate) Different sizes different weights
(b)	liquid	**1 or 0**		
(c)	Neutralisation	**1 or 0**		

Question	Acceptable Answer	Mark	Worth ½	Worth 0
6 (a)	A substance that is burned/combusts to produce energy/heat (burning and energy both required) any mention of molecule, element, hydrocarbon or compound will not conflict	**1 or 0**		Combusts on its own/ Something that gives out energy Substance which heats to produce energy
(b) (i)	Above zero → 35 If outwith range, check candidate's working	**1 or 0**		
(ii)	The smaller the number of carbons in the molecule, the more efficient/useful/better (the fuel) The smaller the structure/molecule, the more efficient/useful/better it is **OR** If a molecule has a branch/or methyl group in the hydrocarbon it is more efficient/useful/better (fuel) The more yl groups the more efficient… The more complex, the more efficient/useful/better The less hydrogens the more efficient…	**1**	Smaller the number of carbon atoms, the higher the octane number **OR** More branches, the higher the octane number (or vice versa)	The more hydrocarbons present the more efficient
7 (a)	Aluminium oxide (Al_2O_3) If formula given, must be correct Steel wool Wrong formula, name correct	**1 or 0**		Wrong formula
(b) (i)	Butene/C_4H_8 Full or shortened structural formula accepted Allow one missing bond/H	**1 or 0**		Butane + C_4H_8 Butene + C_4H_{10} cyclobutane
(ii)	(Bromine solution would) decolourise/change from brown to colourless turns bromine colourless loses colour allow follow through from b (i) ie no change/stays brown	**1 or 0**		Any mention of clear Change of colour

Question	Acceptable Answer	Mark	Worth ½	Worth 0
8 (a)	Ethyne/etyne	**1 or 0**		
(b) (i)	 Allow one missing bond (C-H) or allow one missing H Shortened structural formula accepted	**1 or 0**		Missing bond and missing H
(ii)	Bromines are not attached to adjacent carbon atoms Bromines not beside each other/not together Bromines have hydrogen between them/hydrogen in the middle bromines too far apart/not close enough to react	**1 or 0**		Mention of bromine ions or molecules Bromide Carbon to carbon triple bond can't be formed
9 (a)	 Hydrogens to be circled	**1 or 0**		Amino acid plus anything else eg protein
(b)	Amino acids	**1 or 0**		
(c)	 Allow square boxes to be missing Allow one slip eg any missing atom or any missing bond - Peptide bond must be there ***error in question – missing Hydrogen so not required in candidate's answer.**	**1**	Polymer – end bonds must be there	

Question	Acceptable Answer	Mark	Worth ½	Worth 0
10 (a)	Starch + water → glucose Ignore non conflicting additional information eg hot water in equation and mashing above arrow Reversible arrow acceptable If formulae is given, must be correct Mix of formulae and words is acceptable must be correct	**1**	= instead of →	Mashing or heat in equation
(b)	Fermentation Anaerobic respiration	**1 or 0**		
(c)	 Allow shortened structural formula CH_3COOH Bond does not need to be shown between O and H Allow one slip eg missing bond (C to H), missing atom but **not** carbon to carbon bond or carbon atom 	**1 or 0**		
(d)	Methyl ethanoate	**1 or 0**		2-methyl ethanoate

Question	Acceptable Answer	Mark	Worth ½	Worth 0
11 (a)	Biological catalyst Biochemical catalyst Natural catalyst Naturally occurring catalyst Catalyst found in a living thing Proteins which speed up chemical reactions	**1**	Protein Globular protein Specifically shaped protein	Any mention of living/ Organic catalyst Organic living catalyst Living catalyst Catalyst Substance which speeds up a reaction (doesn't cancel)
(b) (i)	One which does not completely/partially ionise/dissociate (into ions) Does not fully iodise Partially breaks up/split	**1 or 0**		Doesn't split/break up (into ions) Low concentration of ions Any mention of pH Any mention of named ions
(ii)	Titration Volumetric titration	**1 or 0**		neutralisation

Question	Acceptable Answer	Mark	Worth ½	Worth 0
12 (a)	167 (s) 166.67 166.7 seconds converted to minutes and seconds	**1**	1/0.006 1/0.006 = wrong answer 166 166.6	180
(b)	(Increasing the number of rhubarb cubes) increases the surface area /concentration/ more particles allows more (successful) collisions to take place	½ ½	Increases surface area More collisions More particles More rhubarb particles Increase in concentration	More rhubarb means more particles move faster wrong chemistry cancels
(c) (i)	$\frac{100}{1000} \times 1$ = 0.1 moles 100/1000= 0.1 0.1 moles deduct ½ for arithmetic error	**1**	100 x 1 = 100 moles 100/1000 x 1	
(ii)	0.1 moles reacts with 5/2 x 0.1 = 0.25 moles (follow through will apply from (c)(i))	**1 or 0**	5/2 x 0.1 with no answer or wrong answer	

Question	Acceptable Answer	Mark	Worth ½	Worth 0
13 (a)	…until no more solid reacts/until it no longer reacts (unreacted) solid can be seen (at the bottom of the beaker) until a gas is no longer produced no more fizzing/bubbling no more magnesium/magnesium carbonate reacts magnesium/magnesium carbonate left (at the bottom) until no more reaction can be seen	**1 or 0**		Any mention of dissolving Saturated solution Any mention of pH No acid left Until it goes green
(b)	To ensure that all of the acid is reacted Acid is neutralised Acid completely used up Make sure the reaction has stopped/fully taken place	**1 or 0**		
(c)	+ CO_2 (g) + H_2O (*l*) state symbols not required but if given must be correct	**1 or 0**		

Question	Acceptable Answer	Mark	Worth ½	Worth 0
14 (a)	Fe_2O_3 If ionic formula is given, it must be correct but no brackets required	**1 or 0**		Fe^2 O^3
(b)	Fe^{2+} (aq) → Fe^{3+} (aq) + e^- Fe^{2+} - e → Fe^{3+} (aq) State symbols not required but if given must be correct Negative charge on electron not required	**1 or 0**		
(c)	Iron loses electrons to (less reactive) lead Lead/it is lower in the ECS than iron Lead/it is less reactive than iron Sacrificial protection Iron is sacrificed to save lead Lead/it takes electrons away from iron	**1 or 0**		Any mention of ions Mention of atoms displacement

Question	Acceptable Answer	Mark	Worth ½	Worth 0
15 (a)	$2OH^-(aq) + 2H^+(aq) \rightarrow 2H_2O(l)$ **OR** $OH^-(aq) + H^+(aq) \rightarrow H_2O(l)$ State symbols not required but if given must be correct Allow one slip	**1 or 0**		
(b) (i)	Barium hydroxide solution contains a higher concentration of hydroxide ions More ions More hydroxides It has two OH's	**1 or 0**		Any mention of atoms or molecules Stronger base
(ii)	There are no free ions in solution No free moving charged particles Ions are in solid state and cannot move	**1 or 0**		No free moving particles Ions are in solid state Don't conduct

[END OF MARKING INSTRUCTIONS]