AQA Qualifications

A- LEVEL

CHEMISTRY

CHEM4 Kinetics, Equilibria and Organic Chemistry

Mark scheme

2420

June 2015

Version 1: Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available from aqa.org.uk

Question	Marking Guidance	Mark	Comments
1(a) Marked with 1(b)	k = rate / $[A]^2$ or $\frac{3.3\times10^{-5}}{(4.2\times10^{-3})^2}$ = 1.87 or 1.9 $mol^{-1}dm^3s^{-1}$	1 1 1	 Answer scores 2 1.90 scores first mark only (incorrect rounding) Any order and independent of calculation
1(b) Marked with 1(a)	Expt 2 rate = $1.167 \times 10^{-4} - 1.2 \times 10^{-4}$ (mol dm^{-3} s^{-1}) Expt 3 [A] = $9.7 \times 10^{-3} - 9.8(1) \times 10^{-3}$ (mol dm^{-3}) Using alternative value for *k* Expt 2 rate = $1.4(4) \times 10^{-4}$ (mol dm^{-3} s^{-1}) Expt 3 [A] = 8.85×10^{-3} (mol dm^{-3})	1 1	If answers in table are not those given here, check their value of k in part 1(a) or use of alternative k. If their k is incorrect in part 1(a) mark 1(b) consequentially e.g. if k = 7.9×10^{-3} due to lack of squaring in 1(a) expt 2 4.9×10^{-7} expt 3 1.5×10^{-1} (expt 2 6.24×10^{-5} x their k) (expt 3 0.0134 / √k)
1(c)	Slow step or rds involves only A ***OR*** B does not appear in the slow step or the rds ***OR*** B only appears after the slow step or the rds	1	Not B has no effect on the rate or B is not in the rate equation Allow "it" for B

Question		Marking Guidance	Mark	Comments
2(a) Marked with 2(b)		$K_c = \dfrac{[SO_3]^2}{[SO_2]^2[O_2]}$ units = $mol^{-1}\ dm^3$	1 1	Penalise ( ) in part (a) but can score units; mark on in (b) If K_c expression wrong no marks in (a) but can score M1 & M3 in (b)
2(b) Marked with 2(a)	M1	$[O_2] = \dfrac{[SO_3]^2}{[SO_2]^2 K_c}$ or $\dfrac{(0.072/1.4)^2}{(0.055/1.4)^2 \times 27.9}$ or $\dfrac{(0.072)^2}{(0.055)^2 \times 27.9}$	1	Correct answer scores three marks Ignore ( ) in part (b) Penalise contradiction in M1
	M2	0.061(4)		If K_c expression wrong in (a) can score M1 here for rearrangement of their K_c & M3 for multiplication by 1.4
	M3	mol O_2 = 0.0614 × 1.4 = 0.086 (allow 0.085–0.087)	1 1	If K_c or rearrangement wrong here score only M3 for multiplication by 1.4 M3 = correct answer of (M2 × 1.4)
2(c)(i) **G**		No effect **OR** none **OR** no change **OR** stays the same	1	

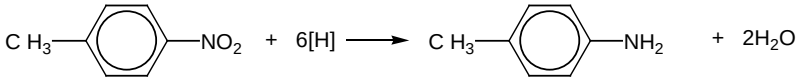
2(c)(ii)	M1	Effect: Increase or more SO_3	Increase or more SO_3	1	If wrong effect, no further marks, but M2 and M3 are independent of each other
	M2	Fewer mole(cule)s on RHS or 3 moles to 2 moles or (eqm shifts) to side with fewer moles	(V^3 or) residual V decreases in numerator of K_c expression	1	
	M3	<u>Equilibrium moves/shifts</u> to reduce the pressure/oppose the increase in pressure	to keep K_c constant, ratio $\frac{(\text{mol } SO_3)^2}{(\text{mol } SO_2)^2(\text{mol } O_2)}$ must increase	1	Allow to oppose the change only if increase pressure mentioned

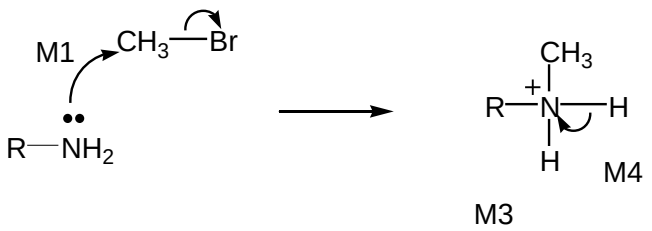
Question	Marking Guidance	Mark	Comments
3(a)(i) **A**	G	1	
3(a)(ii) **A**	F	1	
3(a)(iii) **A**	H	1	
3(b)(i) **A**	cresol purple	1	
3(b)(ii) **G**	yellow to red	1	both colours needed and must be in this order
3(b)(iii) **G**	Yellow or pale yellow	1	Not allow any other colour with yellow

Question		Marking Guidance	Mark	Comments
4(a)	M1	$[H_2O]$ is <u>very</u> high (compared with $[H^+]$ and $[OH^-]$) **OR** <u>Very few</u> H^+ and OH^- ions **OR** <u>Only / very</u> slightly dissociates **OR** Equilibrium lies <u>far</u> to the left	1	Not partially dissociates
	M2	$[H_2O]$ is (effectively) constant OR is incorporated into the constant K	1	Allow changes by only a very small amount
4(b)		(Dissociation OR breaking bonds) is endothermic	1	
		∴ Equilibrium moves to RHS (at higher T) <u>to absorb heat or to lower T or oppose increase in T</u>	1	Allow to oppose change only if increase T mentioned

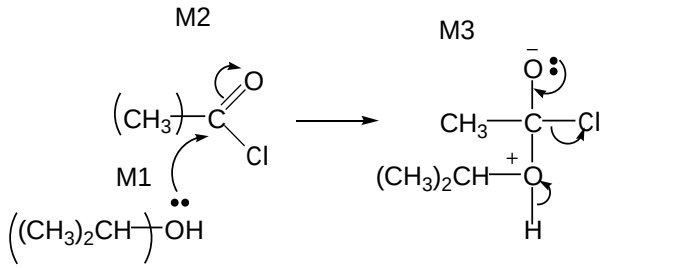
4(c) Marked with 4(d)	$[H^+]$ = $\sqrt{K_w}$ (or = $\sqrt{5.48 \times 10^{-14}}$) If wrong method no marks = 2.34×10^{-7} pH = 6.63	1 1 1	Correct pH answer scores 3 Using alternative K_w (1.00×10^{-14}) gives pH = 7.<u>00</u> which scores 1 Final answer must have 2dp

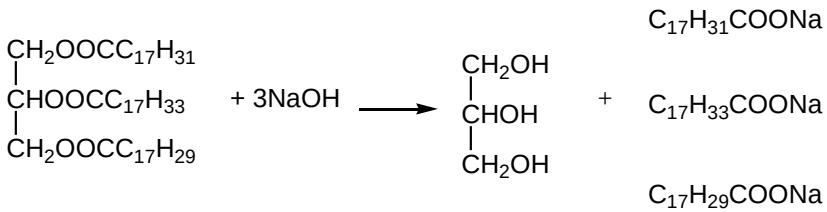
4(d) Marked with 4(c)	$[H^+]$ = $K_w / [OH^-]$ or (= $5.48 \times 10^{-14}/0.12$) If wrong method no marks = 4.566×10^{-13} pH = 12.34	1 1 1	Correct pH answer scores 3 If use alternative K_w (1.00×10^{-14}) again, do not penalise repeat error so pH = 13.08 scores 3 If use alternative K_w (1.00×10^{-14}) **not** as a repeat error, pH = 13.08 scores 1 If AE in K_w value made in part (c) is repeated here, do not penalise again. Final answer must have 2dp, but if dp penalised in 4(c) allow more than 2dp here but not fewer.

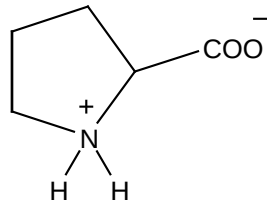
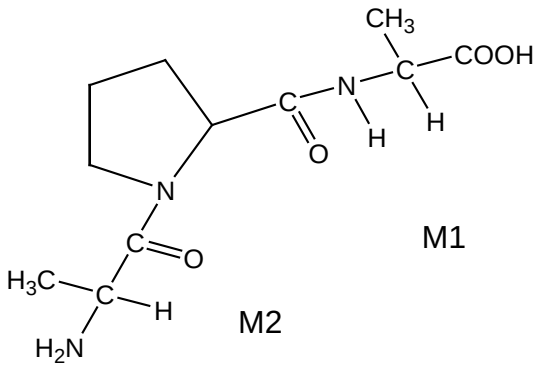
Question	Marking Guidance	Mark	Comments
5(a) **G**	Electrophilic substitution	1	Both words needed Ignore minor misspellings
5(b)(i)	Sn/HCl **OR** H_2/Ni OR H_2/Pt **OR** Fe/HCl **OR** Zn/HCl **OR** $SnCl_2$/HCl	1	Ignore conc or dil with HCl, Allow (dil) H_2SO_4 but not conc H_2SO_4 Not allow HNO_3 or H^+ Ignore NaOH after Sn/HCl Ignore catalyst
5(b)(ii)	$CH_3C_6H_4NO_2 + 6[H] \rightarrow CH_3C_6H_4NH_2 + 2H_2O$ **OR** 	1	Allow molecular formulae as structures given $C_7H_7NO_2 + 6[H] \rightarrow C_7H_9N + 2H_2O$ Qu states use [H], so penalised $3H_2$
5(b)(iii)	making dyes ***OR*** making quaternary ammonium salts ***OR*** making (cationic) surfactants ***OR*** making hair conditioner ***OR*** making fabric softener ***OR*** making detergents	1	

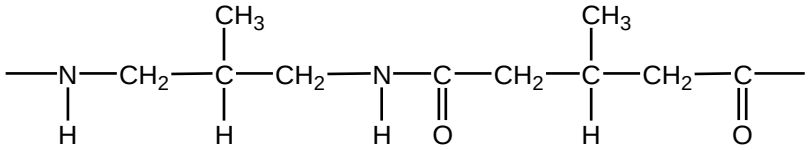
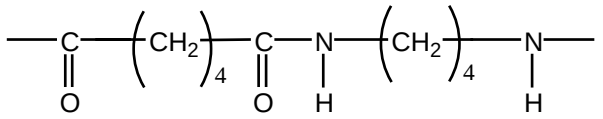
5(c)	M2  NO Mark for name of mechanism	4	Allow SN1 M1 for lone pair on N and arrow to C or mid point of space between N and C M2 for arrow from bond to Br M3 for structure of protonated secondary amine M4 for arrow from bond to N or + on N For M4: ignore RNH_2 or NH_3 removing H^+ but penalise Br-

5(d)	M1	<u>lone or electron pair on N</u>	1	If no mention of lone pair CE=0 If lone pair mentioned but not on N then lose M1 and mark on
	M2	in **J** spread/delocalised into ring (or not delocalised in K)	1	Ignore negative inductive effect of benzene
	M3	less available (for protonation or donation in **J**)	1	Allow interacts with π cloud for M2
		OR		
	M2	in **K** there is a positive inductive effect / electron releasing)		
	M3	more available (for protonation or donation in **K**)		

Question	Marking Guidance	Mark	Comments
6(a)(i)	$(CH_3)_2CHOH + (CH_3CO)_2O \rightarrow CH_3COOCH(CH_3)_2 + CH_3COOH$	1	**Allow** $CH_3CO_2CH(CH_3)_2$ and CH_3CO_2H Ignore $(CH_3)_2$–C in equation
	(1)-methylethyl ethanoate OR Propan-2-yl ethanoate	1	Ignore extra or missing spaces, commas or hyphens
6(a)(ii)	 M4 for 3 arrows and lp NO Mark for name of mechanism	4	M1 for lone pair on O and arrow to C or to mid-point of space between O and C M2 for arrow from C=O bond to O • M2 not allowed independent of M1, but allow M1 for correct attack on C+ • + rather than δ+ on C=O loses M2 • If Cl lost with C=O breaking, max1 for M1 M3 for correct structure <u>with charges</u> (penalise wrong alcohol here) but lone pair on O is part of M4 Penalise $(CH_3)_2$–C in M3 M4 for lone pair on O and three arrows • only allow M4 after correct/very close M3 • M4 can be gained over more than one structure • Ignore Cl- removing H^+

6(b)(i)		LHS 1 RHS 1	Penalise covalent Na e.g. -O-Na
6(b)(ii)	$C_{17}H_{33}COOCH_3$	1	Allow $C_{19}H_{36}O_2$

Question	Marking Guidance	Mark	Comments
7(a)(i)		1	Allow CO_2^- and NH_2^+
7(a)(ii)	NOTE – **Two** marks for this clip  M1 M2	1 1	M1 for alanine section bonded through N M2 for alanine section bonded through C But penalise error in proline ring Allow MAX 1 for correct tripeptide in polymer structure
7(b)(i)	3-methylpent-2-ene	1	Ignore *E-Z*, commas, spaces or missing hyphens
7(b)(ii)	4-amino-3-methylbutanoic acid	1	Ignore commas, spaces or missing hyphens

7(b)(iii)		1	or any polyamide section containing 8 carbons plus two C=O plus two N-H, such as  Trailing bonds are required
7(b)(iv)	Non polar OR no polar groups/bonds (for attack by water / acids / alkalis / nucleophiles or for hydrolysis) C-C bonds are strong	1	

Question	Marking Guidance	Mark	Comments
8(a)(i)	3(-120) – (-208) = -152 OR 3(120) – 208 = 152 (kJ mol^{-1})	1	Must show <u>working</u> and answer and maths must be correct, but ignore sign
8(a)(ii)	Electrons <u>delocalised</u> OR <u>delocalisation</u> (QOL) Or allow reference to <u>resonance</u> (QOL)	1	
8(b) **G**	x, y, w	1	Must be in this order
8(c)(i) **G**	-240 (kJ mol^{-1})	1	Must have minus sign
8(c)(ii)	between -239 and -121 (kJ mol^{-1})	1	Must have minus sign
8(c)(iii)	Must specify which diene:		
	M1 Proximity – for 1,3 C=C bonds are close together	1	allow converse for 1,4 diene
	M2 Delocalisation – for 1,3 some delocalisation OR some overlap of electrons, π clouds or p orbitals	1	allow converse for 1,4 diene
	M3 some extra stability for the 1,3- isomer	1	

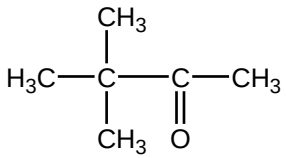
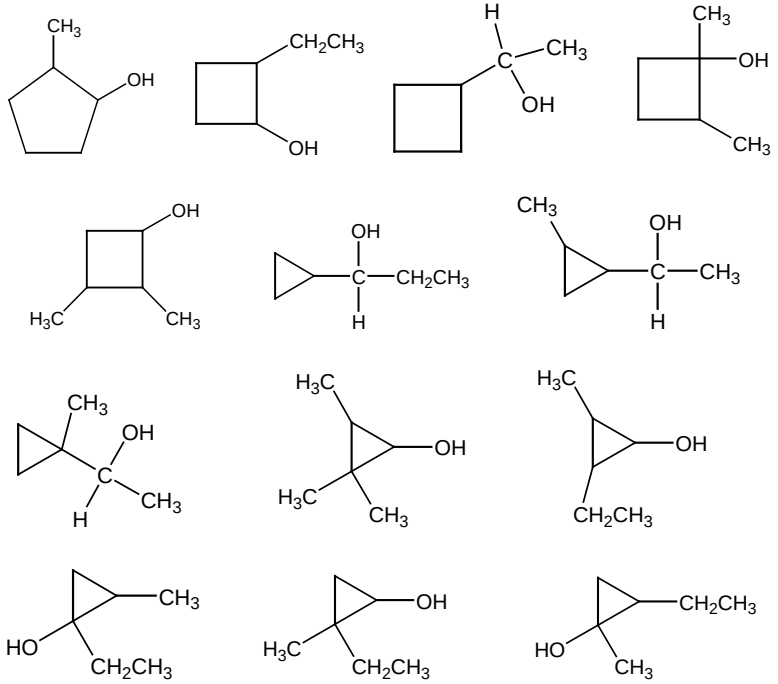
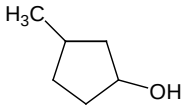
Question		Answers	Mark	Comments
9(a)	M1	$[H^+] = \frac{K_a \times [CH_3COOH]}{[CH_3COO^-]}$ or = $1.74 \times 10^{-5} \times \frac{0.186}{0.105}$	1	Allow ( )
	M2	$= 3.08 \times 10^{-5}$	1	If $[HX]/[X^-]$ or $\frac{0.186}{0.105}$ upside down, or any addition or subtraction lose M1 & M2.
	M3	pH = 4.51 (correct answer scores 3)	1	Can score M3 for correct pH conseq to their $[H^+]$, so pH = 5.01 scores one Must be to 2 dp
9(b)	M1	mol HX after addition (= 0.251 + 0.015) = 0.266	1	For HX, if no addition or error in addition (other than AE) (or subsequent extra add or sub) MAX 3
	M2	mol X^- after subtraction (= 0.140 – 0.015) = 0.125	1	For X^- if no subtraction or error in subtraction (other than AE) (or subsequent extra add or sub) MAX 3
	M3	$[H^+] = \left(\frac{K_a \times [CH_3COOH]}{[CH_3COO^-]} \right) = \frac{1.74 \times 10^{-5} \times 0.266}{0.125}$	1	If errors above in both addition AND subtraction can only score M3 for insertion of their numbers in rearranged expression. One exception, if addition and subtraction reversed then pH =4.58 scores 2
	M4	$[H^+] = 3.703 \times 10^{-5}$ (mol dm^{-3})	1	If $[HX]/[X^-]$ upside down, lose M3 & M4 (or next two marks) but can score M5 for correct pH conseq to their $[H^+]$, so if M1 & M2 correct, pH = 5.09 scores 3.
	M5	pH = 4.43 Correct use of HX and X^- values from 9(a) gives pH= 4.41 and scores 4	1	If wrong method, e.g √ or no use of rearranged K_a expression, may score M1 & M2 but no more. Allow more but not fewer than 2dp here.

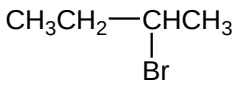
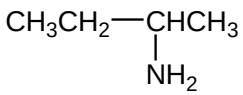
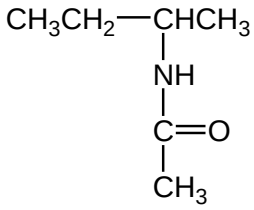
Questio	Answers		Mar	Comments
	Alternative using Henderson-Hasselbach Equation			
9(a)	M1	pH = pKa – log[HX]/X^-] = -log(1.74 × 10^{-5}) – log($\frac{0.186}{0.105}$)	1	Allow ( )
	M2	pKa = 4.76 – 0.248	1	If [HX]/[X^-] or $\frac{0.186}{0.105}$ upside down, can only score 1
	M3	pH = = 4.51	1	so pH = 5.01 Must be to 2 dp
9(b)	M1	mol acid after addition = 0.251 + 0.015 = 0.266	1	For HX, if no addition or error in addition (other than AE) (or subsequent extra add or sub) MAX 3
	M2	mol salt after addition = 0.140 – 0.015 = 0.125	1	For X^- if no subtraction or error in subtraction (other than AE) (or subsequent extra add or sub) MAX 3
	M3	pH = (pKa – log[HX]/[X^-]) = -log(1.74 × 10^{-5}) – log(0.266/0.125)	1	If errors above in both addition AND subtraction can only score M3 for insertion of their numbers - except if addition and subtraction reversed then pH =4.58 scores 2
	M4	pH = 4.76 – 0.328	1	
	M5	pH = = 4.43	1	If [HX]/[X^-] upside down, lose M3 & M4 (or next two marks) but can score M5 for correct pH conseq to their working, so if M1 & M2 correct, pH = 5.09 scores 3. Allow more but not fewer than 2dp here.

Question	Marking Guidance						Mark	Comments
10(a)	Reagent **P** (ketone) **S** (2^o alcohol)	Acidified $K_2Cr_2O_7$ no reaction (orange to) green	Acidified $KMnO_4$ no reaction (purple to) colourless	I_2/NaOH Yellow ppt no reaction	Named RCOOH with HCl or H_2SO_4 no reaction fruity or sweet smell	Named RCOCl no reaction Misty fumes	1 1 1	Allow names including potassium permanganate Wrong or no reagent CE=0 Penalise incorrect formulae or incomplete reagent, such as $K_2Cr_2O_7$ or acidified dichromate, but mark on. Allow no change or nvc but penalise *nothing or no observation* If 2 reagents added sequentially or 2 different reagents used for P and S then CE=0
10(b)	Tollens' silver mirror/solid	Fehling's / Benedicts red ppt					1 1	
10(c) **G**	P 5 OR five						1 1	If not P then no marks for clip

10(d)	$C_4H_{12}Si$ Any **two** from • <u>One or single</u> peak OR all (four) carbon atoms are equivalent or one environment • upfield from others or far away from others or far to right • non toxic OR inert • low boiling point or volatile or easy removed from sample	1 1 1	Must be molecular formula Wrong substance CE=0 for clip Ignore and don't credit single peak linked to 12 equivalent H or has a peak at $\delta = 0$ but use list principle for wrong statements

10 (e)				
	M1	Figure 2 is **R**	1	If not **R** cannot score M2
	M2	90-150 (ppm) or value in range is (two peaks for) C=C/alkene	1	
	M3	Figure 3 is **T**	1	If not **T** cannot score M4 or M5
	M4	50-90 (ppm) or value in range is C—O or alcohol or ether	1	
	M5	two peaks (so not S which would have only one)	1	

10(f)	**U** $C_6H_{12}O_6$ 	1	
	Answers include **V** $C_6H_{12}O_6$ 	1	Not allow **S**  because **V** must be an isomer of **S**

Question	Marking Guidance			Mark	Comments
11	Step 1	M1	HBr	1	In any step, if wrong reagent or extra wrong reagent, can only score mechanism mark, but if $AlCl_3$ added in Step 3, lose M7 but can score M8 & M9
		M2		1	
		M3	electrophilic addition	1	If 1-bromobutane structure given for M2 then 1-aminobutane structure for M5, penalise M2 and M5 but mark M8 consequentially
	Step 2	M4	NH_3	1	
		M5		1	If 1-bromobutane structure given for M2 then 2-aminobutane structure for M5, penalise M2, M5 and M8
		M6	nucleophilic substitution	1	If 2-bromobutane structure given for M2 then 1-aminobutane structure, penalise M5 and M8
	Step 3	M7	CH_3COCl or $(CH_3CO)_2O$	1	Allow C_2H_5 for CH_3CH_2
		M8		1	
		M9	(nucleophilic) addition-elimination	1	Not allow (electrophilic) addition-elimination

General principles applied to marking CHEM4 papers by CMI+ (June 2015)

It is important to note that the guidance given here is generic and specific variations may be made at individual standardising meetings in the context of particular questions and papers.

Basic principles

- **Examiners should note that throughout the mark scheme, items that are underlined are <u>required information</u> to gain credit.**
- **Occasionally an answer involves incorrect chemistry and the mark scheme records CE = 0, which means a chemical error has occurred and no credit is given for that section of the clip or for the whole clip.**

A. The "List principle" and the use of "ignore" in the mark scheme

If a question requires **one** answer and a student gives two answers, no mark is scored if one answer is correct and one answer is incorrect. There is no penalty if both answers are correct.

NB Certain answers are designated in the mark scheme as those which the examiner should "Ignore". These answers are not counted as part of the list and should be ignored and will not be penalised.

B. Incorrect case for element symbol

The use of an incorrect case for the symbol of an element should be penalised **once only** within a clip.
For example, penalise the use of "h" for hydrogen, "CL" for chlorine or "br" for bromine.

C. <u>Spelling</u>

In general

- The names of chemical compounds and functional groups **must be spelled correctly** to gain credit.
- Phonetic spelling may be acceptable for some chemical terminology.

NB Some terms may be required to be spelled correctly or an idea needs to be articulated with clarity, as part of the "Quality of Language" (**QoL**) marking. These will be identified in the mark scheme and marks are awarded only if the QoL criterion is satisfied.

D. Equations

In general

- Equations **must** be balanced.
- When an equation is worth two marks, one of the marks in the mark scheme will be allocated to one or more of the reactants or products. This is independent of the equation balancing.
- State symbols are <u>generally</u> ignored, unless specifically required in the mark scheme.

E. Reagents

The command word "Identify", allows the student to choose to use **either** the name or the formula of a reagent in their answer. In some circumstances, the list principle may apply when both the name and the formula are used. Specific details will be given in mark schemes.

The guiding principle is that a reagent is a chemical which can be taken out of a bottle or container. Failure to identify complete reagents **will be penalised**, but follow-on marks (e.g. for a subsequent equation or observation) can be scored from an incorrect attempt (possibly an incomplete reagent) at the correct reagent. Specific details will be given in mark schemes.
For example, **no credit** would be given for

- the cyanide ion or CN^- when the reagent should be potassium cyanide or KCN;
- the hydroxide ion or OH^- when the reagent should be sodium hydroxide or NaOH;
- the $Ag(NH_3)_2^+$ ion when the reagent should be Tollens' reagent (or ammoniacal silver nitrate). In this example, no credit is given for the ion, but credit could be given for a correct observation following on from the use of the ion. Specific details will be given in mark schemes.

In the event that a student provides, for example, **both** KCN and cyanide ion, it would be usual to ignore the reference to the cyanide ion (because this is not contradictory) and credit the KCN. Specific details will be given in mark schemes.

F. Oxidation states

In general, the sign for an oxidation state will be assumed to be positive unless specifically shown to be negative.

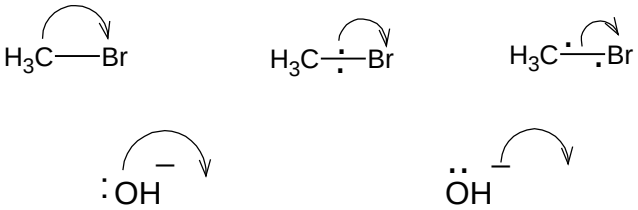
G. Marking calculations

In general

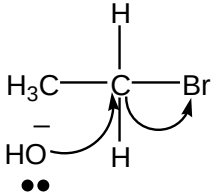
- A correct answer alone will score **full marks** unless the necessity to show working is specifically required in the question.
- An arithmetic error may result in a one mark penalty if further working is correct.
- A chemical error will usually result in a two mark penalty.

H. Organic reaction mechanisms

Curly arrows should originate either from a lone pair of electrons or from a bond.
The following representations should not gain credit **and will be penalised each time** within a clip.



For example, the following would score zero marks



When the curly arrow is showing the formation of a bond to an atom, the arrow can go directly to the relevant atom, alongside the relevant atom or **more than half-way** towards the relevant atom.

In free-radical substitution

- The absence of a radical dot should be penalised **once only** within a clip.
- The use of double-headed arrows or the incorrect use of half-headed arrows in free-radical mechanisms should be penalised **once only** within a clip

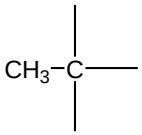
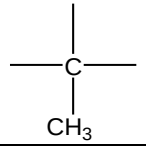
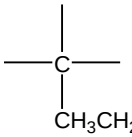
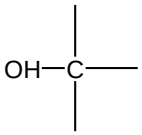
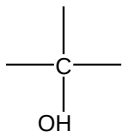
In mass spectrometry fragmentation equations, the absence of a radical dot on the molecular ion and on the free-radical fragment would be considered to be two independent errors and both would be penalised if they occurred within the same clip.

I. Organic structures

In general

- Displayed formulae must show all of the bonds and all of the atoms in the molecule, but need not show correct bond angles.
- Structures must not be ambiguous, e.g. 1-bromopropane should be shown as $CH_3CH_2CH_2Br$ and not as the molecular formula C_3H_7Br which could also represent the isomeric 2-bromopropane.
- Bonds should be drawn correctly between the relevant atoms. This principle applies in all cases where the attached functional group contains a carbon atom, e.g nitrile, carboxylic acid, aldehyde and acid chloride. The carbon-carbon bond should be clearly shown. Wrongly bonded atoms will be penalised **on every occasion**. (see the examples below)
- The same principle should also be applied to the structure of alcohols. For example, if students show the alcohol functional group as C ─ HO, they should be penalised **on every occasion**.
- Latitude should be given to the representation of C ─ C bonds in alkyl groups, given that CH_3─ is considered to be interchangeable with H_3C─ even though the latter would be preferred.
- Similar latitude should be given to the representation of amines where NH_2─ C will be allowed, although H_2N─ C would be preferred.
- Poor presentation of vertical C ─ CH_3 bonds or vertical C ─ NH_2 bonds should **not** be penalised. For other functional groups, such as ─ OH and ─ CN, the limit of tolerance is the half-way position between the vertical bond and the relevant atoms in the attached group.

  By way of illustration, the following would apply.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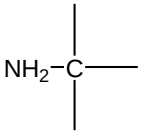	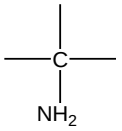	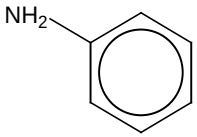	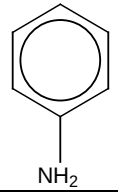	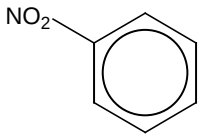
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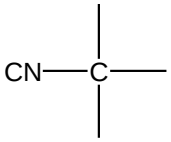	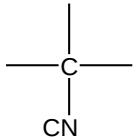	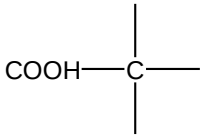	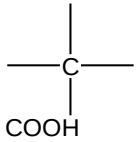	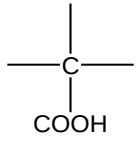	
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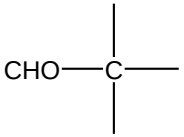	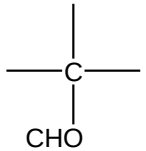	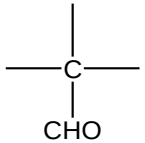	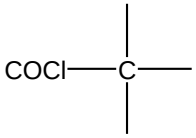	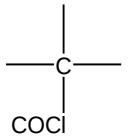	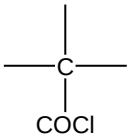
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- In most cases, the use of "sticks" to represent C ─ H bonds in a structure should **not** be penalised. The exceptions will include structures in mechanisms when the C ─ H bond is essential (e.g. elimination reactions in haloalkanes) and when a displayed formula is required.
- Representation of CH_2 by $C–H_2$ will be penalised

- Some examples are given here of **structures** for specific compounds that should **not** gain credit

CH_3COH	for	ethanal
CH_3CH_2HO	for	ethanol
$OHCH_2CH_3$	for	ethanol
C_2H_6O	for	ethanol
CH_2CH_2	for	ethene
$CH_2.CH_2$	for	ethene
$CH_2:CH_2$	for	ethane

NB Exceptions <u>may</u> be made in the context of balancing equations

- Each of the following **should gain credit** as alternatives to correct representations of the structures.

$CH_2 = CH_2$	for	ethene, $H_2C=CH_2$
$CH_3CHOHCH_3$	for	propan-2-ol, $CH_3CH(OH)CH_3$

J. Organic names

As a general principle, non-IUPAC names or incorrect spelling or incomplete names should **not** gain credit.
Some illustrations are given here.

but-2-ol	should be **butan-2-ol**
2-hydroxybutane	should be **butan-2-ol**
butane-2-ol	should be **butan-2-ol**
2-butanol	should be **butan-2-ol**
ethan-1,2-diol	should be **ethane-1,2-diol**
2-methpropan-2-ol	should be **2-methylpropan-2-ol**
2-methylbutan-3-ol	should be **3-methylbutan-2-ol**
3-methylpentan	should be **3-methylpentane**
3-mythylpentane	should be **3-methylpentane**
3-methypentane	should be **3-methylpentane**
propanitrile	should be **propanenitrile**
aminethane	should be **ethylamine** (although aminoethane can gain credit)
2-methyl-3-bromobutane	should be **2-bromo-3-methylbutane**
3-bromo-2-methylbutane	should be **2-bromo-3-methylbutane**
3-methyl-2-bromobutane	should be **2-bromo-3-methylbutane**
2-methylbut-3-ene	should be **3-methylbut-1-ene**
difluorodichloromethane	should be **dichlorodifluoromethane**