OXFORD
INTERNATIONAL
AQA EXAMINATIONS

INTERNATIONAL A-LEVEL CHEMISTRY

(9620)

PAPER 4
Mark Scheme

Specimen 2018

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.

Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

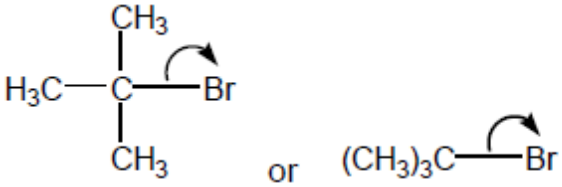
Step 2 Determine a mark

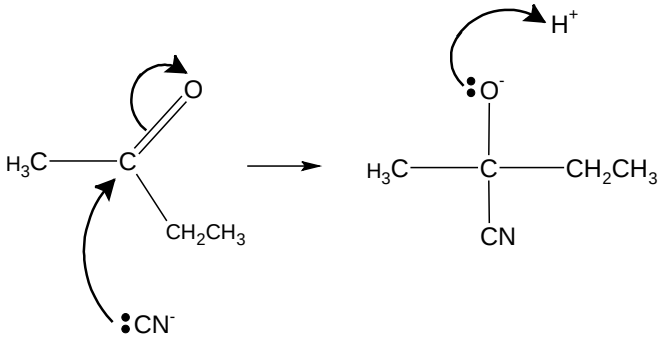
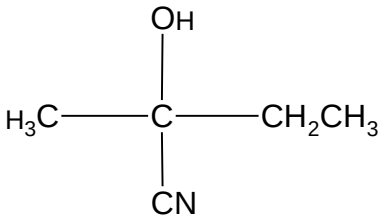
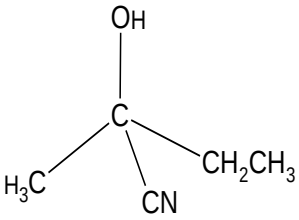
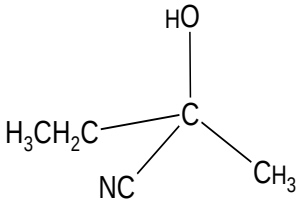
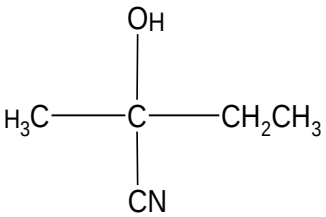
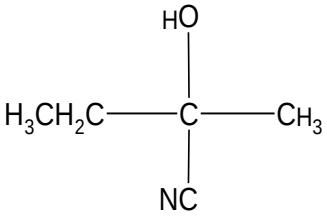
Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

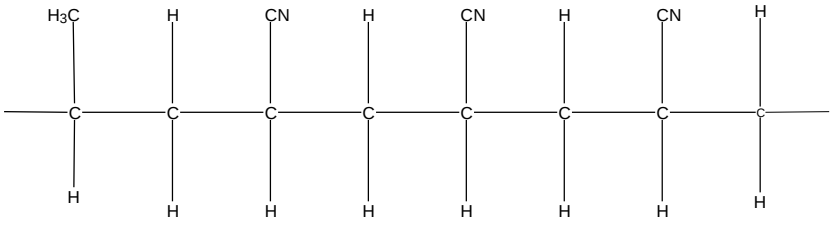
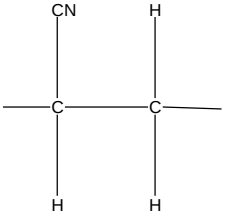
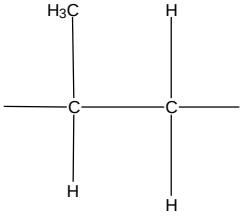
Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

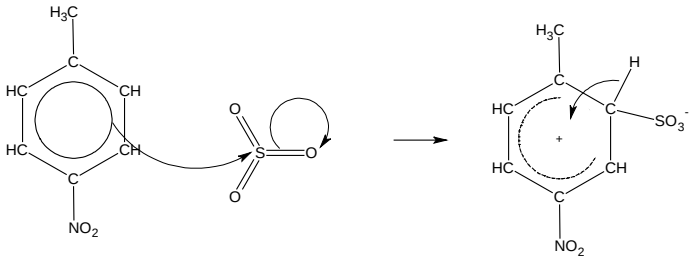
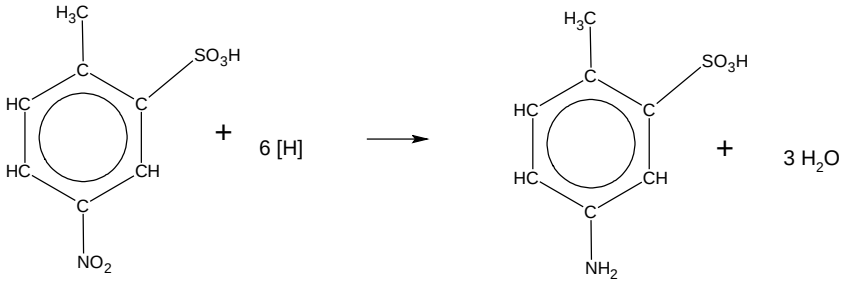
An answer which contains nothing of relevance to the question must be awarded no marks.

Question	Part	Marking guidance	Total marks
01	1	$k = 9.5 \times 10^{-5} / (3.4 \times 10^{-2} \times (4.6 \times 10^{-2})^2)$ $k = 1.32$ $mol^{-2}\ dm^6\ s^{-1}$	1 1 1
01	2	Second	1
01	3	Zero	1
01	4	M1: $\ln k = \ln A - E_A/RT$ or $E_A = RT(\ln A - \ln k)$ M2: $E_a = 8.31 \times 750 (\ln 1.94 \times 10^{15} - \ln 1.84 \times 10^{-4}) / 1000$ M3: $E_a = 273\ kJ\ mol^{-1}$	1 1 1
01	5	Hydroxide ions must react in a step after the rate determining step	1
01	6	 Ignore partial charges, penalise full/incorrect partial charges	1
01	7	Slower C-Cl bond is stronger	1 1

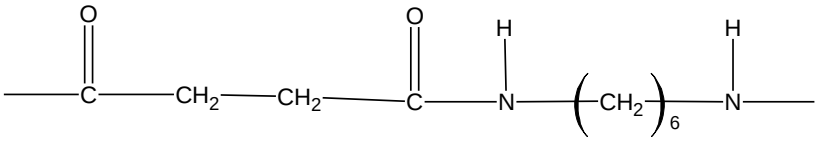
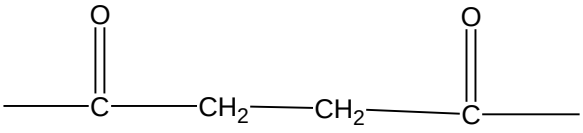
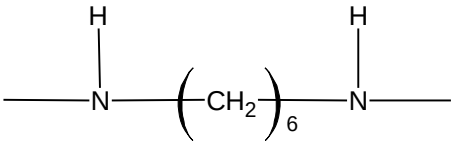
Question	Part	Marking guidance	Total marks
02	1	Nucleophilic addition (both words required for the mark)  	1 1 1 1 1
02	2	 M1: M2: Pair of mirror images.   Allow…   	1 1

02	3	M1: (Plane) polarized light M2: Rotated in opposite directions (equally) (only allow if M1 correct or close)	1 1

02	4	 Must show, in any order  Three: and one….  	1

Question	Part	Marking guidance	Total marks
03	1	Nitration / Electrophilic Substitution Concentrated H_2SO_4 Concentrated HNO_3	1 1 1
03	2	$HNO_3 + 2H_2SO_4 \rightarrow NO_2^+ + H_3O^+ + 2HSO_4^-$ OR using two equations $HNO_3 + H_2SO_4 \rightarrow H_2NO_3^+ + HSO_4^-$ $H_2NO_3^+ \rightarrow H_2O + NO_2^+$	1
03	3	Reactive Species: Sulphur trioxide  M1: Arrow from delocalised ring to S of SO_3 M2 Arrow from S=O to O M3: Structure of Ion M4: Arrow from C-H bond into hexagon. Accept Kekulé structures	1 1 1 1 1
03	4	 Accept structural formulae	1

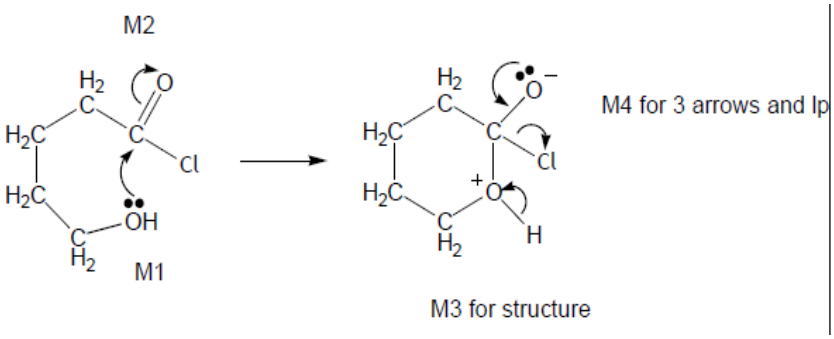
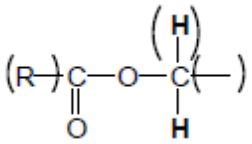
03	5	alkyl group in ethylamine has positive inductive effect **or** alkyl group in ethylamine increases electron density on N atom allow alkyl group in ethylamine pushes / donates electron density on N atom	1
		lone pair of N in 5-amino-2-methylbenzenesulphonic acid delocalise into aromatic ring	1
		lone pair on N in ethylamine is more available to accept proton / H^+ allow converse	1

Question	Part	Marking guidance	Total marks
04	1	 M1:  M2: 	1 1
04	2	**M1** in polyamides - H bonding **M2** in polyalkenes - van der Waals forces **M3** Stronger forces (of attraction) in polyamides Or H bonding is stronger (must be a comparison of correct forces to score M3)	1 1 1
04	3	$(CH_3CO)_2O + 2\ CH_3NH_2 \rightarrow CH_3CONHCH_3 + CH_3NH_3^+CH_3COO^-$ N-methylethanamide	2 1

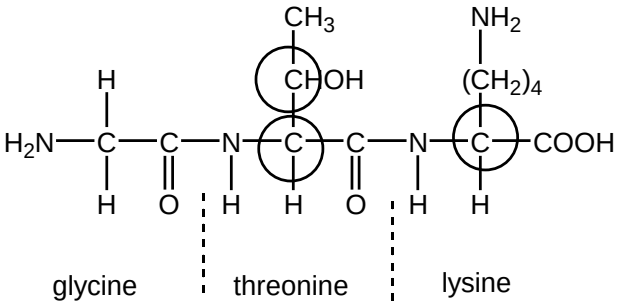
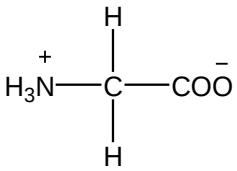
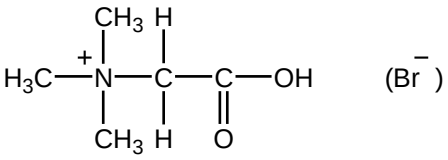
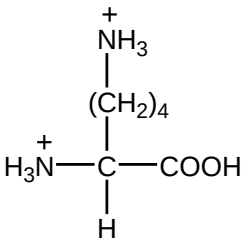
Question	Part	Marking guidance	Total marks
05	1	M1: oxidation (of alcohol by oxygen in air)	1
		M2: absorption at 1680 -1750 cm^{-1} (due to C=O)	1
		M3: comparison of polarity of molecules or correct imf statement: propanone is less polar OR propan-2-ol is more polar OR propanone has dipole-dipole forces OR propan-2-ol has hydrogen bonding	1
		M4: about attraction to stationary phase or solubility in moving phase Propan-2-ol has greater affinity for stationary phase or vice versa OR propanone is more soluble in solvent/moving phase or vice versa	1

Question	Part	Marking guidance	Total marks
06	1	M1 Route **A** : stage 1 KCN	1
		M2 Aqueous or ethanolic	
		M3 Route **A** Intermediate CH_3CN or ethanenitrile	1
		Name alone must be exactly correct to gain M1 but mark on if name close	1
		correct formula gains M1 (ignore name if close)	
		contradiction of name and formula loses mark	
		M4 Route **A** : stage 2 H_2 $LiAlH_4$	1
		H loses M4 but mark on	
		M5 Ni or Pt or Pd ether	1
		M6 Route **B** NH_3	1
		M7 Excess NH_3	1

06	2	Route A disadv: Toxic /poisonous KCN or cyanide or CN^- or HCN / Expensive $LiAlH_4$ OR lower yield because 2 steps	1
		Route B disadv: Further reaction/substitution likely	1

Question	Part	Marking guidance	Total marks
07	1	Nucleophilic) <u>addition-elimination</u>  a: 20-50 ppm or single value/range within this range b: 50-90 ppm or single value/range within this range	1 4 1 1
07	2	M1: Ester I  M2: peak at δ=4.1 due to M3: δ = 4.2 peak is) quartet as adjacent/next to/attached to CH_3 M4: Other spectrum quartet at δ = 2.1-2.6 (or value in this range)	1 1 1 1

Question	Part	Marking guidance							Total marks
08	1	Propan-1-ol	M1	Acidified potassium dichromate	Sodium	Named acid + conc H_2SO_4	Named acid chloride	PCl_5	1
			M2	(orange) turns green	effervescence	Sweet smell	Sweet smell/misty fumes	Misty fumes	1
		Propanal	M1	Tollens	Fehlings / Benedicts	Acidified potassium dichromate	Bradys / 2,4-DNPH		1
			M2	Silver mirror	Red ppt	(orange) turns green	Yellow / Orange ppt		1
		Propanoic Acid	M1	Named carbonate / hydrogencarbonate	Na/Mg	Named alcohol + conc H_2SO_4	PCl_5		1
			M2	effervescence	Effervescence	Sweet smell	Misty fumes		1
		1-chloro propane	M1	(NaOH then acidified) $AgNO_3$					1
			M2	White ppt					1
		If 2 stage test for one compound, award no marks for that compound. If reagent is wrong or missing, no mark for that test If reagent is wrong but close/incomplete, then lose reagent mark, but can award obs mark. In each test, penalise each example of wrong chemistry							8

Question	Marking guidance	Mark
09.1		1
09.2		1
09.3		1
09.4	2-amino-3-hydroxybutanoic acid	1
09.5		1