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CHEMISTRY

9202/1

Paper 1

Mark scheme

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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 Examiner.

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 oxfordaqaexams.org.uk

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 2 with a small amount of Level 3 material it would be placed in Level 2 but be awarded a mark near the top of the level because of the Level 3 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.

Information to Examiners

1. General

The mark scheme for each question shows:
- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement
- the Assessment Objectives, level of demand and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of errors / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system.

[2 marks]

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. Full marks can, however, be given for a correct numerical answer, without any working shown.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ecf in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

'Ignore' is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

3.10 Do <u>not</u> accept

'Do **not** accept' means that this is a wrong answer which, even if the correct answer is given as well, will still mean that the mark is not awarded.

Question 1

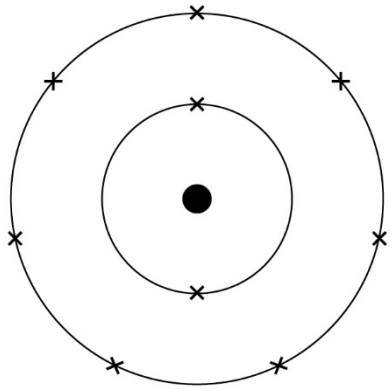
Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.1	sodium		1	AO2 3.1.2b

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.2	Al		1	AO2 3.1.3a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.3	Ar		1	AO2 3.1.3c

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.4	Fe		1	AO2 3.7.2a 3.8.3.c

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.5	any **one** from: • elements are in the same group • same number of electrons in their highest energy level • same number of outer electrons	allow same number of electrons in outer shell	1	AO1 3.1.3a b

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.6		allow electrons as x, ●, ○, $e^{(-)}$	1	AO2 3.1.2i

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.7	(volume =) $\frac{9.10}{1.82}$		1	AO2 3.1.2a
	= 5 (cm^3)		1	

Total Question 1		**8**

Question 2

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.1	carbon hydrogen	in any order ignore C ignore H	1 1	AO1 3.10.1.1b

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.2	fractional distillation		1	AO1 3.10.1.1c

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.3	ethane		1	AO1 3.10.1.2b

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.4	high temperature catalyst / steam	ignore references to pressure allow a temperature in the range 450–750 °C	1 1	AO1 3.10.1.3a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.5	fuels		1	AO1 3.10.1.3e

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.6	to make polymers	allow to make alcohols	1	AO1 3.10.2a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.7	colourless	ignore clear	1	AO1 3.10.1.3d

Total Question 2		**9**

Question 3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.1	shared		1	AO1 3.2.1g

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.2	fullerene		1	AO1 3.2.3e

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.3	$\frac{10.0}{1.60}$ = 6.25		1 1	AO2 3.2.3b 3.2.3c

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.4	each carbon atom is (covalently) bonded to four others in a giant (covalent) structure (and covalent) bonds are strong	 allow in a lattice 	1 1 1	AO1 3.2.3b 3.2.1g

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.5	each carbon / atom forms three bonds (so) one electron per carbon / atom is delocalised (so delocalised / free) electrons move through the structure	 allow (so) electrons can carry charge through the structure ignore throughout for through ignore current / electricity for charge	1 1 1	AO1 3.2.2g 3.2.3d

Total Question 3		**10**

Question 4

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.1	any **one** from: • saves limited resources • extraction uses a lot of energy • extraction causes environmental damage	allow to reduce landfill	1	AO1 3.3.1.1i

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.2	carbon is more reactive (than iron) (so carbon) will displace iron (from iron oxide) **or** (so carbon) will remove the oxygen (from iron oxide)	allow converse	1 1	AO1 3.3.1.1d

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.3	oxidation **and** reduction (are happening at the same time)	allow electrons / oxygen are being lost **and** gained (at the same time)	1	AO1 3.8.4c

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.4	(56 × 2) + (16 × 3) = 160		1 1	AO2 3.6.2.a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.5	(mass of aluminium oxide =) $\frac{12.1}{52.9} \times 100$		1	AO2 3.6.2.b
	= 22.873 (g)		1	
	= 22.9 (g)	allow a correctly calculated answer given to 3 significant figures from an incorrect calculation using the values given in the question	1	

Total Question 4		**9**

Question 5

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.1	alkalis		1	AO1 3.5.1a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.2	nitric acid	allow HNO_3	1	AO2 3.5.1c

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.3	$ZnO(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2O(l)$		1	AO2 3.5.2a 3.6.1b

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.4	filter (the mixture) to remove excess zinc oxide		1 1	AO1 AO4 3.5.2a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.5	$\left(\text{number of moles } ZnCO_3 = \frac{25.0}{125} =\right) 0.2$ (mass of $ZnCl_2$ =) 0.2 × 136 = 27.2 (g)	 allow correct use of an incorrectly calculated value for moles of $ZnCO_3$	1 1 1	AO2 3.6.1d

Total Question 5		8

Question 6

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.1	(initially) as temperature increases the potential difference increases		1	AO3 3.9.3a
	until 40 (°C)	allow until 37.5 °C	1	
	(then) the potential difference becomes constant		1	

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.2	reproducible		1	AO1 3.9.3.a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.3	(most reactive) magnesium zinc cobalt		1	AO3 3.9.3a
	copper (least reactive) silver		1	

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.4	1.44 − (−0.40)		1	AO3 3.9.3a
	= 1.84 (volts)	if no other marks awarded, allow −1.84 (volts) for **1** mark	1	

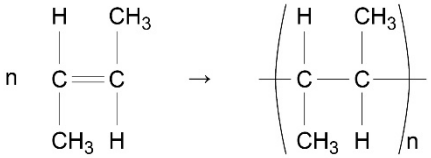
Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.5	0.60 × 0.075		1	AO2 3.6.4a
	= 0.045		1	

Question	Answers	Mark	AO/ Spec. Ref.
06.6	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO4 3.3.1.1a
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content: • measure mass of metal • same mass of metal • same surface area of metal • measure fixed volume of (sulfuric) acid • same concentration of (sulfuric) acid • add (sulfuric) acid to container • add metal to (sulfuric) acid • measure volume of gas given off per unit time **or** compare rate of bubbling • suitable method for collecting and measuring volume of gas • repeat with other metals		

Total Question 6		**16**

Question 7

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.1	many (small) molecules **or** many monomers		1	AO1 3.10.2a
	join together to form large molecules	allow join together to form a long chain	1	

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.2	single C−C **and** trailing bonds		1	AO2 3.10.2a
	1 CH_3 and 1 H attached to both carbon atoms		1	
	brackets **and** n		1	
		an answer of  scores **3** marks		

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.3	different catalysts **or** different reaction conditions	allow different pressure / temperature	1	AO1 3.10.2b

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.4	weak intermolecular forces (between chains) (which are) easily overcome by heating **or** (which) do not require a lot of energy to break	allow no covalent bonds / crosslinks between chains	1 1	AO1 3.10.2c

Question	Answers	Mark	AO/ Spec. Ref.
07.5	**Level 2:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	3–4	AO2/AO3 3.10.2e 3.10.2f
	Level 1: Some logically linked reasons are given. There may also be a simple judgement.	1–2	
	No relevant content	0	
	Indicative content: • **A** is made from cornstarch which is renewable • **B** is made from crude oil which is non-renewable • renewable sources preserve scarce natural resources • polymers from cornstarch are biodegradable • non-biodegradable polymers have disposal issue • **A** and **B** can be recycled so less landfill use • (65%) less energy used to make **A** • the less energy used the less carbon dioxide produced • carbon dioxide contributes to global warming • **A** has a greater mass therefore costs more to transport		

Total Question 7		**12**

Question 8

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.1	any **one** from: • reaction is reversible • reaction reaches equilibrium • ammonia / product reacts to form hydrogen and nitrogen	allow reactants for nitrogen and hydrogen	1	AO2 3.8.2a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.2	as temperature increases the yield decreases	allow converse	1	AO3 3.8.2c

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.3	(as pressure increases) the yield increases		1	AO3
	an increase in pressure favours the forward reaction	allow the equilibrium shifts to the right-hand side	1	AO2
	(because) fewer moles on the right-hand side **or** (because) the forward reaction produces least number of molecules		1	AO2 3.8.2d

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.4	(% yield) = 58%		1	AO2 3.8.2e
	$58 = \frac{\text{mass of ammonia}}{450} \times 100$	allow correct use of an incorrectly determined value for percentage yield	1	
	$(\text{mass of ammonia}) = \frac{450 \times 58}{100}$		1	
	= 261 (kg)		1	

Total Question 8		**9**

Question 9

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
09.1	the ions are free to move		1	AO2 3.3.2a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
09.2	(test) glowing splint (result) relights		1 1	AO1 3.4.2.b

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
09.3	$4\,OH^- \rightarrow 2\,H_2O + O_2 + 4\,e^-$	allow **1** mark for $4\,OH^- \rightarrow 2\,H_2O + O_2\,(+ e^-)$ **or** e^- correctly balanced in line with number of OH^-	2	AO2 3.3.2e 3.3.2f

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
09.4	copper ions are attracted to the negative electrode (where copper) ions gain electrons (gain) two electrons (to form a copper atom)	allow copper ions move to the negative electrode allow (where copper) ions are reduced	1 1 1	AO2 3.3.2c 3.3.2e

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
09.5	any **one** from: • appearance • durability • prevention of corrosion	allow copper is unreactive	1	AO1 3.3.2h

Total Question 9		**9**