OXFORD
INTERNATIONAL
AQA EXAMINATIONS

INTERNATIONAL A-LEVEL CHEMISTRY

(9620)

PAPER 1
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	Marking Guidance	Marks	Comments
01.1	Abundance of third isotope = 100 – 78.8 – 11.7 = 9.5% $\frac{(24 \times 78.8) + (25 \times 11.7) + (y \times 9.5)}{100} = 24.31$ $9.5y = 2431 – (1891.2 + 292.5) = 247.3$ $y = 247.3 / 9.5 = 26.03$ $y = 26$	1 1 1 1	Answer must be rounded to the nearest integer
01.2	A high voltage is applied to the sample (in polar solvent) Atoms / Molecules lose an electron	1 1	
01.3	Ions, not molecules, will interact with and be accelerated by an electric field Only ions will create a current when hitting the detector	1 1	
02.1	$Ca(g) \rightarrow Ca^{+}(g) + e^{-}(g)$ OR $Ca(g) - e^{-}(g) \rightarrow Ca^{+}(g)$ OR $Ca(g) + e^{-}(g) \rightarrow Ca^{+}(g) + 2e^{-}$	2	One mark for balanced equation One mark for state symbols Charge and state on electron need not be shown

02.2	Increases	1	If trend wrong then CE = 0/3 for (b). If blank mark on.
	Increasing nuclear charge / increasing no of protons	1	Ignore effective with regard to nuclear charge
	Same or similar shielding / same no of shells / electron (taken) from same (sub)shell / electron closer to the nucleus / smaller atomic radius	1	

02.3	Lower	1	If not lower then CE = 0/3 If incorrect p orbital then M2 = 0
	Paired electrons in a (4) p orbital	1	If shared pair of electrons M2 + M3 = 0
	(Paired electrons) repel	1	

02.4	Xe is a bigger atom / has more shells / more shielding in Xe / electron removed further from nucleus/ electron removed from a higher (principal or main) energy level	1	CE if molecule is mentioned Must be a comparative answer

02.5	2 / two / II	1	

02.6	Antinomy / Sb	1	

03.1	1.48 / 241.8 = $\underline{0.00612}$ or $\underline{6.12 \times 10^{-3}}$ (moles)	1	Penalise if not to 3 sig figs

03.2	n(O2) = 0.00612 × 0.75 (= 0.00460 mol)	1	Allow (a)(i) × 0.75

03.3	M1 = T = 566 K and P = 100 000 Pa	1	If M1 incorrect can only score M2 and M3
	M2 = Moles NO_2 = 0.0184 (mol)	1	If M2 incorrect can only score M1 and M3 Allow moles of NO_2 = student's answer to (a)(i) × 3 OR (a)(ii) × 4 and consequential M4 Minimum of 2 significant figures.
	M3 = V = $\underline{nRT}$ OR = $\underline{0.0184 \times 8.31 \times 566}$ p 100 000	1	If M3 incorrect can only score M1 and M2 Allow minimum of 2 significant figures.
	M4 = 8.64×10^{-3} (m^3) or 0.000846 (m^3)	1	Allow no units but incorrect units loses M4 If 0.00893 moles used: M2 = Moles NO_2 = 0.0268 mol M3 = V = $\underline{nRT}$ = $\underline{0.0268 \times 8.31 \times 566}$ p 100 000 M4 = 0.00126 (m^3) allow 1.26×10^{-3}(m^3)

03.4	(thermal) decomposition	1	Do not allow catalytic decomposition

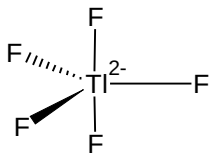
03.5	Other products are gases / other products escape easily	1	Allow no other solid (or liquid) product.

04.1	$Al + 1.5Br_2 \rightarrow AlBr_3$	1	Accept multiples. Also $2Al + 3Br_2 \rightarrow Al_2Br_6$ Ignore state symbols.

04.2	Coordinate / dative (covalent) Electron pair on Br^- donated to Al(Br_3)	1 1	Lone pair from Br^- not just Br Penalise wrong species

04.3	Al_2Br_6	1	Allow Br_6Al_2 Upper and lower case letters must be as shown. Not $2AlBr_3 = 0$

04.4	$SiBr_4$ / silicon tetrabromide	1	Accept silicon(4) bromide or silicon(IV) bromide. Upper and lower case letters must be as shown. Not silicon bromide.

04.5	 Trigonal bipyramid(al)	1 1	Accept shape containing 5 bonds and no lone pairs from Tl to each of 5 Br atoms. Ignore charge.

04.6	F — Tl — F Accept this linear structure only with no lone pair on Tl	1	Ignore charge.

04.7	(Two) bonds (pairs of electrons) repel equally / (electrons in) the bonds repel to be as far apart as possible.	1	Dependent on linear structure in (f)(i). Do not allow electrons / electron pairs repel alone.

04.8	Second	1	

05.1	energy change when 1 mol of a compound is formed from its elements all reactants and products in their standard states	1 1	

05.2	enthalpy change is independent of the route taken	1	

05.3	it is an element **or** by definition	1	

05.4	$\Delta H = \Sigma \Delta_f H$ (products) – $\Sigma \Delta_f H$ (reactants) **or** = [(4 x 90) + (6 x – 242)] – [4 x – 46] – 908 (kJ mol^{-1})	1 1	allow correct cycle

06.1	$Ba + 2H_2O \longrightarrow Ba(OH)_2 + H_2$ $Ba + 2H_2O \longrightarrow Ba^{2+} + 2OH^- + H_2$	2	Allow multiples Ignore state symbols

06.2	$Ba^{2+} + SO_4^{2-} \longrightarrow BaSO_4$ <u>White precipitate / solid</u>	1	Ignore state symbols in equation Not multiples in equation Extra ions must be cancelled Penalise contradictory observations

06.3	M1= Barium meal / barium swallow / barium enema **OR** used in X-rays **OR** to block X-rays **OR** X-ray contrast medium **OR** CT scans M2= <u>$BaSO_4$ / barium sulfate is insoluble/not absorbed</u> (and therefore not toxic)	1 1	Accept a correct reference to M1 written in the explanation in M2, unless contradictory For M2 NOT barium ions NOT barium NOT barium meal and NOT "It" Ignore radio-tracing

07.1	**M1** q = m c ΔT **M2** = (75 × 4.18 × 5.5) 1724 (J) OR 1.724 (kJ) OR 1.72 (kJ) OR 1.7 (kJ) **M3** Using 0.0024 mol therefore ΔH = – 718 (kJ mol^{-1}) **M4** and **M5** in any order Any two from • incomplete combustion • heat loss • heat capacity of Cu not included • some ethanol lost by evaporation • not all of the (2.40 × 10^{-3} mol) ethanol is burned / reaction is incomplete	1 1 1 1 1	This mark for correct mathematical formula Correct answer with correct units scores 2 marks (Accept a range from –708 to –719 but do not penalise more than 3 significant figures)

07.2	$\left(\frac{2 \times 0.1}{5.50} \times 100\right) = 3.64\ \%$	1	

07.3	decrease the mass of water **or** burn more ethanol	1	

08.1	**M1** and **M2** (either order) Any two from • purple vapour / gas • (white solid goes to) black or black / grey or black / purple solid • bad egg smell or words to this effect **M3** The iodide ion(s) / they lose (an) electron(s) OR $2I^- \longrightarrow I_2 + 2e^-$ **M4** Accept "changes by − 8" Oxidation state of S changes from +6 to −2 or changes by 8 **M5** $H_2SO_4 + \mathbf{8}H^+ + \mathbf{8}e^- \longrightarrow H_2S + \mathbf{4}H_2O$ **OR** $SO_4^{2-} + \mathbf{10}H^+ + \mathbf{8}e^- \longrightarrow H_2S + \mathbf{4}H_2O$	1 1 1 1 1	Ignore misty white fumes Ignore yellow solid Ignore purple solid Ignore "goes (dark) brown" Or multiples for possible equation in M3

09.1	**Q** is calcium or magnesium bromide **R** is barium carbonate **S** is ammonium sulfate	1 1 1 1 1 1	Mark this question independently

09.2	For **Q** $Ca^{2+} + OH^- \longrightarrow Ca(OH)_2$ **Or** $Mg^{2+} + OH^- \longrightarrow Mg(OH)_2$ $Ag^+ + Br^- \longrightarrow AgBr$ Gas for **R** $2H^+ + CO_3^{2-} \longrightarrow CO_2 + H_2O$ Gas for **S** $NH_4^+ + OH^- \longrightarrow NH_3 + H_2O$	1 1 1 1	