

Higher

GCSE

Chemistry B Twenty First Century Science

J258/04: Depth in Chemistry (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2025

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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MARKING INSTRUCTIONS**PREPARATION FOR MARKING****RM ASSESSOR**

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Online Training: OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are available in RM Assessor
3. Log-in to RM Assessor and mark the **required number** of practice responses (“scripts”) and the **required number** of standardisation responses.

MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the RM Assessor messaging system.

5. Crossed-Out Responses

Where a candidate has crossed out a response and provided a clear alternative then the crossed-out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed-out response where legible.

Rubric Error Responses – Optional Questions

Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM Assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple-Choice Question Responses

When a multiple-choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).

When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only one mark per response)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth two or more marks)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space).

Longer Answer Questions (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add the annotation 'SEEN' to confirm that the work has been seen and mark any responses using the annotations in section 11.
7. There is a NR (**No Response**) option. Award NR (No Response):
 - if there is nothing written at all in the answer space
 - OR if there is a comment which does not in any way relate to the question (e.g., 'can't do', 'don't know')
 - OR if there is a mark (e.g., a dash, a question mark) which is not an attempt at the question.

Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The RM Assessor **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.

Once the level is located, award the higher or lower mark:

The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in *italics*) have been met.

The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in *italics*) are missing.

In summary:

The skills and science content determines the level.

The communication statement determines the mark within a level.

Level of response questions on this paper are **5b** and **8a**.

11. Annotations available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given
	Ignore

12. Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
✓	Separates marking points
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
()	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

13. Subject-specific Marking Instructions

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9-1) in Chemistry B:

	Assessment Objective
AO1	Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
AO3	Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.
AO3.1	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
AO3.2	Analyse information and ideas to make judgements and draw conclusions.
AO3.2a	Analyse information and ideas to make judgements.
AO3.2b	Analyse information and ideas to draw conclusions.
AO3.3	Analyse information and ideas to develop and improve experimental procedures.
AO3.3a	Analyse information and ideas to develop experimental procedures.
AO3.3b	Analyse information and ideas to improve experimental procedures.

Question			Answer	Marks	AO element	Guidance
1	(a)		Sodium hydroxide and hydrogen ✓ Sodium moves less quickly/(more) slowly / fizzes (more) slowly/less vigorously / fizzes gently ✓ No flame ✓	3	1 x 1.2 2 x 2.2	IGNORE sodium is less reactive than potassium ALLOW reaction is slower/less violent with sodium (than potassium). ALLOW water fizzes ALLOW no comparison e.g. fizzes/moves on the surface/forms a ball / (appears to) dissolve/disappear DO NOT ALLOW incorrect comparison e.g. moves quickly/fizzes violently ALLOW no sparking/no explosion ALLOW yellow/orange flame DO NOT ALLOW other colours for flame
	(b)	(i)	Lithium has one electron in the outer shell and is in Group 1 ✓ Fluorine has seven electrons in the outer shell and is in Group 7 ✓	2	2.1	ALLOW 1 mark for the group number is the same as the number of electrons in the outer shell. ALLOW outer shell = outer/highest energy level IGNORE orbital/rings IGNORE references to gaining/losing electrons IGNORE stated electronic configurations 2.1 and 2.7
		(ii)	Both (atoms) have the same number of shells of electrons / both (atoms) have two shells of electrons ✓	1	2.1	DO NOT ALLOW have the same number of outer shells ALLOW shell = energy level IGNORE orbital/rings

Question			Answer	Marks	AO element	Guidance
		(iii)	Shows charges on ions Li +1/1+/+ and F -1/1-/- ✓ Shows two shells with 8 electrons in outer shell of F ⁻ ✓ Seven electrons in outer shell of F ⁻ are dots and one is a cross ✓	3	2.1	DO NOT ALLOW MP2 if additional (occupied) shells are shown on Li ⁺ or F ⁻ / electrons drawn on first shell of F ⁻ IGNORE additional empty shell drawn for lithium ALLOW MP3 ECF if electrons added to first shell
		(iv)	It does not show that the ions are different sizes. ✓	1	2.1	

Question			Answer	Marks	AO element	Guidance
2	(a)		Hydroxide ions from water react to form oxygen ✓ Non-metals usually form at the positive electrode ✓	2	1.2	
	(b)	(i)	(instead of the test-tube use) a measuring cylinder / (upside down) burette ✓	1	3.3b	ALLOW gas syringe ALLOW graduated test-tube / description of test-tube with volume markings
		(ii)	volume of gas AND time / intervals of time / stated measurement of time e.g. one minute ✓ Rate is worked out by volume ÷ time / volume measured in a minute is rate (in cm ³) <u>per minute</u> ✓	2	1 x 3.3a 1 x 2.2	ALLOW for MP1 Take reading on gas syringe/measuring cylinder/graduated test-tube for 'volume'. ALLOW correct units for MP2 e.g. cm ³ /min or cm ³ /s ALLOW ECF for MP2 from 'counting bubbles' or 'measure the amount' 'change in mass' e.g. divide number of bubbles or amount of gas by the time. ALLOW idea of plotting a graph of volume vs time AND measuring gradient
	(c)		Mass of positive electrode stays the same <u>and</u> negative electrode increases ✓ Positive electrode: gas/oxygen forms ✓ Negative electrode: copper/metal/solid/coating forms ✓	3	1 x 2.2 2 x 3.2b	IGNORE values of mass change, even if incorrect IGNORE ions attracted to electrodes, even if identified incorrectly IGNORE 'gas/oxygen/copper is <u>attracted</u> to the electrode' alone DO NOT ALLOW <u>ions</u> are lost as gas DO NOT ALLOW <u>ions</u> are added onto the electrode

Question			Answer	Marks	AO element	Guidance
3	(a)	(i)	LH flask: sea water Under flask: heat Top of condenser: water out Bottom of condenser: water in RH beaker: pure water ✓✓	2	2.2	All five correct = 2 marks Three or four correct = 1 mark
		(ii)	Before distillation: white precipitate ✓ After distillation: no precipitate / no change / remains colourless ✓ Explanation: (due to) chloride (ions) / forms silver chloride ✓	3	2.2	IGNORE goes cloudy IGNORE 'stays clear' ALLOW no reaction IGNORE 'nothing happens' / nothing / no observations IGNORE contains <u>sodium</u> chloride / halide ions DO NOT ALLOW chlorine
	(b)	(i)	Deaths decreased until 1947 / became zero in 1947 ✓ time until death rate becomes zero is approximately 40 years / 40 years between 1908 and 1947 / states 40 years after 1908 / 40 years before 1947 ✓	2	3.1b	ALLOW range 1907-1910 and 1946-1950 ALLOW 'around 1950' DO NOT ALLOW MP1 for '1950s' plural ALLOW 1 mark only for idea that deaths decreased (gradually) after chlorine first added.

Question			Answer	Marks	AO element	Guidance
		(ii)	Any three from: Statement that ‘benefit outweighs risk’ / less people die from chlorine in water than from typhoid ✓ idea that few(er) people have allergies/health problems due to chlorine in water / allergies/health issues not (usually) fatal / can take medication to treat allergies ✓ concentration/amount of chlorine in water is low ✓ graph shows that chlorination of water stops deaths/saves lives (from typhoid) / chlorine kills bacteria/water borne pathogens/microorganisms / chlorine prevents the transmission of water-borne diseases ✓	3	2.1 2 x 3.2a	ALLOW idea that risk is (very) small (compared to benefit) IGNORE ‘chlorine only affects a few people’ (too vague) IGNORE hazards relating to higher concentrations of chlorine e.g. toxicity, acidity etc. ALLOW ‘protects us from....’ ALLOW examples of microorganisms e.g. bacteria/fungi/viruses ALLOW examples of water-borne diseases e.g. cholera ALLOW ORA e.g. people would die if chlorine was not added
	(c)		Information in newspapers is for everybody / the public/general population / gives a simplified version ✓ Information for peer review is for scientists ✓ Who check/validate the findings ✓	3	1.1	ALLOW newspapers may show bias / exaggerate / not fully accurate idea IGNORE many people/more people ALLOW experts / professional colleagues ALLOW unbiased / idea of checking / comparing / identify errors / seeing if they agree / critically evaluate / feedback

Question			Answer	Marks	AO element	Guidance
4	(a)		4Fe ✓ 3O_2 ✓ (s) (g) (s) ✓	3	2 x 2.2 2.1	All three state symbols required for this mark DO NOT ALLOW G
	(b)	(i)	(Steel/it) is easy to break / brittle ✓ (Steel/it) can (easily) rust/corrode / no (enhanced) corrosion resistance ✓	2	2.1	IGNORE iron breaks/iron rusts/ iron oxidises alone etc ALLOW (adding) carbon does not prevent rusting / 'nothing' to stop rusting ALLOW steel/it oxidises/ reacts with oxygen
		(ii)	Lists elements chromium, nickel and copper ✓ Gives percentages of two elements: Cr:18 and Ni: 9 and Cu:4 ✓ Percentage of Fe = $100 - 18 - 9 - 4 - 0.1 = 68.9$ ✓	3	2.1 2 x 3.2a	IGNORE ~ / < / > ALLOW Cu 3-5 OR and Cr 17-19 and Ni 8.1-9.9 ALLOW ECF if MP2 not awarded e.g. $(100 - 9 - 0.1 =) 90.9 - \% \text{Cu} - \% \text{Cr}$

Question			Answer	Marks	AO element	Guidance
5	(a)		False True False ✓✓	2	1.1	All three correct = 2 marks Two correct = 1 mark

Question	Answer	Marks	AO element	Guidance
(b)*	Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. Level 3 (5–6 marks) Describes the effects of two or more conditions on both yield and rate and states why higher or lower values of temperature and pressure are not chosen. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) Describes the effects of two or more conditions on both yield and rate OR Describes the effect of conditions on yield or rate and states why a higher or lower value of temperature or pressure is not used. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) States the effects of two or more conditions on yield and/or rate OR states why a higher or lower value of temperature or pressure is not used. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 marks <i>No response or no response worthy of credit.</i>	6	1.1	LEVEL 3 AO1.1 Identifies disadvantages of high/low conditions of temperature/pressure Clear statements that.... • Higher temperature fast(er) rate but low(er) yield / yield is too low • Lower temperatures increase yield but the rate is slow / rate is too low • Lower pressure low(er) yield and rate / yield and rate is too low • Higher pressures are dangerous/damage equipment/requires specialist equipment • Higher temperatures/pressures use more energy/a lot of energy/high costs AO1.1 Effect of conditions on rate • High temperature/450 °C fast(er) rate • High pressure/200atm fast(er) rate • Catalyst fast(er) rate AO1.1 Effect of conditions on yield • High pressure/200atm high(er) yield • High temperature/450 °C low(er) yield • Catalyst no effect on yield • Recycling gases high(er) (overall) yield ALLOW moves equilibrium to the right/to the product side = higher yield ORA IGNORE all references to exo- or endothermic reactions / activation energy / collision theory / bond strengths

Question			Answer	Marks	AO element	Guidance
6	(a)		Burning methanol produces carbon dioxide / CO₂ ✓ Burning hydrogen produces only water ✓ carbon dioxide is a greenhouse gas / traps heat energy/radiation (in the Earth/atmosphere) / burning methanol produces greenhouse gases / burning methanol causes climate change/global warming/(increased) greenhouse effect ORA ✓	3	1.1	IGNORE carbon monoxide/particulates DO NOT ALLOW methane ALLOW CO₂ etc. IGNORE CO₂ IGNORE water or methanol is a greenhouse gas ALLOW ECF from MP1 for incorrect greenhouse gas identified e.g. carbon monoxide/methane ALLOW examples of <u>climate</u> change e.g. extreme weather, droughts, hurricanes IGNORE natural disasters/ice caps melting/flooding/sea level rising DO NOT ALLOW tsunamis/earthquakes/deforestation etc. DO NOT ALLOW other environmental issues e.g. ozone layer/acid rain etc.
	(b)		By-products have a use / can be sold as products / can be used to make other products ✓ Waste products need to be disposed of / are discarded / thrown away ✓	2	1.1	IGNORE recycling idea e.g. can be re-used/used again/recycled IGNORE are not wasted ALLOW MP1 for 'waste products do not have a use'/ can't be sold as products / can't be used to make other products DO NOT ALLOW MP1 if reference to use of carbon dioxide in reverse reaction of equation 1 IGNORE are wasted/go to waste

Question			Answer	Marks	AO element	Guidance
	(c)	(i)	44 ✓	1	2.2	
		(ii)	First check the answer on the answer line. If answer = 15.4(%) award 4 marks Uses 2 (x4) and 16 and 18 (x2) in calculation / 8 and 52 ✓ Substitution (mass of useful product ÷ total mass x 100) $[2 \times 4] / [16 + (2 \times 18)] \times 100$ OR $8/52 \times 100$ ✓ Evaluation = 15.3846 ✓ = 15.4 (%) ✓	4	3 x 2.2 1.2	DO NOT ALLOW MP2 if RFM of CO₂ is included in mass of useful products (numerator). ALLOW ECF on arithmetical error in substituted values DO NOT ALLOW MP2 or MP3 for upside down relationship OR for calculating AE of another compound ALLOW 3 marks for >1 dec place 15.3846.... or truncated to 15.3 ALLOW 1 mark for clear evidence of incorrect answer correctly rounded to 1 decimal place
	(d)		First check the answer on the answer line. If answer = 74(%) award 2 marks Selects 500 and 370 <u>only</u> for use in calculation ✓ Correct answer = 74 (%) ✓	2	2.2	

Question			Answer	Marks	AO element	Guidance
	(e)	(i)	Reaction is reversible / has equilibrium sign ✓ (When reaction has ended) idea that not all reactants form products / some products reform reactants / reactants remain / reaction does not reach completion ✓	2	1.1 2.1	ALLOW MP1 for any mention of equilibrium/reversible/reference to (forward and) backward reaction occurring IGNORE $\rightleftharpoons$ alone DO NOT ALLOW MP1 if answer refers to atom economy/idea of more than one product formed
		(ii)	Not all atoms in reactants form products / waste product / two products / water is (also) formed / does not only make methanol / mass/RFM of useful product is less than total mass/RFM of reactants/products / not all atoms (in reactants) are used to form methanol/the useful product ✓	1	2.1	ALLOW AE = 32/50 (x100) is not 100% / is 64%

Question			Answer	Marks	AO element	Guidance
7	(a)		$1 \times 10^{-10} \text{ m}$ ✓	1	2.2	
	(b)		First check the answer on the answer line. If answer = 6(.0) award 3 marks radius = $1/2$ or 0.5 ✓ shows $3/0.5$ in calculation ✓ = $6(.0)$ ✓	3	2.2	IGNORE any units given by candidate ALLOW ECF for MP2 and MP3 radius to the wrong order e.g. 5×10^{-10} ALLOW 3 marks for 6:1 ALLOW 2 marks for inverted ratio 1:6 ALLOW 2 marks for 6×10^9 / 6000000000
	(c)	(i)	Have hollow centres / are hollow (to carry medicines) ✓ They are (very) <u>small</u> therefore can travel around the body/enter the blood ✓	2	1.1	IGNORE not toxic/harmful etc. IGNORE small enough to enter the body ALLOW (very) <u>small</u> therefore can enter/pass through cells/membranes/blood brain barrier IGNORE references to targeting
		(ii)	Can penetrate cells/membranes / can pass blood-brain barrier / not enough data to be sure of effects (on health) / not enough research to be sure of effects (on health) / side effects not known / unknown effects (on health) / long term effects (on health) unknown ✓	1	1.1	IGNORE may be harmful/may harm health /may have side effects alone

Question	Answer	Marks	AO	Guidance
8 (a)*	Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. Level 3 (5–6 marks) Describes trends in energy changes for Group 1 and Group 7 <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) Identifies the energy changes as exothermic or endothermic for all compounds of two or more ions <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) Identifies energy changes as endothermic or exothermic OR Identifies a trend in temperature changes OR Identifies the ion(s) that give the greatest energy change(s) <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 marks <i>No response or no response worthy of credit.</i>	6	4 x 3.1a 2 x 3.2b	AO 3.1a Describes trends in energy changes • All potassium compounds dissolve endothermically/show greatest endothermic changes • All lithium compounds dissolve exothermically/show greatest exothermic changes • Sodium compounds dissolve both exo- and endothermically • Group 1 energy change becomes more endothermic/goes from exo to endo down the group • Group 7 energy change becomes more exothermic down the group for lithium or sodium compounds/goes from endo to exo for sodium compounds • Group 7 energy change becomes more endothermic down the group for potassium compounds AO 3.2b Links temperature change to energy change • A negative temperature change means an endothermic change • A positive temperature change means an exothermic change • LiCl/LiBr/LiI/NaI/ Li⁺ ions give an exothermic change • NaCl/KCl/KBr/KI/K⁺ ions give an endothermic change Level 1 only AO 3.1a Identifies trends in temperature • Lithium produces the greatest temperature/energy changes / sodium has the smallest • Group 1 temperature change becomes more negative down the group • Group 7 temperature change becomes more positive down the group for lithium or sodium compounds • Group 7 temperature change becomes more negative/decreases for potassium compounds • Iodide ions produce the highest temperature or energy changes / temperature changes become greater down Group 7 ALLOW gets warmer = temperature increase, gets colder = temperature decrease

Question	Answer	Marks	AO	Guidance
(b)	E_a shown for larger hump and E_{acat} shown for smaller hump ✓ Both with arrows starting at level of reactants and ending exactly on humps (by eye) ✓ ΔE shown as <u>downward arrow</u> pointing from reactants to products starting and ending at correct level by eye ✓	3	1.1	ALLOW double headed arrows for MP1 and MP2 DO NOT ALLOW downward arrows for E_a IGNORE lines without arrows DO NOT ALLOW double headed arrow ALLOW ECF MP3 if all three arrows are drawn shorter

Question			Answer	Marks	AO element	Guidance
9	(a)		No mass is gained or lost / mass is not created or destroyed / (total) mass of reactants is equal to the (total) mass of the products ✓ Both sides have a total RFM of 103 / total (relative) masses of both sides is 103 ✓	2	3.1b	ALLOW mass = matter/atoms ALLOW for 1 mark only no change in RFM alone
	(b)		$\text{H}^+ + \text{OH}^-$ ✓ (1 mark) Fully correct equation: $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$ ✓✓	2	1.1	IGNORE additional spectator ions Na^+ and/or NO_3^- for MP1 only ALLOW for 1 mark: shows H^+ and OH^- as reactants IGNORE state symbols ALLOW multiples
	(c)	(i)	Acid 1: 0.2 and 0.2 ✓ Acid 2: 0.6 ✓ Acid 3: 2(.0) ✓	3	2.2	
		(ii)	Acid 4 / H_2SO_4 ✓ because it has the highest concentration of hydrogen ions ✓	2	3.1b	IGNORE it is the most concentrated ALLOW ECF from (c)(i) if H^+ concentration for Acid 1 is given as > 2

Question			Answer	Marks	AO element	Guidance
		(iii)	(Comparing concentrations) Concentration acid = concentration of hydrogen ions for Acid 1 and/or acid 2 (HCl) and/or acid 3 (HNO₃), AND different for Acid 4 ✓ (Formula of HCl and/or HNO₃) idea that they have one hydrogen (atom/ion) in the formula/HCl/HNO₃ / they are monobasic ✓ (Formula of H₂SO₄) There are two hydrogen (atoms/ions) in the formula/H₂SO₄ / it is dibasic ✓	3	3.1b 2 x 2.1	IGNORE all references to acid strength / degree of dissociation/ionisation IGNORE they have one hydrogen alone IGNORE It has two hydrogens alone

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