GCSE MARKING SCHEME

SUMMER 2024

GCSE
APPLIED SCIENCE (DOUBLE AWARD) - UNIT 3
3445U30-1 & 3445UC0-1

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About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

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WJEC GCSE APPLIED SCIENCE (DOUBLE AWARD) – UNIT 3

SUMMER 2024 MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (apart from the questions where a level of response mark scheme is applied).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statements.

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Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

Cao = correct answer only
ecf = error carried forward
bod = benefit of doubt

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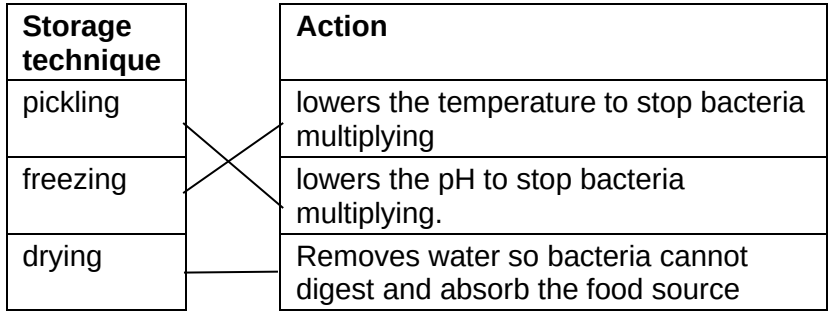
Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)	(i)		 2 or 4 lines – 1 mark max 5 lines – 0 marks	2			2		
		(ii)		adding salt	1					
	(b)			Ticks in boxes 1 and 3	2			2		
				Question 1 total 5	**5**			**5**		

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)			Carbon dioxide	1			1		
	(b)			A F D C B E 3 boxes correct – 2 marks 1 or 2 boxes correct – 1 mark	2			2		
	(c)	(i)		3 units		~~1~~		1	1	
		(ii)		40 [hours]		1		1	1	
		(iii)		70 [hours]		1		1	1	
		(iv)		6		1		1	1	
	(d)	(i)		6 (ecf answer from c iv) /30 0.2 Correct answer only – 2 marks For ecf, must have correct rounding on final answer for (2)	1	1		2	2	
		(ii)		Disagree as different (sugars have different maximum alcohol concentrations) Accept comparative statement that includes value(s) e.g. only maltose is 6.5 or glucose is 5.5 and fructose is 4.0 Do not credit comments about rate			1	1		
				Question 2 total	**4**	**5**	**1**	**10**	**6**	

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			mixture metal	2			2		
	(b)			Line always below			1	1		
	(c)	(i)		{Mass/length} of magnesium (1) concentration of acid (1) surface area of magnesium (1) volume of acid (1)	3			3		2
		(ii)	I	from 20 – 40 (1) it decreases to ¼ / 10 isn't half of 40 / it should decrease from 40 to 20 (1) so disagree OR The time taken halves every time the temp increases by 10^{o}C so disagree (2) Allow for 1 mark: As it doubles from 10 to 20 ^{o}C, time halves (So agree) Judgement needed for 2 marks			2	2	2	
			II	2.5			1	1	1	
		(iii)		Faster More often	2			2		
				Question 3 total	**7**		**4**	**11**	**3**	**3**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		Higher temp – faster bacteria grow (1) Accept converse AND Any 2 × (1) from: Plate 3 / 25 ^{o}C: most bacteria(1) Plate 2 / 5 ^{o}C: fewest bacteria(1) Plate 1 /15 ^{o}C: in-between (1) (so disagree)			3	3		
		(ii)		the results have not been compared to other groups / only one {group's/person's} results DO NOT ACCEPT: only one set of results		1				1
	(b)	(i)		No bacteria (on plate at start) / only the bacteria from the food is present / no other bacteria present	1					1
		(ii)		Flame / heat (until red hot) / ethanol Do not accept sterilise	1					1
		(iii)		Avoid growing {pathogens / harmful microbes}	1					1
		(iv)		No bacteria from air / stop bacteria getting in / stop contamination	1					1
	(c)	(i)		1 (1) 0.5 (1) 2 (1)		3			3	3
		(ii)		increase sample size / closer to true value / more accurate mean accept improved {accuracy / confidence}			1			1
				Question 4 total 12	**4**	**4**	**4**	**12**	**3**	**9**

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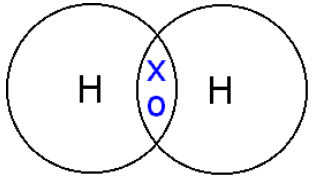
Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5 FT	(a)			 Accept anywhere in the overlap region including on the line Could be two dots or two x	1					
	(b)	(i)		436 +242 (1) = 678 (1) Accept answers of 436 or 242 for (1) only		2			2	
		(ii)		431+431 (1) = 862 (1) Accept answer of 431 for (1) only		2			2	
		(iii)	I	A			1			
			II	More energy given out than taken in /Exothermic (1) So the line ends up lower than it started / -184 (1)		2				
	(c)			More taken in decrease thermal runaway	4					
				Question 5 total	**5**	**6**	**1**	**12**	**4**	

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6				**Indicative content:** 1. The pH was 14 at the start 2. Solution A is (strong) alkali 3. pH drops when standard solution was added 4. The solution became {neutral/pH 7/at the equivalence point} 5. When the volume of standard solution added was 25 cm^3 6. pH flattens out at about pH 1 (which is acidic) 7. Solution B is a (strong) acid		6		6		

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				5 or 6 marks **At least 5 points made** *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.* **3-4 marks** **Three or four points made** *There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.* **1–2 marks** Up to two points made. *There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure*. *The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.* **0 marks** *No attempt made or no response worthy of credit.*						
				Question 6 total		**3**	**3**	**6**		

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7/1	(a)			Scale on x-axis 10/2 cm (1) 6 points correct ± < 1 small square(2) 5 points correct ± < 1 small square (1) Smooth curve between 30-70 which goes back to origin(1)		4		4	4	4
	(b)			Proportional would be straight line (1) through origin (1) OR Line is curve so not proportional (2) ALLOW FOR (1) There are not equal changes every 10 cm Allow ecf from graph			2	2		2
	(c)			Select D = 6 (1) Subs 5/6 (1) = 0.8(3) N/cm (1)	1	1 1		3	3	2
				Question 7/1 total	**1**	**6**	**2**	**9**	**7**	**8**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
8/2.	(a)	(i)		stoma / stomata guard cell	2			2		
		(ii)		Any 2 × (1) from: allow CO_2 to move in or out (1) Allow O_2 to move in or out(1) prevent water loss (1) Allow gas exchange for (1) but no extra mark for named gas	2			2		
	(b)	(i)		Starts at 140 (1) If halves then should end at 70 (1) But ends (above) 90 / only drops 50 (so disagree) (1) No data – 0 marks			3	3	2	
		(ii)	I	1260 000 ha		1		1	1	
			II	(1260 000 ecf ×) 40 (1) = 50 400 000 kg (1) Correct ans only (2)		2		2	2	
				Question 8/2 total	**4**	**3**	**3**	**10**	**5**	

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			Potassium (1) carbonate (1) Potassium chloride (1) Reference to CO_2 for sample 1 neutral		3		3		3
	(b)			$16 \times 4 = 64$ (1) Addition: $M_r = 136$ (1) 34/136 (1) Number of moles = 0.25 (1) For 3 Marks: 88 (1) 34 /88 (1) 0.386 (1) Use of 64 as M_r to give 0.53 (3) Use of 352 (88×4) as M_r to give 0.097/ 0.09659 (3) For 2 marks 34/candidate mass (1) Ans (1)	1	1 1 1		4	4	
				Question 3 total	**1**	**6**		**7**	**4**	**3**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			Glucose → carbon dioxide + ethanol Energy neutral Yeast above arrow neutral	1			1		
	(b)	(i)		{Transfer/exchange/movement} of gene from one organism to another	1			1		
		(ii)		The maximum of yeast is at 4.5 (days) (1) But on this day the sugar content was 60 (units) {and still falling/which is not the minimum} (1) And ethanol concentration was 2.8 (%) {and still rising / which is not the maximum (1) (so disagree) no data max (1) e.g. when yeast is at a maximum, sugar content {still falling/not at a minimum} and ethanol content {still rising/not at a maximum}			3	3	3	
	(c)			Any 2 ×(1) from: (Long term human) health effects are unknown (1) Effects on insects unknown (1) Any correct statement about resistance (1) May cross pollinate with other plants/yeast (to produce super yeast that would be difficult to kill) (1) Out-compete other plant species (1) Reduce gene pool (1)	2			2		

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)			Any 4 × (1) from: Mixture is boiled (1) Mixture is cooled (1) yeast is added (1) Allow fermentation (1) Filter (1) Must be in sequence For 4 marks yeast must be added	4			4		
				Question 4 total	8		3	11	3	

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			5 × 413 =2065 (1) + 336 + 464 +347= 3212 (1) 4706 – (3212) ecf = 1494 (1) 1494 (ecf) /3 = 498 (1) Allow for 3 marks: 413 + 336 + 464+ 347 = 1560 (1) 4706 – 1560 = 3146 (1) 3146 / 3 = 1049 (1) Allow for 2 marks: 4706 – n = answer (1) Answer / 3 = (1)		4		4	4	
	(b)			Energy given out as bonds made > energy need to break the bonds (1) Exothermic (1) Cooling system takes { energy / heat } away (1)		3		3		
				Question 5 total	**0**	**7**	**0**	**7**	**4**	

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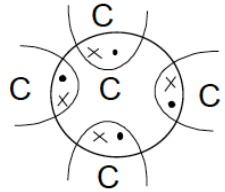
Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		Covalent bonding (1) Each carbon atom {shares electron pairs/bonds} with four other carbon atoms (1)  (1)	3			3	4	
		(ii)		Each carbon atom is joined to three others	1			1		
		(iii)		In graphite, the fourth electron is {free / delocalised/not involved in bonding} (1) and able to move (1) In diamond, there are no free electrons (1)	3			3		
		(iv)		In graphite, the carbon atoms are arranged in layers joined by weak forces (1) This allows (each layer to) slide over the other (easily) (1) In diamond, there (is a rigid structure/no layers} held together by strong (covalent) bonds (1)	3			3		
	(b)			Any 3 × (1) from: Carbon nanotubes have higher strength / stronger (1) The lower density / lighter (1) They are much better conductors (1) There can be a greater distance between pylons / greater breaking length (1) Accept converse Comments about other properties are neutral		3		3		
				Question 6 total	**10**	**3**		**13**		

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7				**Indicative content:** **Fission** 1. A heavy nucleus captures a slow neutron, splits into lighter nuclei (fission fragments), releases energy and excess neutrons 2. The fission reaction can be controlled safely with boron control rods, which absorb excess neutrons 3. A moderator is needed to slow down the neutrons so they can cause further fission events in a chain reaction **Comparison with fusion** 4. Two light nuclei collide and fuse producing a heavier nucleus and releasing energy 5. The process requires very high temperature and pressure, making it very difficult to contain. 6. Nuclear fission is splitting of nuclei; fusion is joining of nuclei. 7. Currently fission is used for energy generation but fusion reactors have not yet been built. 8. Badly-controlled fission reactors can overheat and cause meltdown / breach their containment; 9. Fission products are long half-life radioactive materials and require safe storage; Fusion does not produce long half-life radioactive waste. 10. Per kilogram, fusion releases more energy than fission.	6			6		

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				5 or 6 marks At least 5 points from 2 sections *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.* **3-4 marks** At least 3 points from 2 sections *There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.* **1-2 marks** up to 2 points made from any parts of the indicative content. *There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure*. *The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.* **0 marks** *No attempt made or no response worthy of credit.*						
	(b)			$\begin{matrix}3\ (1)\\1\ (1)\end{matrix}$ H		2		2		
				Question 7 total	**6**	**2**		**8**		

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)			130 (1) × 3 = 390 (1) × 30 = 11 700 (1) 390 / 3900 on answer line = (2)		3		3	3	
	(b)	(i)	I	At 0.01 number of cells = 4.5×10^3 / 4500 (1)			1	1	1	1
			II	Doubling 3 times of 4.5×10^3 / ecf (1) Ans = 3.6×10^4 (1) where there is an absorbance of 0.081 (1) (so disagree) OR Doubling (1) 3 times/ 0.01→0.02→ 0.04 → 0.08 (1) Ans = 0.08 which is > 0.03 (1) (So disagree)			3	3	3	3
		(ii)		3.6×10^4 (ecf) × 7 (1) = 252 000 (ecf) (1) This is more than 120 000 so would make a person ill (ecf) (1) Judgement must match answer on ecf			3		2	
				Question 8 total		**3**	**7**	**10**	**7**	**4**

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SUMMARY FOUNDATION TIER

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	5			5		
2	4	5	1	10	6	
3	7		4	11	3	3
4	4	4	4	12	3	9
5	5	6	1	12	4	
6		6	0	6		6
7	4	3	3	10	5	
8	1	6	2	9	7	8
TOTAL	**30**	**30**	**15**	**75**	**28**	**26**

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SUMMARY HIGHER TIER

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	1	6	2	9	7	8
2	4	3	3	10	5	
3	1	6		7	3	3
4	8		3	11	3	
5	0	7	0	7	4	
6	10	3		13		
7	6	2		8		
8		3	7	10	7	4
TOTAL	**30**	**30**	**15**	**75**	**29**	**15**

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