



GCSE MARKING SCHEME

SUMMER 2024

**GCSE
APPLIED SCIENCE (SINGLE AWARD) - UNIT 2
3440U20-1 & 3440UB0-1**

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.

WJEC GCSE APPLIED SCIENCE (SINGLE AWARD) – UNIT 2

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.

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

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1.	(a)			A = red (blood cell) (1) B = platelet (1) C = white (blood cell) (1)	3			3		
	(b)			Part of the blood Job Red blood cell White blood cell Platelet Plasma Clotting Carries oxygen Destroys bacteria Carries glucose 1 correct (1) 2/3 correct (2) 4 correct (3) Do not allow 2 lines from each part	3			3		
				Question 1 total	6	0	0	6	0	0

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2.	(a)	(i)		High (1)	1			1		
		(ii)		20 000 Hz (1) Allow: 20 001		1		1	1	
		(iii)		Box 2 and 3 Monitoring of a baby during pregnancy (1) Detecting heart problems (1) 3 ticks – 1 mark max	2			2		
	(b)	(i)		Top Image = Compound (1) Bottom Image = Greenstick (1) Do not allow two lines from an image	2			2		
		(ii)		Any 2 × (1) from: MRI (scans) (1) CAT / CT (scans) (1) Gamma (camera) (1) Accept PET scan / endoscopy (1)	2			2		
				Question 2 total	7	1	0	8	1	0

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3.	(a)	(i)		Antagonistic (1) Tendons (1)	2			2		
		(ii)		Biceps contracts (1) Triceps relaxes (1) Allow: one contracts and one relaxes / incorrect muscles named that contract and relax (1) Accept: pulls for contract Do not accept: they contract and relax / references to muscles pushing	2			2		
	(b)	(i)		5 (kg) (1)		1		1	1	1
		(ii)		Correct statement about one of the boys (1) e.g. Tom's left arm is stronger than his right / Roan or Brandon's right arm is stronger Data to justify the statement (1) e.g. Tom 8 and 4 / Brandon 6 and 12 / Roan 5 and 10 Judgement – only true for {two of the boys / Roan and Brandon} boys/ not true for {one of the boys / Tom} (1)			3	3	3	3
		(iii)		Any 3 × (1) from: different ages/not only 14-year-olds (1) more people (1) Use teenagers from a wider (geographical) area / not just Bridgend / all over Wales (1) Use other genders / girls (1) Choose right-handed and left-handed people (1) Persons of different weighs/sizes (1) Do not accept repeat			3	3		
				Question 3 total	4	1	6	11	4	4

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4.	(a)			Indicative content: • A-B – constant speed / travel 400 m in 1 min • A-B - fastest • B-C 400m in 2 mins (at constant speed) • B-C which is {half the speed of A-B/slower} • C-D is stationary for 1 minute • D-E – 800 m for 4 minutes / {steady/constant} speed • Along D-E Osian is returning home • D-E is the same speed as B-C • Moves 800m in one direction and 800m back • Total distance 1600m • Total time 8 mins 5-6 marks <i>At least 5 points which includes data and reference to constant speed in one section. All sections of the graph should be correctly referenced.</i> 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. <i>At least 3 points which includes data from at least two sections of the graph.</i> 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.		6		6	6	

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				1-2 marks <i>Up to 2 points including data / description with no mention of data.</i> 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.						
	(b)			1 600 (1)		1		1	1	
	(c)			1 600 (ecf) / (8 × 60) (1) 3.3 m/s (1) If total distance in b(i) was 800 – allow 1.7/1.67/1.666666 for (2) If total distance in b(i) was 800 – allow 1.6 (1) Ecf must have correct rounding		2		2	2	
				Question 4 total	0	9	0	9	9	0

Question				Marking details			Marks Available											
							AO1	AO2	AO3	Total	Maths	Prac						
5.	(a)			<table><tr><td>Hazard</td><td>Risk</td><td>Control Measure</td></tr><tr><td><i>Dilute hydrochloric acid is an irritant</i></td><td><i>Transfer of acid during pouring from hands to eyes</i></td><td>Wear eye protection/goggles /safety glasses OR Wash acid off hands (immediately) OR Don't rub eyes</td></tr></table> Not: glasses / gloves Any one control measure (1)			Hazard	Risk	Control Measure	<i>Dilute hydrochloric acid is an irritant</i>	<i>Transfer of acid during pouring from hands to eyes</i>	Wear eye protection/goggles /safety glasses OR Wash acid off hands (immediately) OR Don't rub eyes	1			1		1
				Hazard	Risk	Control Measure												
<i>Dilute hydrochloric acid is an irritant</i>	<i>Transfer of acid during pouring from hands to eyes</i>	Wear eye protection/goggles /safety glasses OR Wash acid off hands (immediately) OR Don't rub eyes																
	(b)	(i)		The value 53 is circled in the table (1)				1		1	1	1						
		(ii)		Calculation shown 34+32 (1) 66/2 = 33 (1) OR 53+34+32 = 119 (1) 119/3 = 39.6666666..../39.67/39.7/40(1) Allow 39.6				2		2	2							
		(iii)		5 points correctly plotted (+/- less than 1 square) (2) 4 points correctly plotted (+/- less than 1 square) (1) 3 points or fewer correctly plotted (0) Correct scale on x-axis with 0 at origin (1) Suitable line of best fit- curve between 1.0 and 2.5 (1) Do not accept sketchy/thick/feathered/double lines No scale – no marks				4		4	4	4						

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iv)	I	As the concentration of acid increases, the time taken decreases (1)		1		1		1
			II	Higher concentration means more (acid) particles (1) More collisions (1) Do not accept references to 'strength of acid'	2			2		
	(c)			Any 2 × (1) from: - Improves the repeatability of data / Improves precision (1) - Reduces the chance of obtaining an anomalous result (1) - end point recorded automatically / reduces human error (1) - Reduces uncertainty of results / improves accuracy (1)			2	2		
				Question 5 total	3	8	2	13	7	7

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6.	(a)			Crisp A give a {higher/greater} increase in temperature ORA (1) Crisp A contain more energy ORA (1) (so James is correct)			2	2		2
	(b)			Any (1) from: - Place the flame/burning food closer to the tube - Place the apparatus in a sealed container to prevent heat loss (to the surroundings) - Insulate tube to prevent heat loss - Make sure the food has completely burned Accept use a bomb calorimeter. Do not accept same sized crisps			1	1		1
				Question 6 total	0	0	3	3	0	3

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7.	(a)			2 half lives (1) $1 \rightarrow \frac{1}{2} \rightarrow \frac{1}{4}$ (1) $\frac{1}{4}$ on answer line (2)		2		2	2	
	(b)			Gamma can pass into the brain /can penetrate the skull (1) {Longer half-life / decays slower} means that it does not need to be replaced regularly (1)		2		2		
	(c)			Gamma can leave the body (1) {Shorter half-life / decays quicker} so reduces harm to the patient (1)		2		2		
				Question 7 total	0	6	0	6	2	0

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
8/1	(a)	(i)		(Repeat) to check that they are similar/ spot anomalies (1)	1			1		1
		(ii)		{Compare/check} results with others (1)	1			1		1
	(b)			As number of strips doubles from 1 to 2 and 2 to 4 (1) The temperature change doubles from 2.1°C to 4.2°C and 4.2°C and 8.4°C (1) (so agree)			2	2	2	
	(c)			Exothermic (1) Energy released making bonds is greater than (1) energy to break the bonds (1)	3			3		
				Question 8/1 total	5	0	2	7	2	2

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
9/2	(a)			to compare (different size populations)	1			1		
	(b)	(i)		Started in London in {Nov /Dec / first / sooner } (1) Didn't start in Cardiff or Edinburgh until {Jan/later} (1) (so disagree)			2	2		
		(ii)		Increased population (1) more contact / people closer together (1) flu easily passed on / more chance of spreading / contagious (1) Increased population density (2)		3		3		
		(iii)		Any time during {Sep / Oct / before November} in London (1) Any time Sept-Dec in Cardiff and Edinburgh (1) {Sept/Oct} for <u>all regions</u> (2)		2		2		
	(c)	(i)		Any 3 × (1) from: vaccines that contain {antigens/inactive pathogens} (1) increased number of {lymphocytes / white blood cells} (1) stimulating antibody production (1) memory cells produced / to protect against future infection / respond faster to future infection(1)	3			3		
		(ii)		Virus mutates / wrong strain in vaccine (1)	1			1		
				Question 9/2 total	5	5	2	12	0	0

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3.	(a)			45°C (1) $3780 / 2 = 1890$ (1) conversion to 1.89 kJ (1) Accept 1.9 kJ		3		3	3	3
	(b)	(i)		$285/100 = 2.85$ kJ/g (1) Difference = 0.95 (1) $0.95 / 2.85 \times 100 = 33.3 \%$ (less) (1) OR $285/100 = 2.85$ kJ/g (1) Difference = 0.95 (1) $0.95/1.89$ (ecf from (a)) $\times 100 = 50.26/50 \%$ more (1)		3		3	3	3
		(ii)		Any 2 $\times$ (1) from Place flame nearer to boiling tube to prevent heat {convecting passed / being lost to surroundings } (1) Place in sealed container to prevent {convection from boiling tube / evaporation from boiling tube / being lost to surroundings} (1) Insulate tube to prevent heat lost out of side of tube (1) Crumb food to ensure complete burning (1) Bomb calorimeter to prevent heat loss to surroundings (1)			2	2		2
				Question 3 total		6	2	8	6	8

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4.	(a)			Too many IVs / changing too many (named) things / more than one IV (1) nothing to compare / No controlled variables (1)		2		2		2
	(b)			Don't measure mass in spatulas / measure in g (1) Don't measure time in mins / measure in s (1)			2	2		2
	©			Any 2 × (1) from: more successful collisions (1) higher rate of collisions / per unit time (1) Because there are more particles in contact between the acid and the solid (1)	2					
				Question 4 total	2	2	2	6	0	4

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5.	(a)			Any 3 × (1) from: Rapid increase (1) High peak (1) Slow decline (1) Doesn't return to baseline (within the 4 hours) (1)		3		3		
	(b)			Any 3 × (1) from: pancreas produces insulin (1) (insulin) transported in blood (1) Which converts glucose to glycogen (1) that is stored in {liver /muscle} (1) Which reduces blood glucose (1)	3			3		
	(c)			Converting 160 cm to 1.6m (1) BMI = $70 / 1.6^2$ (1) = 27.34 (1) Therefore overweight (ecf from 3 rd marking point) so Andy is wrong (1) Allow 2 marks for answer of incorrect answer of 2.73×10^{-3}			4	4	2	
				Question 5 total	3	3	4	10	2	0

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6.	(a)			12/ 60 / 0.2 (1) m/s ² (1)	1	1		2	1	
	(b)			Method 1 first triangle (= $0.5 \times 60 \times 12 =$ 360 (m) (1) Rectangle (= $(240-60) \times 12 =$ 2 160 (m) (1) 2 nd triangle = $(0.5 \times (360-240) \times 12 =$ 720 m (1) Sum = 3 240 (ecf) (m) (1) Method 2 Use of formula for area of trapezium (1) Area = $0.5 (180(1) + 360 (1)) \times 12$ = 3 240 (m) (1)		4		4	4	
	(c)			360 (1) Mean velocity = 3 240 (ecf) /360 (1) = 9 m/s (1)	1	1 1		2	1	
				Question 6 total	2	7	0	9	6	0

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7.	(a)			Indicative content: • (named) stimulus detected by receptor • Nerve impulse is an electrical signal • moves down sensory neuron • through relay neuron • in spinal cord / CNS • synapses • signal moves down motor neuron • To effector/muscle • (named) effector gives response / muscle contracts 5-6 marks at least 5 points which reference 3 areas of the reflex arc 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 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 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.	6			6		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)			Any 2 × (1) from: in reflex signal path bypasses brain/automatic/no conscious thought (1) quick (1) protective (1)	2			2		
				Question 7 total	8	0	0	8	0	0

Question				Marking details	Marks Available														
					AO1	AO2	AO3	Total	Maths	Prac									
8.	(a)	(i)		A pair of different {genes/alleles} / one recessive one dominant(1) in an individual genetic makeup/ type of {genes/alleles} (1)	2			2											
		(ii)		A {type/form} of gene (1) Only shows itself (within the phenotype) when two alleles are present / hidden by a dominant allele (1)	2			2											
	(b)			<table border="1"><tr><td></td><td>B</td><td>b</td></tr><tr><td>B</td><td>BB</td><td>Bb</td></tr><tr><td>b</td><td>Bb</td><td>bb</td></tr></table> 75% /3/4/ 3 in 4/ 0.75 Parents(1) Cross (ecf)(1) Probability (ecf) (1)		B	b	B	BB	Bb	b	Bb	bb		3		3	1	
	B	b																	
B	BB	Bb																	
b	Bb	bb																	
				Question 8 total	4	3	0	7	1	0									

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
9.	(a)			Time difference 26 years (1) 1600 Bq /kg occurred at 12 years (1) 26 years later it would drop to 900 Bq (1) Which is below the safe limit OR 1000 is at 34 years and 1600 after 12 years (1986) (1) The time taken to go from 1600 to 1000 is 22 years (1) So 22 years takes it to 2008 which is before 2012 (1) so under the safe limit			3	3	3	
	(b)			Half life = 34 years (allow 32-36) (1) $\times 5 = 170$ years (1) $1986 + 170 = 2156$ (1)		3		3	1	
	(c)			$^{137}_{56}\text{Ba}(1) + ^0_{-1}\text{e}(1)$	1	1		2		
				Question 9 total	1	4	3	8	4	0

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	6	0	0	6	0	0
2	7	1	0	8	1	0
3	4	1	6	11	4	4
4	0	9	0	9	9	0
5	3	8	2	13	7	7
6	0	0	3	3	0	3
7	0	6	0	6	2	0
8	5	0	2	7	2	2
9	5	5	2	12	1	0
TOTAL	30	30	15	75	26	16

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	5	0	2	7	0	3
2	5	5	2	12	0	0
3		6	2	8	6	8
4	2	2	2	6	0	4
5	3	3	4	10	2	0
6	2	7	0	9	6	0
7	8	0	0	8	0	0
8	4	3	0	7	1	0
9	1	4	3	8	4	0
TOTAL	30	30	15	75	19	15