GCSE MARKING SCHEME

SUMMER 2022

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

INTRODUCTION

This marking scheme was used by WJEC for the 2022 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

WJEC GCSE APPLIED SCIENCE (SINGLE AWARD)

UNIT 2

SUMMER 2022 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.

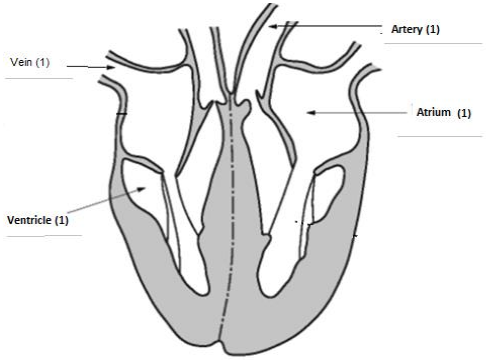
Marking abbreviations

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)	(i)		Genes	1			1		
		(ii)		DNA/genes	1			1		
		(iii)		Ionising	1			1		
		(iv)		Downs syndrome	1			1		
	(b)			T G	1			1		
				Question 1 total	**5**	**0**	**0**	**5**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2.	(a)			<table><tr><td>Breakfast</td><td>✓</td></tr><tr><td>Lunch</td><td>×</td></tr><tr><td>Dinner</td><td>×</td></tr><tr><td>Supper</td><td>✓</td></tr></table> 2 ticks in correct position (1) 2 crosses in correct position (1)			2	2		
	(b)			Eat some more glucose / sugar (or named sugary food) Allow carbohydrates / carbs	1			1		
	(c)	(i)		Type 1: (Pancreas) does not produce insulin (1) Accept low insulin Type 2: Patient has developed insulin resistance/body cells don't respond to insulin produced (1)	2			2		
		(ii)		Low {sugar/carbohydrate} diet / increased exercise	1			1		
	(d)	(i)		Benedict's	1			1		1
		(ii)		A, B and D		1		1		1
				Question 2 total	**5**	**1**	**2**	**8**	**0**	**0**

<table>
<tr><th colspan="4">Question</th><th>Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th colspan="4"></th><th></th><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>3.</td><td>(a)</td><td colspan="2"></td><td> 
</td><td>4</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td colspan="2"></td><td>
<table>
<tr><th>Name</th><th>Description</th><th>Purpose</th></tr>
<tr><td></td><td></td><td>diffusion (of gases)/ movement of {small molecules/glucose} / deliver oxygen to tissues / let {gases/small molecules} through / carry blood to {tissues/cells}/ carry blood at low pressure (1)</td></tr>
<tr><td rowspan="2">Artery
(1)
Vein</td><td>Thick (muscular) walls (1)
Not valves</td><td></td></tr>
<tr><td></td><td>Carry blood at low pressure / carry blood back to heart (1)

Allow: stop backflow</td></tr>
</table>
</td><td>4</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="2"></td><td>Question 3 total</td><td>8</td><td>0</td><td>0</td><td>8</td><td>0</td><td>0</td></tr>
</table>

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4.	(a)	(i)		50		1				
		(ii)		50 (ecf) × 500 000 (1) /10 000 = 2 500 (1) Answer only (2) 25 000 000 – 1 mark 50 × 50 – 1 mark		2			2	
		(iii)	I	60 year old woman 10 (per 10 000) (1) (67 year old man) nearer to 30 (nearer to 70 year old than 60 year old) so not (likely to be) true (1) Must give judgement for 2 marks No marks for judgement alone			2		2	
			II	More data in-between ages			1			
	(b)	(i)		Ball & socket No marks if two underlined	1					
		(ii)		Osteoarthritis No marks if two underlined	1					
				Question 4 total	**2**	**3**	**3**	**8**	**4**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5.	(a)			43 (1) correct electron/beta particle (1) $^{99}_{43}Tc \quad + \quad ^{0}_{-1}e$ Accept β for e		2		2		
	(b)	(i)		1 250		1		1	1	
		(ii)		Scale – y axis-1 000 per cm – must have 0 / number at origin (1) 7 correct plots < 1 square tolerance (2) 6 correct plots < 1 square tolerance (1) Suitable curved line which joins all points and quality of curve between 6 and 30 assessed (1) Ecf from b(ii) Only 1 mark max for bar chart (scale)		4		4	4	
		(iii)		Line above but shouldn't end at the same point (1) allow horizontal (never goes below) Starting at same point (10 000) (1)		2		2		
	(c)			Any 2 × (1) from: Limit time of exposure of operator (1) stand behind lead screen (1) leaded apron (1) leave room (1)	2			2		
				Question 5 total	**2**	**9**	**0**	**11**	**5**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6.	(a)			Any 2 × (1) from: Headaches (1) Pain (in joints) (1) Tremors (1) Mental health effects (1) Not: Cancer/named illness	2			2		
	(b)	(i)		Correct substitution 500/800 (1) 2 000/4 000 (1) Correct calculation of both speeds 0.625 (m/s) (1) 0.5 (m/s) (1) so newspaper is incorrect judgement necessary for 4 marks OR The distance has increased 4 times (1) The time has increased 5 times (1) So when you divide distance by time (1) the speed is less so disagree (1) Answer of 0.125 (m/s) (slower) so newspaper incorrect – 4 marks judgement necessary for 4 marks No marks for judgement alone			4	4		
		(ii)		speed decreased but volume increased (so disagree) (1) Ecf			1	2		
				Question 6 total	**2**	**0**	**5**	**7**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7.	(a)			2nd 3rd 5th	3					
	(b)			**Non-smokers** • lung function drops with age (from 100% to 75%) • so non-smokers stay healthy / don't have symptoms / don't become disabled due to smoking **People who give up smoking** • Lung function drops from 100% to 75% by the time they are 45 • When they quit lung function drops from approx. 75% to 35% by the time they are 75 • Start to show symptoms at around 67 • but do not regain lung function of non-smoker **Smokers** • Lung function drops quicker than non-smokers (100% to approx. 10%) • Start suffering symptoms at around 57 years old and disability at about 67 years old • Death through lung disease at 75 **5-6 marks** Detailed description of outcomes of smokers, non-smoker and people who quit. (at least 5 statements from all three regions including data on more than one region on lung function) *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	3	6		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				3-4 marks Detailed description of outcomes of smokers and some description for either non-smokers or quitters. (up to 4 statements from at least 2 regions including at least one piece of data from one region on lung function) *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** A basic description of outcomes for smokers or non-smokers or quitters. (Up to 2 statements from anywhere) *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.*						
				Question 7 total	**3**	**3**	**3**	**9**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
8./1.	(a)			Any 2 × (1) from: Minimise the time the lid is taken off the plate (1) Flame/sterilise forceps (1) Updraught from Bunsen (1) sterilise bench (with ethanol) (1) aseptic technique/seal lid (1) Not: clean alone	2			2		2
	(b)	(i)		D (1) Smallest clear area/killed fewest bacteria/smallest radius/ only 0.2 cm (1)		2		2		2
		(ii)		3.14 × 1.96 (1) = 6.1544 (1) 6.15 (1) Allow 6.157 - 2 marks Allow 6.16 - 3 marks (if obvious candidates use π on calculator and workings shown) 6.16 on answer line – 2 marks 6.15 on answer line – 3 marks	1	2		3	3	3
		(iii)		6.15 (ecf) × 50 000 (1) = 307 500 (1) Accept 307 700 / 308 000 / 307 850 for 2 marks		2		2	2	2

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iv)		Area B = 1.54 (1) Area C is 4 × bigger so Jeremy is correct (1) OR Radius of C is 2 × radius B (1) Area of C is 4 × area of B therefore Jeremy is correct (1) OR Radius doubles (1) But area quadruples therefore Jeremy is correct (1)			2	2	2	3
				Question 8/1 total	**3**	**6**	**2**	**11**	**7**	**11**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
9./2.	(a)			Any 2 × (1) from: Initial concentration of acid (1) Concentration of thiosulfate (1) Volume of thiosulfate (1) Temperature of acid (1) Same cross (1) Total volume (1) Not amount		2				2
	(b)			The greater the concentration of HCl the more particles (per unit vol) (1) (The higher the concentration of HCl) the more (successful) collisions (per unit time) (1) the faster the reaction/less time for cross to disappear (1)		3				3
	(c)			Particles will move more slowly/less (kinetic) energy (1) So fewer (successful) collisions /fewer particles will have the activation energy when they collide/fewer particles have enough energy to react when they collide (1) Reaction rate would be slower/longer for cross to disappear (1)		3				3
				Question 9/2 total	**0**	**8**	**0**	**8**	**0**	**8**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3.	(a)			A Vena cava/vein (1) B (Right) atrium (1) C (Right) ventricle (1)	3			3		
	(b)	(i)		One cell thick / porous/ very thin (1) to allow diffusion to occur / allow movement across (1)	2			2		
		(ii)		Any 4 × (1) from: Arteries have thicker walls / veins have thinner walls (1) Arteries have narrower lumen / veins have wider lumen (1) Arteries carry blood at high pressure but veins carry blood at low pressure / arteries carry blood at higher pressure/ veins carry blood at lower pressure (1) Arteries carry blood away from the heart / veins carry blood towards the heart (1) (some) veins contain valves (to prevent backflow of blood) / arteries do not (1) (most) arteries carry oxygenated blood / veins carry deoxygenated blood (1) Allow table of comparison	4			4		
	(c)			ingesting / engulfing bacteria (1) producing antibodies (which inactivate particular bacteria or viruses) (1) producing antitoxins (which counteract the toxins released by bacteria) (1)	3			3		
				Question 3 total	**12**	**0**	**0**	**12**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4.	(a)			• If glucose levels increase the pancreas produces insulin. • Glucose is stored as glycogen in the liver and muscles to reduce glucose level. • If glucose levels decrease the pancreas produces glucagon. • Glycogen in the liver and muscles is converted back to glucose to increase glucose level. • Type 1 diabetes is due to the body not producing {any/enough insulin} • therefore glucose levels remain high (following meals if not controlled.) • Diabetics need to monitor blood glucose levels and inject insulin if necessary. **5-6 marks** 5 statements covering all areas *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** up to 4 statements from at least 2 areas *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*** 1 or 2 statements from any area *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					

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)			DNA double helix (1) Held by (weak/hydrogen) bonds (1) A pairs with T and that C pairs with G. (1)	3					
				Question 4 total	**9**	**0**	**0**	**9**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5.	(a)			If you **do give** up your lung function will decrease more slowly / only reduces by 25% if you don't smoke (1) Any 2 × (1) from: You are likely to {live longer / suffer symptoms later / become disabled later} if you give up or don't smoke (1) You are likely to suffer symptoms at 70 compared to 57 if you continue (1) You are likely to become disabled at 80 compared to 65 if you continue (1) Live past 75 (1)			3			
	(b)			point identified / line starting at 60 from the smokers curve (1) Curved downwards between the two dotted lines, shouldn't cross the other lines (1)		2				
	(c)			Llinos' gran might be an outlier/anomaly (1) not susceptible to smoke / Don't know how many cigarettes were smoked per day /don't know what type of cigarette / The majority of people would show effects/would be more likely to follow pattern (1) therefore disagree with Llinos Need judgement for second mark			2	2		
				Question 5 total		**2**	**5**	**7**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6.	(a)	(i)		Compound has multiple breaks/an open wound AND Simple has no open wound /a single break	1					
		(ii)		5% of 255 000 (1) 12 750 (1)		2				
	(b)	(i)		Both men and women increased risk over 40 (1) Women's risk increases faster (1)		2				
		(ii)		Obvious use of graph e.g. Estimated risk at 65 =25 per 10 000 people Estimated risk at 80 =100 per 10 000 people (1) Estimated mean = 62.5 per 10 000 people (1) 62.5 (ecf) × 6 000 000 (1) /10 000 (1) = (37 500)		4			4	
	(c)			Any 2 × (1) from cartilage worn down (1) increasing friction (1) causes pain/ loss of movement (1)	2					
				Question 6 total	**3**	**8**	**0**	**11**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7.	(a)	(i)		(High speed/energy) Electron (1) From the decay of a neutron in the nucleus (1)	2					
		(ii)		$(^{99}_{42}\text{Mo}) \rightarrow {}_{43}\,{}^{99}_{(1)}Tc + {}^{0}_{-1}e$ (1)	1	1				
	(b)	(i)		Series of halving (1) 4 half-lives (1) 1×10^7 / 0.1×10^8 (1)		3			3	
		(ii)		5 half-lives is 1/32(1) So this happens in 30 hours so {agree as will have gone by 2 days / disagree as it will have gone before 2 days} (1) OR {2 days / 48 hours} = 8 half lives This takes it to 1/256 so {agree will have gone by 2 days / disagree as it will have gone before 2 days} (1)			2			
	(c)			Active in body for longer / takes longer to decay in the body (1) Beta will be {more ionising/less penetrating/not detected outside the body} (1)		2				
				Question 7 total	**3**	**6**	**2**	**11**	**3**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
8.				Mean speed for journey A 16/45 (1) = 0.356 (km/min) (1) Mean speed for journey B Working out one part correctly (1) (0.5 × 30)/2 = 7.5km 0.75 × 30 = 22.5km (0.75 × 30)/2 = 11.25km Correct total distance travelled = 41.25km (1) Mean speed = 41.25/2 = 20.63 km/h (1) (ecf) Comparison of the two journeys in consistent units (mean speed for A = 21.3 km/h or mean speed for B = 0.34 km/min So disagree – must be linked for full marks (1)			6			
				Question 8 total	**0**	**0**	**6**	**6**	**0**	**0**