



GCSE MARKING SCHEME

SUMMER 2022

**GCSE
APPLIED SCIENCE (DOUBLE AWARD) - UNIT 2
3445U20-1 & 3445UB0-1**

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 (DOUBLE 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)			Site	Indicator species	Pollution level		3		3		3
				1 & 2	MAYFLY / NYMPH (1)	low						
				3 & 4	No life	EXTREME (1)						
				5	worm	high						
				6	worm	high						
				7 & 8	HOGLOUSE (1)	Medium						
	(b)			(Between) 2 & 3 Accept between 3 and 4					1	1		1
				Question 1 total				3	1	4		4

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2.	(a)			Habitats are destroyed / less space for wildlife	1			1		
	(b)			Seed banks (1) captive breeding (1) Ticks in boxes 1 and 2 3 ticks – (1) max	2			2		
	(c)			Allows movement of animals (1) For hunting / breeding / migration / feeding / water (1)	2			2		
				Question 2 total	5			5		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3.	(a)	(i)		A – ligament (1) B – synovial fluid (1) C – cartilage (1)	3					
		(ii)	I	Wear and tear / injury Accept: damaged cartilage / bony spurs / genetics / obesity Do not accept: exercise/age	1					
			II	Bones rub together	1					
	(b)			(Foot moves when) muscles contract (1) Foot moved up by TAM / foot moved down by calf muscle (1) Accept: one moves the foot one way and the other moves the foot the other way (1) Accept 'pull / tense' for contract		2				
				Question 3 total	5	2		7		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4.	(a)	(i)		Line X		1		1		
		(ii)		Insulin (injections) / low carbohydrate diet / decrease sugar / low sugar diet / pancreatic transplant	1			1		
	(b)			Ultrasound (1) monitoring (unborn) baby/monitor soft tissue damage (1) Accept: check for pregnancy CAT / CT / MRI (1) detect cancer/soft tissue scan (1) Accept: named body parts Accept: examine soft tissue	4			4		
	(c)	(i)		(T -) A and (G -) C	1			1		
		(ii)		ionising	1			1		
				Question 4 total	7	1		8		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5.	(a)	(i)		Space based clearer / detect more types of radiation (that don't penetrate atmosphere / no interference from Earth's atmosphere / no interference from light pollution	1			1		
		(ii)		Earth based are cheaper / hard to maintain / hard to repair in space	1			1		
	(b)			years		1		1		
	(c)	(i)		X – rays	1			1		
		(ii)		Radio (waves)	1			1		
		(iii)		Any 2 × (1) from: Gamma (rays) (1) u-v / ultra-violet (1) i-r/infra-red (1) micro(waves) (1) Do not accept ultra or violet Do not accept infra or red X-rays, visible light and radio waves neutral	2			2		
	(d)			Selection of 2 m (1) Ans = 150 000 000 Hz (1) Ans of 150 000 000 only (2) Ans of 30 000 000 (1 only) Accept 50 000 000 (1)		2		2	2	


Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(e)			Big Bang	1			1		
				Question 5 total	7	3		10	2	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6.	(a)			<p>Indicative content:</p> <p>Diets compared: Actual diet has:</p> <ol style="list-style-type: none"> 1. Too much energy 2. Too much fat 3. Too many carbohydrates 4. Too many sugars 5. Too much salt 6. Not enough fibre 7. Same protein <p>Effect on health:</p> <ol style="list-style-type: none"> 1. Puts on weight / obesity 2. (Increased risk of) high blood pressure 3. stroke / heart disease 4. Becomes constipated 5. (Increased risk of) diabetes 6. Tooth decay <p>5-6 marks Detailed comparisons <u>and</u> at least one linked effect on health (at least 6 points overall, but at least 2 from each area) <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.</i></p>		2	4	6		6

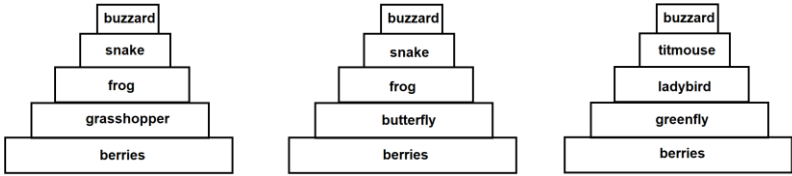
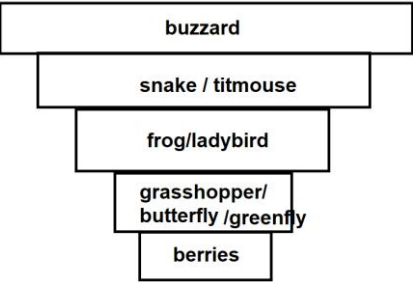
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				<p>3-4 marks Detailed comparison /detailed effects / limited comparison and limited effects (at least 3 points) <i>There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</i></p> <p>1-2 marks Up to 2 points from any area. <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.</i></p> <p>0 marks <i>No attempt made or no response worthy of credit.</i></p>						
				Question 6 total	4	2		6		6

Question				Marking details	Marks available													
					AO1	AO2	AO3	Total	Maths	Prac								
7.	(a)	(i)		78		1		1		1								
		(ii)		Drop is 11 in 1 minute (1) Needs to drop another 44 (1) = 4 minutes (1) 11 on answer line (1) 44 on answer line (1) 5 on answer line (2) 55 on answer line (1)		3		3	3	3								
		(iii)		Speed = 400/58 (select and subs) (1) = 6.897/6.9/7 m/s (1) Accept 6.89 / 6.8 / 7.25 / 7.23 (1)		2		2	2	3								
		(iv)		<table border="1"><tr><td>Fastest section</td><td>0 to 100</td></tr><tr><td></td><td>100 to 200</td></tr><tr><td></td><td>300 to 400</td></tr><tr><td>Slowest section</td><td>200 to 300</td></tr></table> All correct (2) 2 or 1 correct (1) Accept 101, 301 etc. Accept pairs in reverse order	Fastest section	0 to 100		100 to 200		300 to 400	Slowest section	200 to 300		2		2	2	2
Fastest section	0 to 100																	
	100 to 200																	
	300 to 400																	
Slowest section	200 to 300																	
	(b)			<table border="1"><tr><td>Pulse rate (bpm)</td><td>< 78 (1) Not 0</td><td>All other boxes < 132 but > their resting pulse rate (1)</td></tr></table>	Pulse rate (bpm)	< 78 (1) Not 0	All other boxes < 132 but > their resting pulse rate (1)		2		2	2	2					
Pulse rate (bpm)	< 78 (1) Not 0	All other boxes < 132 but > their resting pulse rate (1)																
				Question 7 total		10		10	9	10								

Question				Marking details		Marks available					
						AO1	AO2	AO3	Total	Maths	Prac
8./1.	(a)	(i)		Kingdom:	Animalia	1	2	3			
				Phylum:	Arthropoda						(1)
				Class:	Insecta						
				Order:	Hemiptera						
				Family:	Aphididae						
				Genus	<i>Acyrthosiphon</i>						(1)
				Species	<i>pisum</i>						(1)
				Binomial name	<i>Acyrthosiphon pisum.</i>						
Ignore case											
Allow <i>Acyrthosiphon pisum</i> reversed for (1)											
		(ii)	I	No confusion / unique name / universal / same in every language		1			1		
			II	Same genus/Vanessa/same first name		1			1		
	(b)	(i)	I	Migration		1			1		
			II	Temperature changes/weather/food availability Accept: breeding/better resources Do not accept: better conditions		1			1		
		(ii)		Larger population (than the mean last year) (1) Peaked earlier (1) Accept: population increased (1) Do not accept: population increased and decreased				2	2	2	
		(iii)		Similar shape line to the right of the dotted line (1) Smaller amplitude (1)			2		2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
HT		(iv)		<p>As Red Admiral population increases so does the frog population (1)</p> <p>EITHER</p> <p>The population line for frogs lags behind that for the RA (1) because there is a delay before the frog population responds to the RA population change (1)</p> <p>OR</p> <p>The number of frogs never increases to the same value as the RA (1)</p> <p>because prey always outnumber the predator (1)</p>		3		3		
FT	(c)	(i)		<p>greenfly → <u>ladybird</u> (1) → <u>dragonfly</u> (1) → frog berries → <u>grasshopper</u> (1)</p> <p>2 names in box (0)</p>		3		3		
HT		(i)		<p>One food chain drawn from berries (1)</p> <p>Second food chain drawn from berries (1)</p> <p>Third linked food chain (1)</p> 						

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
FT		(ii)		<p>Rabbits and/or mice will decrease (1) Less food for foxes (1) fox numbers decrease (1)</p> <p>OR</p> <p>Rabbits and/or mice will decrease (1) Foxes (compete with buzzards to) feed on titmice (1) fox numbers decrease (1)</p> <p>OR</p> <p>Less food for rabbits and/or mice (1) Numbers decrease/die out (1) Less food for foxes/numbers decrease (1)</p>			3	3		
FT HT		(iii) (ii)		<p>Frogs occupy more than one food chain (1) which consist of different (numbers of) living things (1)</p> <p>OR</p> <p>Frogs have more than one food source / eat many things (1) In different (length) food chains (1) OR</p> <p>The frog is found in multiple food chains (1) Changes level depending on the chain (1)</p> <p>OR</p> <p>Eats primary and tertiary consumers (2) Treat secondary as neutral</p> <p>Do not accept they are omnivores</p>			2	2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
FT HT	(d)			<p>shape (only one organism per level) (1) labelling of 4 levels – must include berries, buzzard and two other correct (1) order must start with berries and end with buzzard (1)</p> <div style="display: flex; justify-content: space-around; align-items: flex-end;">  </div> <p>If 4/6/7 levels shown (2) only If 3 levels shown (1) only If sequence of arrows (2) max Sequence of lines / sequence of arrows, but one in wrong direction (1) only</p> <p>If:</p> <div style="display: flex; align-items: center; justify-content: center;">  (2) </div>			3	3		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				<div><div>berries</div><div>grasshopper / butterfly / greenfly</div><div>frog/ladybird</div><div>snake/titmouse</div><div>buzzard</div></div> <div>(2)</div>						
FT HT	(e)			383 (1) 3 368 (1) =11.37 / 11.4 / 11 (1) 0.11 / 0.1137 (2)	1	2		3	3	
				Question 8 & 1 total	6	9	10	25	5	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2.	(a)	(i)		Bases along each strand pair up (by weak/hydrogen) bonds)(1) A-T and C-G (1)	2			2		
		(ii)		X-rays are ionising (1) CAT scans are ionising (1) Ultra sound and MRI are not ionising so no risk (so disagree) (1)			3	3		
	(b)			Any 2 × (1) from: High frequency sound waves (1) Reflections/echos (1) off different (density) tissues (1)	2			2		
				Question 2 total	4		3	7		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3.	(a)			One muscle contracts (1) The other muscle relaxes (1) Dorsalextension produced by contraction of tibialis anterior / Plantarflexion produced by contraction of calf muscle (1)	1	2		3		
	(b)			(Can't train or compete due to) pain (1) Due to bone rubbing bone / cartilage breakdown (1) Stiffness / swelling / unable to put weight on leg / joint feels loose (1)	3			3		
	(c)	(i)		Speed = distance/time/The faster the speed the shorter the time (1) Last 100 m was ran in 15.6 s / 1st 100 metres ran in 11.4 s / 2 nd 100 metres ran in 14s / 3 rd 100 metres ran in 15.55 s (1) This isn't the shortest time to travel 100m / all other 100m times are shorter / the shortest time was in the 1 st 100 metres (so disagree) (1)			3	3	3	3
		(ii)		Scale on x-axis (10s/2cm) (1) Plots for Tom or Dafydd (1) line of best fit (1) plots (and line) for second person (1) {Curve/ line} for Dafydd is steeper so greater max speed (do disagree) (1) Penalty of (1) if lines do not go back to origin		5		5	5	5
				Question 3 total	4	7	3	14	8	8

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4.	(a)	(i)		Any 2 × 1 from: distances between burning food and bottom of tube – (otherwise variable heat loss) (1) masses of food used – (different masses release different amounts of energy) (1) volumes/mass of water in tube – (different volumes give different temperature rise) (1) surface area of food – (different amount of heat produced/more complete burning) (1) type of food– (different foods release different amounts of energy/ contain different amounts of energy) (1)	2			2		2
		(ii)		Water in tube does not absorb all the heat /heat lost to surroundings (1) Incomplete combustion of food (1)			2	2		2
		(iii)		Any 3 × (1) from: Provides oxygen to encourage complete combustion (1) Jacket of air surrounds the combustion chamber - insulating (1) Copper coil for better conduction/heat transfer to water (1) Stirrer to mix warm and cold water (1)		3		3		3
	(b)			20 × 15.4 × 4 200 (1) Ans / 1 000 = 1 293.6 J (1) 1 293.6 (ecf) ÷ 12.4 = 104.3 (J/g) (1) 1 293.6 on ans line (2) 1 293 600 on ans line (1) 104 300 on ans line (2)		3		3	3	3
				Question 4 total	2	6	2	10	3	10

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5.	(a)			<p>Any 3 × (1):</p> <ul style="list-style-type: none"> • Maintaining habitats / provide safe areas for species • Poaching in protected areas • Not all habitats represented e.g. ocean or freshwater • Some species (large cats / bears) need large areas to feed and find mates • so corridors are needed to connect nature reserves and this is uncommon. 	3			3		
	(b)			<p>Indicative content:</p> <p>Reduce/reuse/recycle:</p> <ul style="list-style-type: none"> • reduce polluting effects of waste • There are problems with increased consumption of resources. Measures to reduce their use include reduce, reuse and recycle schemes. • There are problems created by waste and the increasing demand for landfill sites. This can also benefit from reuse and recycle schemes. • Less energy use with recycling than processing raw materials so less production of greenhouse gases. <p>Biodegrading:</p> <ul style="list-style-type: none"> • The use of biodegradable materials in packaging has a beneficial effect. • Disposal of plastics and their non-biodegradability puts pressure on landfill sites • And can be harmful to wildlife. <p>Bioaccumulation:</p> <ul style="list-style-type: none"> • Heavy metals and pesticides can bioaccumulate in animals. 	6			6		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				<p>Biodiversity</p> <ul style="list-style-type: none"> Increased land use for building destroys habitats and reduces biodiversity / increased extinction of species To maintain biodiversity it is important that there are seed banks, captive breeding programmes and protected habitats. <p>Global warming</p> <ul style="list-style-type: none"> Increased Carbon footprint Increased temperature Rising water levels Extreme weather Reduce fossil fuel use Increased use of renewables <p>Eutrophication</p> <ul style="list-style-type: none"> Fertilizers enter water system Algal bloom Dead fish <p>Acid Rain</p> <ul style="list-style-type: none"> Changes pH of lakes Kill fish Destroy forests 						

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				<p>5-6 marks 5 or 6 points from any area <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.</i></p> <p>3-4 marks 3 or 4 points from any area <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.</i></p> <p>1-2 marks 1 or 2 points from any area <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.</i></p> <p>0 marks <i>No attempt made or no response worthy of credit.</i></p>						
				Question 5 total	9			9		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6.	(a)	(i)		Earth based are cheaper /some wavelengths do not penetrate atmosphere / can use a larger telescope on Earth (1) Space based clearer / detects more regions of em spectrum (1) Accept converse	2			2		
		(ii)		(the absorption spectra/light) is red shifted (1) Wavelengths have increased / as Universe expanded (1) following the Big Bang (1) Not CMBR	3			3		
	(b)	(i)		5 billion years		1		1		
		(ii)		Tick in 2 nd box X-rays take the same time to travel the same distance as radio waves.		1		1		
		(iii)		$3 \times 10^8 = 3 \times 10^{16} (1) \times \text{wavelength} (1)$ (use of correct frequency) $\text{wavelength} = 3 \times 10^8 / 3 \times 10^{16} (1)$ $= 1 \times 10^{-8} \text{ m} (1)$ Ans of $1 \times 10^{-11} (2)$ $9 \times 10^{24} (1)$ Correct manipulation of the written equation (1)		3		3	3	
				Question 6 total	5	5		10	3	