



GCSE MARKING SCHEME

SUMMER 2019

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

INTRODUCTION

This marking scheme was used by WJEC for the 2019 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 2019 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)		plants		1		1		
		(ii)		baitfish		1		1		
		(iii)		Any 2 × (1) from: Number of porpoises decrease / less food for porpoises(1) Baitfish increase (1) Seabirds decrease / less food for seabirds(1)			2	2		
	(b)			(Toxins) build up in a food chain / bioaccumulation (1) to <u>{toxic/poisonous}</u> levels (1)	2			2		
				Question 1 total	2	2	2	6		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		(human cells) in the laboratory (1) on animals (1) on humans (1) Any order	3			3		
		(ii)		Any 2 × 1 from: Could be harmful (to animals / humans) (1) animals don't have a choice (1) keeping animals for drug testing is cruel (1) religious reasons (1)	2			2		
	(b)	(i)		reduces the risk of blood clots occurring (1) and so the chances of a heart attack/stroke (1)	2			2		
		(ii)		aspirin can cause bleeding (in the patient's stomach) / stomach ulcers (1)	1			1		
				Question 2 total	8			8		

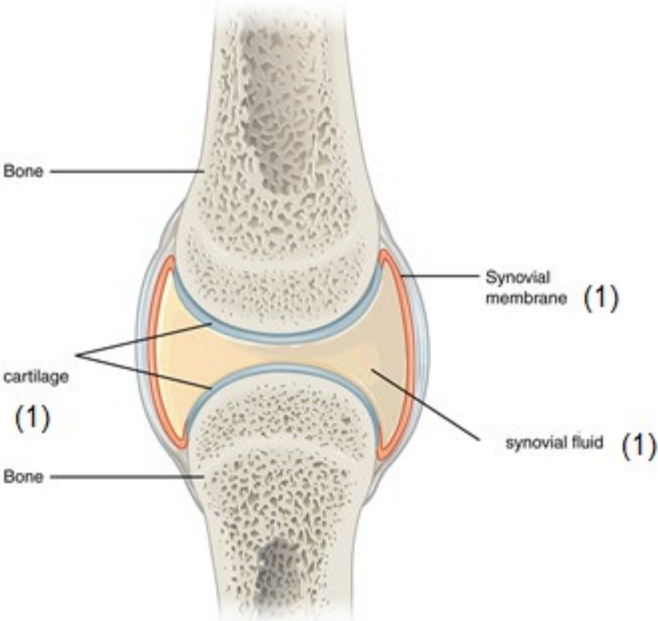
Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		3		1		1		1
		(ii)		C and D		1		1		1
		(iii)		Mean of 3 per quadrat (1) So $15 \times 3 = 45$ (1)		2		2	2	2
		(iv)		Take more quadrat samples/ use a capture-recapture technique / more than 3 quadrats			1	1		1
	(b)			Universal name / more than 1 common name (1)	1			1		
				Question 3 total	1	4	1	6	2	5

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4				Indicative content: The main parts of the electromagnetic spectrum are gamma rays, X-rays, ultraviolet, visible light, infra-red, microwaves and radio waves. Images of the universe are taken by Earth based systems, and space craft and transmitted to Earth. Electromagnetic waves are used to study structures in the universe e.g. • X-ray images of stars • ultra violet images of the Sun, galaxies and the planets • visible light images of the Sun, the planets, moons and galaxies • infra-red images of the Sun, the planets and the Milky Way • microwave images of the Sun • radio wave images of stars • gamma images of black holes 5–6 marks Full list of em spectrum regions, 3 or more types of images, from Earth or space craft. <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>	6	1		1		1

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				3–4 mark Lists 4+ regions of the em spectrum and states 2 examples of the types of images that can be produced. OR Full list (7) regions of the em spectrum with one use with Earth-based or space craft – based. <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> 1–2 marks Lists 1+ regions of the em spectrum OR One region and its use <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> 0 marks <i>No attempt made or no response worthy of credit.</i>						
				Question 4 total	6			6		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		Ticks in boxes 1, 3, 5	3			3		
		(ii)		Flu virus <u>mutates</u> / new <u>strains</u> of flu	1			1		
	(b)			Antibiotics providing best protection are A/B/C/D/F (1) E or H are not very effective against bacteria (1) G not effective so agree (1) 2 marks max without judgement 0 marks if no letters of antibiotics stated			3	3		3
				Question 5 total	4	0	3	7		3

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		Velocity = 45/0.5 subs (1) = 90 cm/s (1)	1	1		2	2	2
		(ii)	I	1.7		1		1	1	1
			II	1.2 + 1.3 + 1.1 + 1.2 = 4.8 (1) anomaly ignored (ecf) mean = 1.2 s (1) Anomaly included so answer of 1.3 (1 only)		2		2	2	2
		(iii)		acceleration = 90/1.2 (ecf) subs of selected data (1) = 75 (cm/s ²) (1) If ecf of 1.3 expect answer of 69.23 (2)		2		2	2	2
	(b)	(i)		2 × (1) from: h ₂ (1) shape of ramp (1) length of ramp (1) slope of ramp (1)	2			2		2
		(ii)		5 correct points ± < 1 small square tolerance (2) 4 correct points ± < 1 small square tolerance (1) 3 correct points ± < 1 small square tolerance (0) Straight line of best fit through origin (1)		3		3	3	3
		(iii)		Reading from their graph Expect 35(m/s ²)		1		1	1	1

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		 Diagram of a synovial joint showing the articulation of two bones. The bones are covered by a layer of cartilage. The joint space is filled with synovial fluid, which is enclosed by a synovial membrane. Labels point to the bone, cartilage, synovial membrane, and synovial fluid.	3			3		
		(ii)		Compound		1		1		
				Question 6 total	6	11		17	11	13

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)	(i)		48 hours		1		1		
		(ii)		10 years		1		1		
	(b)	(i)		1982		1		1		
		(ii)		No data between 1976 and 1982 / gap of 6 years			1	1		
		(iii)		There was a drop of <u>0.4%</u> between 2006 and 2008 (1) Which is lower than other periods so not supported (1)			2	2	2	
				Question 7 total		3	3	6	2	

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
8 FT 1 HT	(a)	(i)		23 units		1		1	1	
		(ii)		Time before driving = 14 hours (1) 23 units (ecf) not processed so unable to drive/should allow 23 hours (1) OR 9 unit over so not safe to drive (2) OR Won't be safe to drive until 10 pm (2)			2	2		
	(b)	(i)		Servings are of different sizes/amounts (1) so need to scale up/down the figures/ should be per 100g (1)			2	2		
		(ii)		Wheat Squares (1) No salt/highest protein /highest fibre(1)		2		2		
	(c)			BER = $32 \times 70 = 2240$ (1) EER = $8.5 \times 4 \times 70 = 2380$ (1) PER = BER (ecf) + EER (ecf) = 4 620 units (1)	1 1	1		3	3	

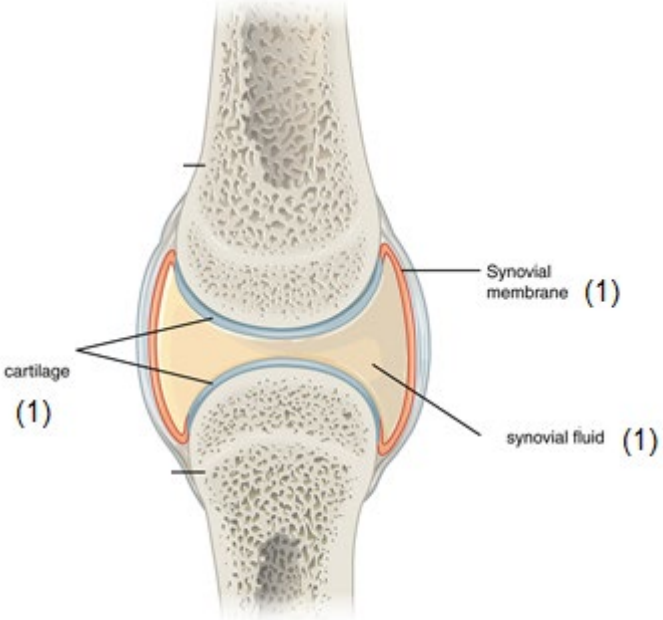
Question				Marking details	Marks Available														
					AO1	AO2	AO3	Total	Maths	Prac									
	(d)	(i)		90 kg Accept 86.7 kg		1		1											
		(ii)		As BMI doubles from 14 to 28 mass also doubles from 40 to 80 Therefore yes they are proportional. 2 marks for above. 1 mark if final 'yes' statement not included			2	2	2										
		(iii)		Subs 75/2.56 or 2.6 (1) = 29.3/29.29 or 28.8/29 (1)	1	1		2	2										
	(e)	(i)		<table border="1"><tr><td></td><td>d</td><td>d (1)</td></tr><tr><td>D</td><td>Dd</td><td>Dd</td></tr><tr><td>d (1)</td><td>dd</td><td>dd (1 ecf)</td></tr></table>		d	d (1)	D	Dd	Dd	d (1)	dd	dd (1 ecf)		3		3		
	d	d (1)																	
D	Dd	Dd																	
d (1)	dd	dd (1 ecf)																	
		(ii)		50 % (must be consistent with Punnett square) If Punnett square is blank accept 50%		1		1	1										
				Question 8 total	3	10	6	19	9										

HT

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)			Any 2 ×(1) from: Blood pressure and pulse drop in first 30 minutes. (1) {blood oxygen levels increase/less CO} after 8 hours. (1) Circulation improves after 2 weeks-3 months (1) After a year, risk of heart disease drops to half of that of a smoker. (1) Plus: Cardiovascular system has become <u>more efficient</u> because circulation improves. (1) If no times indicated (1) max If factors not related to circulatory system included (0)		3		3		
	(b)			Drop in 2000 <u>and</u> 2012 (1) (rate of) increase at other times (1) was inconsistent (1) any reference prior to 1996 neutral			3	3	3	
				Question 2 total HT		3	3	6	3	

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			Lay two (20m) tape measures at right angles along two edges of the area to survey / produce grid(1) Roll two (20 sided) dice to determine the coordinates/ random number generator/pull numbers out of hat (1) Place the quadrat (at the place where the coordinates meet) and count the number of snails (1)	3			3		3
	(b)	(i)		Species A: not present in either habitat (1) Species C: More common {and evenly distributed in habitat X/ Unevenly distributed in habitat Y } (1) Species D: Less common in habitat X but evenly distributed in both habitats (1) Any (1) for 4 th mark: Species B, C and D present in X <u>and</u> C and D present in Y (1) Species B: present in habitat X and not present in habitat Y (1) If no species or habitat identified (0)		4		4	4	4
		(ii)		Area of habitat irrelevant since only counting numbers in a constant quadrat area so disagree.			1	1		1
				Question 3 total	3	4	1	8	4	8

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			Velocity = 0.45/0.5 subs and conversion (1) = 0.9 m/s (1) acceleration = 0.9/1.2 (ecf) subs of selected data (1) = 0.75 (m/s ²) (1) Answer of 75 m/s ² (3) Answer of 90 (1)		4		4	4	4
	(b)	(i)		Axes labels including units with scales starting from 0,0 shown(1) 5 Points ($\pm < 1$ small square)(1) Ignore 0,0 Straight line of best fit must go through the origin(1)		3		3	3	3
		(ii)		Reading from their graph (0.7)		1		1	1	1
		(iii)		Vary h_2 (1) Keep shape and h_1 constant (1)			2	2		2

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		 The diagram shows a cross-section of a synovial joint. Two bones are visible, with a layer of yellow cartilage between them. The joint is surrounded by a blue synovial membrane. The space between the bones is filled with a yellowish synovial fluid. Labels with leader lines point to the synovial membrane (1), cartilage (1), and synovial fluid (1).	3			3		
		(ii)		increases friction in the joint (1) (Will be painful if) bones rub together (1)		2		2		
		(iii)		Compound	1			1		
				Question 4 total	4	10	2	16	8	10

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			Any 4 × (1) from: soil {bacteria / fungi} act as decomposers, (1) converting {proteins / urea} into ammonia; (1) ammonia is converted to nitrates(1) which are taken up by plant roots (1) and used to make new protein (1)	4			4		
	(b)			Any 4 × (1) from: Washes into rivers/leaching (1) and causes the rapid growth plants and algae/algal bloom(1) (blocks sunlight) death of plants and algae (1) {bacteria/microbes/decomposers} break them down (1) (bacteria) use up the dissolved oxygen in the water / respiration(1) animals, including fish, may suffocate (1) use of pesticides neutral No marks for the term 'eutrophication' without qualification	4			4		
				Question 5 total	8			8		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		vaccines contain <u>antigens</u> (that are derived from disease-causing organisms) (1) vaccines stimulate <u>antibody</u> production (to protect against bacteria and viruses) (1)	2			2		
		(ii)		The <u>memory cells</u> produce (specific) antibodies (1) The flu virus has a high mutation rate (1) resulting in different antigens (1) not recognized by the memory cells (1) References to bacteria neutral	1	3		4		
	(b)	(i)		Antibiotics that are most effective are A, (B),C,D, and F (1) Some effectiveness for (B), E, <u>and</u> H (1) G not effective (1)			3	3		3
		(ii)		Shows what normal growth of bacteria looks like/compare to normal growth (1) It shows that the antibiotics, and not the paper, are affecting the bacteria. (1)	2			2		2
				Question 6 total	5	3	3	11		5

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)			microwaves	1			1		
	(b)			Indicative content: The Steady State Theory suggests that the Universe is always expanding with matter being continuously created to form new stars and galaxies to fill in the gaps Evidence The wavelength of the early radiation in the form of short wavelength/high energy radiation (gamma rays) has become longer wavelength / stretched (microwave) radiation. This is CMBR that presently pervades the Universe. Cosmological redshift means that light stretches as space expands. In fact, it stretches so much that by the time light gets to us from distant galaxies, absorption spectra from them show that black lines have moved to the red end of the spectrum. Both of the above support the Big Bang theory.	6			6		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				5 – 6 marks Full description and how evidence disagrees with Steady State theory. <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> 3 – 4 mark Reference to Big Bang and full description of CMBR or cosmological red shift or steady or partial description of more than one. <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> 1-2 marks Any reference to Big Bang or cosmological red shift or steady state <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> 0 marks <i>No attempt made or no response worthy of credit.</i>						
				Question 7 total	7			7		

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	2	2	2	6	2	2
2	8			8	8	
3	1	4	1	6	1	4
4	6			6	6	
5	4	0	3	7	4	0
6	6	11		17	6	11
7		3	3	6		3
8	3	10	6	19	3	10
TOTAL	30	30	15	75	30	30

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	3	10	6	19	9	
2		3	3	6	3	
3	3	4	1	8	4	8
4	4	10	2	16	8	10
5	8			8		
6	5	3	3	11		5
7	7			7		
TOTAL	30	30	15	75	24	23