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# **GCSE MARKING SCHEME**

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**SUMMER 2018**

**GCSE (NEW)  
APPLIED SCIENCE (SINGLE AWARD)  
UNIT 2 COMBINED  
3440U20-1 / 3440UB0-1**

## **INTRODUCTION**

This marking scheme was used by WJEC for the 2018 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 COMBINED (NEW)

## SUMMER 2018 MARK SCHEME

### Foundation TIER

#### 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 FT	(a)			Skull - fixed (1) Hip - ball and socket (1) Elbow – hinge (1)	3			3		
	(b)			arthritis/bone cancer  accept osteoporosis	1			1		
				<b>Question 1 total</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>0</b>

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
2 FT	(a)	(i)	2300 kcal (1)		1		1	1	
		(ii)	(More) carbohydrate (1) (More) protein (1)		2		2		
	(b)	(i)	muscle cramps	1			1		
		(ii)	high blood pressure	1			1		
		(iii)	obesity	1			1		
	(c)	(i)	3.61		1		1	1	
		(ii)	$\frac{110}{3.61}$ (1) (ecf) 30.5/30.47(1) Accept 30	1	1		2	2	
		(iii)	Obese (ecf)			1	1		
			<b>Question 2 total</b>	<b>4</b>	<b>5</b>	<b>1</b>	<b>10</b>	<b>4</b>	<b>0</b>

Question				Marking details	Marks Available															
					AO1	AO2	AO3	Total	Maths	Prac										
3 FT	(a)			Tongue rolling(1) Blood group (1) Eye colour (1)	3			3												
	(b)			<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>N</td> <td>n</td> </tr> <tr> <td>N</td> <td>NN</td> <td>Nn</td> </tr> <tr> <td>n</td> <td>Nn</td> <td>nn</td> </tr> </table> <p>Parents (1) Cross (1) (allow ecf)  25% (1)</p>		N	n	N	NN	Nn	n	Nn	nn		2		1	3		
	N	n																		
N	NN	Nn																		
n	Nn	nn																		
				<b>Question 3 total</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>6</b>	<b>0</b>	<b>0</b>										

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4 FT	(a)	(i)		23 (1)		1		1	1	1
		(ii)		E (1) Largest (clear) zone or description (1)			2	2		2
		(iii)		31 (in row C)			1	1		1
		(iv)		Same person doing the experiment again (using the same equipment)			1	1		1
	(b)	(i)		overuse of antibiotics/not completing the full course of antibiotics	1			1		
		(ii)		Any 2 x (1) from:  sterilisation of equipment (1) using disposable equipment/gloves (1) washing hands / hand sanitizer(1) isolation of patients/barrier nursing(1)	2			2		
				<b>Question 4 total</b>	<b>3</b>	<b>1</b>	<b>4</b>	<b>8</b>	<b>1</b>	<b>5</b>

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5 FT	(a)			The time taken for the activity of a radioactive sample to decrease by half	1					
	(b)	(i)		Horizontal or vertical line added to the graph(1) correct value taken from the graph -30 years (1)		2			2	
		(ii)		3 (allow ecf)		1			1	
		(iii)		$^{137}_{55}\text{Cs} \rightarrow ^{137}_{56}\text{Ba} + ^{-1}_0\text{e}$  (middle equation)	1					
	(c)	(ii)		Beta particles are ionising (1) Damages/mutates cells/DNA (1)	2					
				<b>Question 5 total</b>	<b>4</b>	<b>3</b>	<b>0</b>	<b>7</b>	<b>3</b>	<b>0</b>



Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
6 FT	(a)	(i)	7 points correctly plotted ( $\pm$ less than 1 square) (2) 6 points correctly plotted ( $\pm$ less than 1 square) (1) 5 or fewer points correctly plotted (0)  Suitable curve of best fit (1) goes through 0,0 and 20s treated as anomaly Do not accept sketchy/thick/feathered/double lines		3		3	3	3
		(ii)	50 s			1	1		
		(iii)	Steeper incline (above 30°C) /to the left(1) Plateaus (sooner) at 7.6 (1)		2		2		2
	(b)	Rate of reaction increases(1) More acid particles available for (successful) collision (per unit volume) (1)	2			2			
			<b>Question 6 total</b>	<b>2</b>	<b>5</b>	<b>1</b>	<b>8</b>	<b>3</b>	<b>5</b>

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
7 FT	(a)	(i)	Constant velocity / 12 m/s accept steady speed		1		1		
		(ii)	Constant deceleration		1		1		
		(iii)	4-10 s			1	1		
	(b)	(i)	12 × 6 (subs)(1) =72 (1)	1	1		2	2	
		(ii)	$\frac{12}{4}$ (subs) (1) 3 (1)	1	1		2	2	
	(c)		<p>For both the office worker and the athlete the heart rate increases to supply oxygen to muscles and remove carbon dioxide from muscles, when exercise starts. The office worker heart rate increases more rapidly than the athlete and heart rate reaches a higher level than the athlete. The athlete's heart is stronger pumps more efficiently.</p> <p>For both the athlete and office worker the heart rate decreases after exercise stops as oxygen does not need to be delivered to the muscles as quickly, and carbon dioxide does not need to be removed as quickly. The athlete's recovery time is shorter than the office worker and returns to resting heart rate more quickly.</p> <p><b>5/6</b> Correct comparison for all sections of both graphs. Complete, detailed explanation of both graphs.</p> <p>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.</p>	2	2	2	6		

			<p><b>3/4</b> Correct description of part of the graphs linked to partial explanation  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</p> <p><b>1/2</b> attempted correct description of the graphs or comparison of the two graphs.  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.</p>						
			<b>Question 7 total</b>	<b>4</b>	<b>6</b>	<b>3</b>	<b>13</b>	<b>4</b>	<b>0</b>

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
8 FT 1 HT	(a)	(i)	Substance that speeds up the reaction (1) Without being used up (1)	2			2		
		(ii)	Any 2 × (1) from: Speeds up reaction (1) Reducing energy costs/cheaper(1) Reducing damage to environment/less greenhouse gases(1)  Accept - Use less reactants/increases yield (1)	2			2		
	(b)	(i)	Height of foam		1		1		1
		(ii)	Any 2 × (1) from: Mass of catalyst (1) Number of drops / volume of washing liquid (1) Volume of hydrogen peroxide (1) Concentration of hydrogen peroxide (1) Particle size of catalyst (1) {Diameter/size} of measuring cylinder (1) temperature (1)  Do not accept 'amount'		2		2		2
	(c)		Manganese(IV) oxide (1) {Largest volume of/most} froth produced per unit time (1)		1	1	2		1
	(d)		Volume of oxygen is not accurately measured(1) - Improvement of measurement of oxygen produced (e.g. count bubbles, don't have open to air, use delivery tube/gas syringe) (1)  <b>Or</b>  Difficult to measure height of foam (1) - use narrower measuring cylinder (1)			2			2

			<p><b>Or</b></p> <p>Getting same size drop (1) – Measure/ pipette measured volume of washing up liquid drop (1)</p> <p><b>Or</b></p> <p>Poor stability of foam (1) Improvement of measurement of oxygen produced (eg. count bubbles, don't have open to air, use delivery tube/gas syringe) (1)</p> <p><b>Or</b></p> <p>Mass of catalyst (ie. 1 spatula) will vary (1) Weigh a specific mass of the catalyst (1)</p>						
			<b>Question 8/1 total</b>	<b>4</b>	<b>4</b>	<b>3</b>	<b>11</b>	<b>0</b>	<b>6</b>

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
9 FT 2 HT	(a)	(i)	removes electrons from atoms	1			1		
		(ii)	CAT scan requires multiple X-ray images	1			1		
	(b)	(i)	CAT (1) Relatively quick to perform <u>and</u> can still see all (bone and soft) tissue		2		2		
		(ii)	Gamma camera (1) Can be targeted to (kidneys) <u>and</u> produces real time image(1)		2		2		
	(c)		already received too much radiation for year (over 20) / received 21.57 (1) Therefore MRI or ultrasound as doesn't increase dose of radiation (1)			2	2		
			<b>Question 9/2 total</b>	<b>2</b>	<b>4</b>	<b>2</b>	<b>8</b>	<b>0</b>	<b>0</b>

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
3 HT	(a)	(i)	Diet C (1)  Energy intake $2.5 \times$ normal AND high in carbohydrates (1)			2	2		
	(b)		too little can cause cramp (1) (so can't continue race) too much can cause high blood pressure (1)	2			2		
	(c)		Calculating change in BMI (1) = 6 mass = BMI $\times$ height <sup>2</sup> (Re-arranging formula) (1) change in mass = $6 \times 1.94 \times 1.94$ (Substitution) (1) = 22.6 kg (1)  OR mass = BMI $\times$ height <sup>2</sup> (re-arranging formula)(1) mass = $30 \times 1.94 \times 1.94$ or $24 \times 1.94 \times 1.94$ (Substitution) (1) 112.9 - 90.3 (Calculating change of mass)(1) = 22.6 kg (1)	1	1 1		4	4	
<b>Question 3 total</b>			<b>3</b>	<b>3</b>	<b>2</b>	<b>8</b>	<b>4</b>		

Question			Marking details	Marks Available														
				AO1	AO2	AO3	Total	Maths	Prac									
4 HT	(a)		Use of Punnett square (or similar) diagram with correct genotype of parents (1)  Correct Cross (ecf) (1)  <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>N</td> <td>n</td> </tr> <tr> <td>N</td> <td>NN</td> <td>Nn</td> </tr> <tr> <td>n</td> <td>Nn</td> <td>nn</td> </tr> </table> Correct conclusion 50% / 0.5 / ½ (ecf) (1)		N	n	N	NN	Nn	n	Nn	nn		2		3		
		N	n															
N	NN	Nn																
n	Nn	nn																
	b		Any 2 × (1) from: Whether embryo is screened (1) whether termination is appropriate (1) Whether to have children (1) IVF/surrogacy (1)	2			2											
<b>Question 5 total</b>				<b>3</b>	<b>2</b>	<b>0</b>	<b>5</b>											



Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
5	(a)		number of half-lives = 3 (1) number of years = $3 \times 28 = 84$ (1) year safe to eat = 2100 (OWTTE) so John is incorrect (1)			3	3		
	(b)	(i)	LHS (1), RHS(1), balancing(1)  ${}_{92}^{235}\text{U} + {}_0^1\text{n} \rightarrow {}_{55}^{137}\text{Cs} + {}_{37}^{96}\text{Rb} + 3 {}_0^1\text{n}$		3		3		
		(ii)	3 (ecf) neutrons that are released can each hit uranium nuclei (1) Each nucleus will split and release three more neutrons / 9 (ecf) more neutrons are released total (1)	2			2		
			<b>Question 5 total</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>8</b>	<b>3</b>	

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)			12/10 (using values from graph )(1) = 1.2 (1)		2		2	3	1
	(b)			1 mark per region calculated correctly up to 3  0-4s Area of triangle $(2 \times 4)/2 = 4$ (1) 4-10s Area of trapezium $(2 + 12)/2 \times 6 = 42\text{m}$ (1) (or area of triangle and rectangle) 10-12s Area of rectangle = $2 \times 12 = 24$ (1) 12-14s Area of triangle = $(2 \times 12)/2 = 12$ (1)  (4) regions added together (1) allow ecf Answer = 82m		4		4	4	1
	(c)			82/14 ( ecf) 5.86	1	1		2	1	
				<b>Question 6 total</b>	<b>1</b>	<b>7</b>	<b>0</b>	<b>8</b>	<b>8</b>	<b>2</b>

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
7	(a)		Any 2 × (1) from: overcrowding (1) poor sanitation (1) lack of access to doctors/medicine (1)	2			2		
	(b)	(i)	to be able to compare (countries/populations)	1			1		
		(ii)	$28\,000 (\pm 500) \times 100\,000/85\,000\,000$ (substitution )(1) $= 3.29 / 3.3$ (1)	1	1		2	2	1
		(iii)	drop = $28\,000(\text{ecf}) - 1000 (\pm 500) = 27\,000$ (1) % = $27\,000/28\,000(\text{ecf}) \times 100 = 96.4$ (1)		2		2	2	1
	(c)		<p>Vaccines work by stimulating antibody production to fight disease without actually infecting us with the disease. This level increases quickly, but then decreases before achieving the threshold of immunity.</p> <p>One type of white blood cell, called a lymphocyte, multiplies to form clones of cells. These secrete antibodies specific to the foreign antigen that is present. Antibodies eventually assist in the destruction of the cells bearing the foreign antigen. Memory cells that are produced following vaccination that produce specific antibodies very quickly and in large numbers if the same antigen is encountered by giving a booster.</p> <p>By giving a booster a larger number memory cells is produced which therefore produce more antibodies and allow threshold of immunity to be reached. Large amounts of memory cells are then available to produce antibodies in real infection</p> <p><b>5 – 6 marks</b> Detailed description of how antibodies are produced and how vaccination increases number of memory cells leading to immunity. The purpose of the booster are stated.</p>	6					

			<p>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.</p> <p><b>3 – 4 marks</b> Some description of how antibodies are produced and purpose of a booster.</p> <p>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.</p> <p><b>1-2 marks</b> A basic description of how a vaccination programme works OR trend in the graph.</p> <p>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.</p>						
	(d)		<p>the number of people catching the disease goes down / more people are immune(1) /(Allow converse) it's harder for a disease to pass between people (who have not been vaccinated)/ herd immunity. (1)</p>	2			2		
			<b>Question 7 total</b>	<b>12</b>	<b>3</b>	<b>0</b>	<b>15</b>	<b>4</b>	<b>2</b>

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)	endothermic {absorb/take in} energy during reaction <u>whereas</u> exothermic gives energy out / in endothermic reactions the temperature decreases <u>and</u> in exothermic reactions the temperature increases	1			1		
		(ii)	A (1) Energy in products is greater than reactants / and largest rise(1)			2	2		
	(b)		(Heat energy from the reaction) can't escape/ increases the temperature thus speeding up the rate of reaction(1)  Leading to explosions/fires (1)	2			2		
	(c)	(i)	Reactant(s) have been used up		1		1		1
		(ii)	Tangent drawn (1) attempt at gradient (1) answer 20 +/- 1 (1) ecf from their tangent		3		3	3	3
		(iii)	Evidence of reading from graph (1) 1 minute = 45 (+/- 1), 2 minutes = 70 (+/- 1), 3 minutes = 85 (+/- 1), 4 minutes = 90 (+/- 1)  evidence of calculating for two successive minutes (1)  e.g. mass for first minute = 45, mass for second minute = 25 mass for third minute= 15, mass for fourth minute = 5  Not halving therefore not supported (1)			3	3	2	2
			<b>Question 8 total</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>12</b>	<b>5</b>	<b>5</b>

## Higher TIER

### SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	4	4	3	11	0	6
2	2	4	2	8	0	0
3	3	3	2	8	4	0
4	3	2	0	5	0	0
5	2	3	3	8	3	0
6	1	7	0	8	8	2
7	12	3	0	15	4	2
8	3	4	5	12	5	6
<b>TOTAL</b>	<b>30</b>	<b>30</b>	<b>15</b>	<b>75</b>	<b>24</b>	<b>16</b>

## FOUNDATION TIER

### SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	4	0	0	4	0	0
2	4	5	1	10	4	0
3	3	2	1	6	0	0
4	3	1	4	8	1	5
5	4	3	0	7	3	0
6	2	5	1	8	3	5
7	4	6	3	13	4	0
8	4	4	3	11	0	6
9	2	4	2	8	0	0
<b>TOTAL</b>	<b>30</b>	<b>30</b>	<b>15</b>	<b>75</b>	<b>15</b>	<b>16</b>