



GCSE MARKING SCHEME

SUMMER 2018

**GCSE (NEW)
APPLIED SCIENCE (DOUBLE AWARD) - UNIT 1
3445U10-1 / 3445UA0-1**

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 (DOUBLE AWARD)
UNIT 1 - ENERGY, RESOURCES AND THE ENVIRONMENT
SUMMER 2018 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

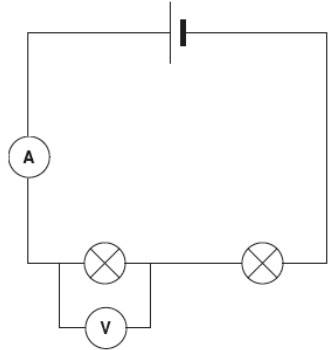
The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only
ecf = error carried forward
bod = benefit of doubt

FOUNDATION & HIGHER TIER

Question			Marking details		Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1 FT	(a)		Raw Material	Extraction Method	2			2		
			crude oil	fractional distillation						
			shale gas	drilling						
			metal ores e.g. haematite	surface mining						
			Gases e.g. oxygen	fracking						
		<p>3 correct (2) 1/2 correct (1)</p>								
	(b)	(i)	180 – 260				1	1		
		(ii)	<u>Fractional</u> distillation		1			1		
		(iii)	Heated / boiled Do not accept 'warmed.		1			1		
		(iv)	Diesel			1		1		

Question			Marking details					Marks Available					
								AO1	AO2	AO3	Total	Maths	Prac
(c)	(i)		Decreases					1			1		
	(ii)		Increases					1			1		
(d)			Monomer	Chemical formula	Structural formula	Polymer	Structure of polymer				3		
			Ethene	C_2H_4		polyethene							
			Vinyl chloride	C_2H_3Cl	(1) Cl may be attached to either C. Do not accept CL	PVC			3				
			Tetrafluoro ethene	C_2F_4 (1)		PTFE							
Ignore brackets, n must be included													
Question 1 total							6	4	1	11	0	0	

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2 FT	(a)	(i)		Series (1) the same as (1)	2			2		
		(ii)		Parallel (1) the same as (1)	2			2		
	(b)	(i)		Total resistance = $3 + 3 = 6$ (1) Substitution $\frac{9}{6}$ (ecf) (1) = 1.5 (1) Do not accept $\frac{9}{3} = 3$	1	1 1		3	3	3
		(ii)		Doubles Accept increase Accept a calculation to show this			1	1	1	1
	(c)			9×3 Subs (1) = 27 (1)	1	1		2	2	
	(d)			D 	1			1		1
	(e)			Any 2 × (1) from: Brighter lamps (1) if one breaks others still work / switched on independently(1) they will have the same voltage (1)	2			2		
Question 2 total					9	3	1	13	6	5

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
3 FT	(a)	(i)	Volume of soap used (to form a lather) Do not accept 'amount'	1			1		1
		(ii)	Same water sample to be checked by different technicians/ different technicians will check water samples		1		1		1
	(b)	(i)	<p>Indicative content Hard water areas are Southampton and Bristol. Soft water found in Birmingham and Manchester. Southampton has temporary hard water - so less volume of soap required to form a lather after boiling. Boiling softens temporary hard water. Calcium and/or magnesium hydrogen carbonates break down by boiling. Carbonates form lime-scale</p> <p>5– 6 marks Identification of cities with hard and soft water and candidates recognise the changes in the hardness of water by the volume of soap required. Candidates recognise that the water from Southampton has become softer as a result of boiling, (temporary hard water) so less soap required to form a lather. The candidates explain the chemical changes occurring in the temporary hard water with the formation of carbonate and lime-scale.</p> <p><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 Identification of cities with hard and soft water and candidates recognise the changes in the hardness of water by the volume of soap required. Candidates may recognise that the Southampton water has become softer as a result of boiling, (temporary hard water) less soap required to form a lather. They may mention formation of lime-scale.</p>		2	4	6		6

			<p><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>2 marks Candidates recognise cities with hard and soft water.</p> <p>OR</p> <p>Candidates recognise the changes in the hardness of water by the volume of soap required. May include a reference to temporary hard water in Southampton.</p> <p><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 used limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</i></p> <p>0 marks No attempt made or no response worthy of credit.</p>						
	(ii)		<p>Any 2 × (1) from: furring or lime-scale in a kettle (1) (lime-scale causing) blocked pipes (1) inefficient boilers(1) scum with soaps/uses a lot of soap/can't get bubbles/can't get lather (1) decreased lifetime of appliances (1)</p>	2					
			Question 3 total	3	3	4	10	0	8

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
4 FT	(a)	(i)	Protein	1			1		
		(ii)	Mouth (1) Lipase (1) amino acids (1) Stomach (1)	4			4		
	(b)	(i)	As temperature increases (above 20°C) starch digested faster (1) Fastest at 40°C/ Optimum at 40°C (1) At temperatures above 40°C starch digestion is slower (1) Award 'it goes up then goes down' for (1) Accept 'it gets faster and then slower and peaks at 40°C' for (2)		3		3		3
		(ii)	No digestion of starch/starch still present(1) 80°C enzyme denaturing (being destroyed) (1)			2	4		2
	(c)	(i)	(Add a few drops of) Benedicts reagent (1) Heat / boil(1) Do not accept 'warm'	2			2		2
		(ii)	Blue to {green/amber/(brick) red} (1)	1			1		1
			Question 4 total	8	3	2	13	0	8

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5 FT	(a)			$\frac{12}{16}(1) \times 100$ (subs) = 75% (1)	1	1		2	2	
	(b)	(i)		50(1) £50(1) (ecf) 500(1) £100 (1) (ecf) £650(1)(ecf) Answers must be in the table		5		5	5	
		(ii)		Correct reference to <u>total cost</u> – homeowner will save money by installing LED lamps so disagree with the homeowner (1) £650 (ecf) - £102.50 = £547.50 (ecf) (1) Conclusion must be consistent with the table		1	1	2		
				Question 5 total	1	7	1	9	7	0

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6 FT 1 HT	(a)			Nitric acid (1) water (1)	1	1		2		
	(b)	(i)		different to other values		1		1	1	1
		(ii)		20.3		1		1	1	1
	(c)			Starts at a low pH/pH1 as {acid is in excess/more acid than alkali} (1) At 20 cm ³ the acid is (exactly) <u>neutralised</u> by the alkali OR pH rises {sharply/from pH2-12} due to <u>neutralisation</u> (1) pH ends at 13 due to excess alkali (1)		3		3		3
	(d)	(i)		A C B (all correct)		1		1		1
		(ii)		A/Methyl blue (1) changes colour too late (1) Accept B + C change on the vertical region (1)			2	2		2
				Question 6 total	1	6	3	10	2	7

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7 FT 2 HT	(a)			Respiration releases carbon dioxide (1) increase CO ₂ indicator turns <u>yellow</u> (1)		2		2		2
	(b)			any 2 × (1) from: rate of respiration is higher (1) more cells in mouse respiring/mouse is bigger (1) warm blooded /constant temperature (1)		2		2		2
	(c)			any 2 × (1) from: Same mass of organisms (1) Same flow rate (of air) (1) same volume of indicator(1) same concentration of indicator (1) same concentration of carbon dioxide in the air flowing into the flask (1) same concentration of oxygen in the air flowing into the flask (1) Do not accept 'amount'	2			2		2
	(d)			Dead organisms/no organisms/replace with glass beads (1) Reference to keeping at least two controlled variables the same (1) Indicator remains red (1)			3	3		3
				Question 7 total	2	4	3	9	0	9

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
3 HT	(a)		supply electricity to consumers (1) Meet demand / provide reliable supply (1)	2			2		
	(b)		X – (step up transformer) reduces current/increases voltage (1) reduces energy loss/more efficient transfer (1) Y – (step down transformer) reduces voltage (1) safe(r) levels (1)	4			4		
	(c)	(i)	Power for each shed = 230×80 (1) = 18 400 W(1) $100/18.4$ (ecf) OR $100\,000/18\,400$ (ecf)(1) = 5.44 – 5 buildings so yes it can power 5 sheds / total power needed is less than 100 kW (1) OR $\frac{100\,kW}{5}$ (1) = 20 kW available for each shed (1) Power for each shed= 230×80 (1) = 18 400 W is less than the 20 000 available so can power the sheds(1) OR Current = $\frac{100\,000}{230}$ (1) =434.8 (1) $\frac{434.8}{5}$ (1) = 86.9 which is >80 A required for the shed so yes (1) OR		4		4	4	

			<p>Maximum current for 5 sheds= 5×80 (1) = 400 A (1) Max voltage available = $\frac{100\,000}{400}$ (1) =250 V which is more than the 230 required so yes (1)</p>						
		(ii)	<p>Uses {sustainable/renewable} energy (1) CO₂ released is absorbed by (new) plant growth (1) / Carbon neutral (1) So reduces contribution to Greenhouse effect (1)</p>	3			3		
			Question 3 total	9	4	0	13	4	0

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
4 HT	(a)	(i)	A – gall bladder (1) B – liver (1) C – stomach (1)	3			3		
		(ii)	Pancreas	1			1		
	(b)	(i)	Lipase digests fats form fatty acids – pH drops (1) pH drop (fat digestion) quicker in expt 2 (1) Bile emulsifies fat/splits into smaller droplets/greater surface area (1) which increases rate of enzyme action (1)	1	2		4		4
		(ii)	No reaction will occur/no change in pH (1) Enzymes have been denatured / altered active site / no enzyme-substrate complexes form(1)		2		2		2
	(c)		Lipid (substrates) attach to enzyme/ active site (1) Forms an enzyme-substrate complex (1) Enzyme able to break down lipid to glycerol <u>and</u> fatty acid (1)	3					
			Question 4 total	8	4	1	13	0	6

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5 HT	(a)			Total resistance = $8 + 4 = 12$ (1) $I = \frac{12}{12}$ (ecf) (1) $= 1$ A (1)		3		3	3	
	(b)	(i)		$\frac{1}{R_1} = \frac{1}{12} + \frac{1}{8} = \frac{5}{24}$, so $R_1 = 4.8$ (1) $\frac{1}{R_2} = \frac{1}{4} + \frac{1}{6} = \frac{5}{12}$, so $R_2 = 2.4$ (1) total resistance = $4.8 + 2.4 = (7.20 \text{ } [\Omega])$ (subs) (1) (ecf) (ecf)	1	2		3	3	
		(ii)		Current = $\frac{12}{7.2} = 1.67$ (1) (allow ecf for 7.2) Current splits $\frac{2}{3}$ (1) Power = $\frac{4}{9} \times 12 = 5.33$ W (1) Alternative Current = $\frac{12}{7.2} = 1.67$ (1) (allow ecf for 7.2) Pd across first parallel 1.67 (ecf) \times 4.8 (ecf) = 8.016 I in 12Ω resistor is $\frac{8.016}{12}$ (ecf) = 0.668 A (1) $P = I^2 R = 5.35$ [W] (1)		3		3	3	
				Question 5 total	1	8	0	9	9	0

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
6 HT	(a)	(i)	CaCO ₃ (1)+ CO ₂ (1)		2		2		
		(ii)	Calcium sulfate is present in permanent hard water (1) not broken down by boiling (1)	2			2		
	(b)	(i)	forms a lime scale (1) calcium carbonate precipitates (1)	2			2		
		(ii)	uses (concentrated) NaCl in resin columns (1) (two) Na ions <u>exchanged</u> for calcium ions. (1)	2			2		
	(c)		Needs to be replaced after time	1					
	(d)		causes {blocked pipes/limescale/furring} inefficient boilers (1)	2					
			Question 6 total	9	2	0	11	0	0

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
7 HT	(a)	(i)	<p>Indicative content Early on He and H₂ escaped from atmosphere. Water vapour present in early atmosphere (from volcanoes) condensed to form oceans. (As the earth cooled) the % of carbon dioxide has decreased to a fraction of 1%. This is due to: photosynthesis in green plants, using up carbon dioxide and releasing oxygen; More CO₂ locked up by animals evolving shells; subsequent formation of limestone; Carbon lock up in fossil fuels from the remains of simple marine organisms. Ammonia decomposed by a reaction with oxygen forming nitrogen the most abundant gas in the atmosphere. Reference to time 4.5-4.0 billion years ago and present day.</p> <p>5– 6 marks Candidates can give a comprehensive description of the changing composition of the atmosphere. They recognise the major changes in all gases. They give a comprehensive explanation of why these changes have occurred from early on to present day.</p> <p><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 Candidates can quantitatively (time or %) describe some changes in the atmosphere. OR Candidates can give some explanation or reasons for the changes in water vapour, carbon dioxide or oxygen.</p> <p><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</i></p>		2	4	6		

			<p><i>and some accurate spelling, punctuation and grammar.</i></p> <p>1-2 marks Candidates can describe some of the changes that have occurred in the atmosphere.</p> <p><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 used limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</i></p> <p>0 marks No attempt made or no response worthy of credit.</p>						
	(b)	(i)	<p>Compounds found on early Earth contained Carbon, Hydrogen, Nitrogen and Oxygen (1) Required to form (named) biological molecules (1)</p>			2	2		
		(ii)	<p>Earth was hot (1) increased electrical activity (lightning) on Earth (1)</p>			2	2		
			Question 7 total	0	2	8	10	0	0

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	6	4	1	11	0	0
2	9	3	1	13	6	5
3	3	3	4	10	0	8
4	8	3	2	13	0	8
5	1	7	1	9	7	0
6	1	6	3	10	2	7
7	2	4	3	9	0	9
TOTAL	30	30	15	75	15	37

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	1	6	3	10	2	2
2	2	4	3	9	0	9
3	9	4	0	13	4	0
4	8	4	1	13	0	6
5	1	8	0	9	9	0
6	9	2	0	11	0	0
7	0	2	8	10	0	0
TOTAL	30	30	15	75	14	15