GCE AS MARKING SCHEME

SUMMER 2019

AS LEVEL
PHYSICS - COMPONENT 1
B420U10-1

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.

AS COMPONENT 1 – MOTION, ENERGY AND MATTER

MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (except for the extended response question).

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 statement.

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)	$\dfrac{\text{stress}}{\text{strain}}$ (1)	1			1		
		(ii)	Strain: no units (1) Stress: $\dfrac{\text{kg m s}^{-2}}{\text{m}^2}$ (1) Young modulus: kg m^{-1} s^{-2} (1)	1	1 1		3	3	
	(b)	(i)	's' shape on graph (1) Loading and unloading labelled (1) Hysteresis shown (1)	3			3		3
		(ii)	Weak (van de Waals) bonds between molecules / unravelling of long chain molecules (1) Easily broken / strong (metallic) bonds in metals (1)		2		2		
		(iii)	Molecules become more entangled / vibrations increase (1) Increase (1)	2			2		
			Question 1 total	**7**	**4**	**0**	**11**	**3**	**3**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
2	(a)		Energy cannot be created or destroyed only changed from one form to another	1			1		
	(b)	(i)	Length from top of pendulum = $2 \cos 48° = 1.34$ [m] (1) Height pendulum rises = $2.00 – 1.34 = 0.66$ [m] (1)		2		2	2	
		(ii)	$\frac{1}{2}mv^2 = mgh$ (1) $v = 3.60$ [m s^{-1}] (1)		2		2	2	
	(c)	(i)	The vector sum of momentum before a collision equals the vector sum of momentum after collision / Accept total for vector sum of (1) provided no external forces act (1)	2			2		
		(ii)	$m_b v_b = 1.91 \times 3.6$ **ecf** (1) $v = 687(.6)$ or 688 [m s^{-1}] (1)		2		2	2	
	(d)		**Any 2 × (1) from:** - Students over the age of sixteen - Legitimate reason for scientific learning - Needs to be transported through school play ground -Possible dangers in transporting - Risk assessment made			2	2		
			Question 2 total	**3**	**6**	**2**	**11**	**6**	**0**

4

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
3	(a)		Force (of a spring) is <u>directly</u> proportional to its extension	1			1		
	(b)	(i)	$\frac{1}{2}kx^2 = \frac{1}{2}mv^2$ (1) k = 50 [N m^{-1}] (1) v = 3.0 [m s^{-1}] (1)		3		3	2	
		(ii)	$a = \dfrac{kx}{m}$ (1) a = 150 [m s^{-2}] and assumption that g is ignored (1)		2		2	1	
	(c)	(i)	Use of $v^2 = u^2 + 2as$ and $v = 0$ (1) $h = \dfrac{v^2}{2g}$ (1) h = 0.46 [m] (1) **Accept alternatives** Equating energies (1) Rearranging (1) h = 0.46 m accept 0.46 + 0.06 = 0.52 m (1)	1	1 1		3	2	
		(ii)	Use of $v = u + at$ or $t = \dfrac{u}{a}$ (1) Total time = 2 × 0.306 = 0.61 [s] (1)	1	1		2	2	
			Question 3 total	3	8	0	11	6	0

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
4	(a)		An object that absorbs all electromagnetic radiation [incident upon it]	1			1		
	(b)		Conversion of temperature 310 K (1) Use of $P = \sigma A T^4$ (1) P = 1047 [W] No he is incorrect / conclusion (1)			3	3	2	
	(c)	(i)	Reasonable attempt at two black body graphs skewed normal distribution curves (1) Curve labelled blue all above curve labelled red (1) λ_{max} blue to the left of λ_{max} red (1)	1	1 1		3		
		(ii)	For distribution to have a peak wavelength of green other colours are emitted / green is in the middle of the (light) spectrum (1) Star will appear white (1)			2	2		
			Question 4 total	**2**	**2**	**5**	**9**	**2**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
5	(a)		**Calculate the mass of the ruler, *R*** Put known mass on the 0 to 30 cm side of the ruler Adjust the mass until the ruler is level / balances Apply principle of moments to find mass of ruler / accept diagram **Finding unknown mass, *M*** Put unknown mass on 0 - 30 cm side of ruler Put known mass on 30 – 100 cm side Adjust until it balances **Calculating unknown mass, *C*** Apply principle of moments Unknown mass × distance to pivot Equals mass of ruler × 20 + known mass × distance to pivot **5-6 marks** Comprehensive description of how to calculate the mass of the ruler and how to find and calculate the unknown mass. *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.* **3-4 marks** Limited description of how to calculate the mass of the ruler and how to find and calculate the unknown mass OR comprehensive description of how to calculate the mass of the ruler OR comprehensive description of how to find and calculate the unknown mass. *There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure.*	6			6		6

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
			1-2 marks Limited description of how to calculate the mass of the ruler OR how to find and calculate the unknown mass. *There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure.* **0 marks** No attempt made or no response worthy of credit.						
	(b)		All force acts at 90º to wall (1) $R \times 3\sin 70°$ (1) $= 30 \times 9.8 \times 1.5\cos 70°$ (1) $R = 53.6$ [N] (1) N3 used to give direction horizontally to the left (1)		1 1 1	1 1	5	3	
			Question 5 total	6	3	2	11	3	6

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)	Constant / steady velocity no resultant / overall force acting	1			1		
		(ii)	Ball bearing attracted to (centre of) the earth and the earth attracted to the ball bearing/ w.t.t.e. (1) Ball bearing pushing down on the oil and the oil pushing up on the ball bearing / w.t.t.e. (1)			2	2		
	(b)		Mean time i.e. 5.6 **and** 3.9 (1) Velocity i.e. 0.699 or 0.70 **and** 1.2 or 1.20 (1) Uncertainty i.e. 0.1 **and** 0.2 (1) All s.f. consistent in all columns (accept first velocity value (i.e. 0.699 or 0.70) to 2/3 s.f.) (1)		4		4	4	4
	(c)	(i)	Scale suitable with at least half of the paper used (1) Axis labelled with units (1) All points plotted correctly with error bars for v except first value (1) Suitable line of best fit (1)		4		4	3	4
		(ii)	**Any 2 × (1) from:** - Straight line graph / constant positive gradient - Through the origin - Line of best fit through all the error bars / close to all points			2	2	2	2
			Question 6 total	1	8	4	13	9	10

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
7	(a)		Protons and neutrons are each made up of 3 quarks (1) Quarks and neutrinos are not made up of other particles (1)	2			2		
	(b)	(i)	No strong force / no electromagnetic force /only interact by weak force (1) They are uncharged (1)	2			2		
		(ii)	Conservation of charge $0 + 1 \rightarrow 1 + 1 - 1$ (1) Conservation of lepton $1 + 0 \rightarrow 0 + 0 + 1$ (1) x is an electron (1)		1 1	1	3		
	(c)		Electromagnetic (1) Presence of photons / gamma rays (1)		1	1	2		
			Question 7 total	**4**	**3**	**2**	**9**	**0**	**0**

10

AS COMPONENT 1: MOTION, ENERGY AND MATTER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	7	4	0	11	3	3
2	3	6	2	11	6	0
3	3	8	0	11	6	0
4	2	2	5	9	2	0
5	6	3	2	11	3	6
6	1	8	4	13	9	10
7	4	3	2	9	0	0
TOTAL	26	34	15	75	31	17