GCE AS MARKING SCHEME

SUMMER 2024

AS
PHYSICS – COMPONENT 1
B420U10-1

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

GCE AS PHYSICS COMPONENT 1 – MOTION, ENERGY AND MATTER

SUMMER 2024 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)	Vector $[\sum]F$ / [resultant] force **and** a / acceleration (1) Scalar m / mass (1)	2			2		
		(ii)	Vector has a direction (scalar doesn't) (1) Example of vector e.g. velocity, displacement and scalar e.g. speed, distance **both needed for the mark** (1)	2			2		
	(b)	(i)	Use of Pythagoras: $\sqrt{360^2 + 150^2}$ (1) 390 N **unit mark** (1) $\tan\theta = \frac{150}{360}$ (1) θ = 22.6 [º] or 67.4 [º] [with angle indicated on diagram or equivalent] (1)	1	1 1 1		4	3	
		(ii)	Equal and opposite to the answer in (b)(i) (2) **Alternative:** Equal / 390 [N] (1) **ecf** Opposite / 67.4 ± 180[º] (1) **ecf**		2		2		
			Question 1 total	**5**	**5**	**0**	**10**	**3**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
2	(a)		v and u in m s^{-1} (1) at m s^{-2} s or m s^{-1} (1)	1	1		2	1	
	(b)	(i)	Use of $v = u + at$ i.e. 0 =15 – 9.81t (1) t = 1.5[3 s] (1) Axes labelled with appropriate scales selected (1) Initial velocity 15 m s^{-1} and final velocity – 15 m s^{-1} shown on graph (1) Straight diagonal line (1) Intersection with x-axis at 1.5[3] (1) **ecf**	1	1 1 1 1 1		6	5	
		(ii)	Use of $v^2 = u^2 + 2ax$ i.e. 0 =15^2 – 2 × 9.81s (1) So: 2 × 9.81x = 15^2 x = 11.47 [m] (1) **Alternative:** Calculate the area of the graph (1) x = 11.47 [m] (1)	1	1		2	2	
			Question 2 total	**3**	**7**	**0**	**10**	**8**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
3	(a)		$P = \frac{W}{t}$ and $W = Fx$ **or** $P = \frac{Fx}{t}$ (1) Now $\frac{x}{t} = v$ [hence $P = Fv$] (1)	1	1		2	1	
	(b)	(i)	Use of $t = \frac{d}{v}$ (1) t = 23.5 [s] (1)	1	1		2	1	
		(ii)	Gain in height = 200 sin 1.5^o so h = 5.24 [m] (1) Gain in PE = 85 × 9.81 × 5.24 (1) 4369 [J] (1)		3		3	3	
		(iii)	Use of $E = ItV$ (1) **ecf** E = 5076 [J] (1)	1	1		2	1	
		(iv)	Efficiency = $\frac{4369}{5076} \times 100$ (1) **ecf** Efficiency = 86[%] (1)		2		2	2	
	(c)		**Yes reasons -** Go too fast Move silently Danger to pedestrians / older people Inexperienced riders / no licence / no test needed **No reasons -** Environmentally friendly No noise pollution Reduction in car use Better accessibility **Award a maximum of 2 marks**			2	2		
			Question 3 total	**3**	**8**	**2**	**13**	**8**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)	Stress / strain or ratio of stress to strain (1)	1			1		
		(ii)	Long chain molecules (1) Crosslinked / tangled (1)	2			2		
	(b)	(i)	**Indicative content** **Molecular scale** (at A) / first section of the graph weak intermolecular / Van de Waals bonds are broken (at B) long chain molecules slide across each other / untangling / straighten out (at C) strong (covalent) bonds within molecules are stretched (at D) the (covalent) bonds within molecules are broken and the (rubber) breaks/ snaps **Gradient change** Initially (at A) (fairly) strong as weak intermolecular bonds need to be broken (at B) small as molecules are slipping across each other (at C) biggest as strong bonds need to be broken **Alternative** **Young modulus** Initially (at A) (fairly) strong as weak intermolecular bonds need to be broken (at B) small as molecules are slipping across each other (at C) biggest as strong bonds need to be broken	3	3		6		

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
			5 – 6 marks Comprehensive account of both the molecular scale and gradient change covered. *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.* **3 – 4 marks** Comprehensive account of either the molecular scale or the gradient change covered or a limited description of both. *There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure.* **1 – 2 marks** Limited account of either the molecular scale and gradient change covered. *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.						
		(ii)	Graph the same shape but below the original finishing on the x-axis at the original position or to the right of the original		1		1		

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
		(iii)	Molecules [when not under tension] recoil (1) They (rub against each other) and realign themselves earlier than originally / are in contact with each other / linkages form earlier (1) **Alternative:** Energy dissipated (1) Hence area smaller on return (1) **Alternative:** Hysteresis is the different in energy between the stretching and unstretching of the rubber (1) Correct reference made to the graph drawn in (ii) (1)		2		2		
			Question 4 total	**6**	**6**	**0**	**12**	**0**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
5	(a)		Hadrons are heavy particles composed of quarks / they feel the strong force (1) Leptons are elementary particles / always exist separately (1) Example of hadrons: proton, neutron, meson etc (1) Example of leptons: electron, electron neutrino (1) Accept antiparticles	4			4		
	(b)	(i)	Conserving charge 0 + 0 = 1 + -1 (1) Lepton number 1 + 0 = 0 + 1 (1) Baryon conservation 0 + 1 = 1 + [0] (1) x has a charge of -1 and lepton number of 1 / is not a baryon / x must be an electron (1)			4	4		
		(ii)	Weak force (1) Neutrinos involved / change of quark flavour (1)			2	2		
			Question 5 total	**4**	**0**	**6**	**10**	**0**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
6	(a)		Drag increases with velocity (1) Drag = weight or force due to gravity (1)	2			2		
	(b)	(i)	$\frac{14.77}{3} = 4.92$ [s]		1		1	1	1
		(ii)	$\frac{10}{4.92}$ **ecf** $= 2.03$ [cm s^{-1}] (1) % uncertainty in $d = \frac{0.2}{10} \times 100 = 2$ [%] (1) Uncertainty in time $= \frac{(5.06 - 4.81)}{2} = 0.125$ (1) % uncertainty in $t = \frac{0.125}{4.92} \times 100 = 2.5$ [%] (1) Total % uncertainty = 2 + 2.5 = 4.5 [%] (1)			5	5	5	5
		(iii)	Absolute uncertainty = 2.03 × 0.045 = 0.09 (1) **ecf** Terminal velocity = 2.03 ± 0.09 [cm s^{-1}] **ecf** (1) uncertainty to 2 sf max		2		2	2	2
		(iv)	**Any 2 × (1) from:** Use slow motion / freeze frame photography Use light gates (at each rubber band) Measure distance with a higher resolution ruler / travelling microscope Measure over a longer / bigger distance			2	2		2
			Question 6 total	**2**	**3**	**7**	**12**	**8**	**10**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
7	(a)		An object that absorbs all electromagnetic radiation [incident upon it] **or** emission alternative	1			1		
	(b)	(i)	Substitution: $\lambda = \frac{2.9 \times 10^{-3}}{7 \times 10^{5}}$ (1) $\lambda = 4.14 \times 10^{-9}$ [m] (1)	1	1		2	1	
		(ii)	X rays **or** UV	1			1		
		(iii)	Area = 1.26×10^{9} [m^2] (1) $P = 5.67 \times 10^{-8} \times 1.26 \times 10^{9} \times (7 \times 10^{5})^4$ $= 1.7 \times 10^{25}$ [W] (1) **ecf**		2		2	2	
		(iv)	Application of inverse square law i.e. $\frac{1.7 \times 10^{25}\ \mathbf{ecf}}{4\pi \times (3 \times 10^{18})^2}$ (1) $I = 9.4 \times 10^{-14}$ [$W\,m^{-2}$] (1)		2		2	2	
			Question 7 total	**3**	**5**	**0**	**8**	**5**	**0**

AS COMPONENT 1: MOTION, ENERGY AND MATTER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	5	5	0	10	3	0
2	3	7	0	10	8	0
3	3	8	2	13	8	0
4	6	6	0	12	0	0
5	4	0	6	10	0	0
6	2	3	7	12	8	10
7	3	5	0	8	5	0
TOTAL	**26**	**34**	**15**	**75**	**32**	**10**