GCE AS MARKING SCHEME

SUMMER 2016

PHYSICS AS Component 1
B420U10/01

INTRODUCTION

This marking scheme was used by WJEC for the 2016 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.

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)		No net / overall/ resultant moment / sum of anticlockwise moments = sum of clockwise moments (1)	1					
			No net / overall force / sum of forces is 0 (1)	1			2		
	(b)	(i)	Weight = 294 N / 30 g / mg approx in the centre (must touch the plank) (1)		1				
			Other 2 forces labelled correctly RH force needs to be closer to the centre than LH force (1)	1			2	1	
		(ii)	Anticlockwise moment / $5.5F_2$ (1)						
			Clockwise moment / 3.5×294 (1)						
			F_2 = 187[.01 N] (1)						
			F_1 = 294 − 187(.01) (**ecf**) / 107 [N] (1)		4		4	4	
		(iii)	Force near B decreases **and** force near A increases			1	1		
		(iv)	2.0 m from A / same distance as B is from his end			1	1		
			Question 1 total	**3**	**5**	**2**	**10**	**5**	**0**

2

Question			Marking details	Marks available					
				AO1	**AO2**	**AO3**	**Total**	**Maths**	**Prac**
2	*(a)*		Vector has (magnitude and) direction (1) Example of vector and scalar (1)	2			2		
	(b)	(i)	Suitable scale (no multiples of 3) so over ½ of each axes used with labelled axes with units (1) Velocity at $8\,s$ = $11.2\,m\,s^{-1}$ and point (8,11.2) correctly plotted ± ½ small square division (1) Shape of graph correct up to $28\,s$ (1) Final diagonal line finishing at $40\,s$ (1)		4		4	4	
		(ii)	Attempt at calculating area under the graph e.g. 1 area correct (1) Distance = 336 [m] (1) **ecf from graph** **Alternative solution:** Distance for first $8.0\,s$ using eq. motion = 44.8 [m] (1) Distance = 336 [m] (1)		2		2	2	
	(c)		0 – 8 s (A-B) <u>constant</u> forward (1) 8 – 28 s (B-C) zero (1) 28 – 40 s (C-D) <u>constant</u> backward (1)		3		3		
			Question 2 total	**2**	**9**	**0**	**11**	**6**	**0**

3

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
3	(a)		$3 \times 10^{-3} \times 85 = 2.6v$ **or** $0 = 3 \times 10^{-3} \times 85 - 2.6v$ (1) $v = 0.10\,[\text{m s}^{-1}] / 0.098\,[\text{m s}^{-1}]$ (1)		2		2	2	
	(b)	(i)	Time $= \dfrac{40}{85} = 0.47\,[\text{s}]$ (1) Use of $s = ut + \frac{1}{2}at^2$ (1) $s = 1.08\,[\text{m}]$ (1)	1	1 1		3	3	
		(ii)	Vertical $v = 4.6\,[\text{m s}^{-1}]$ (1) Tan $\theta = \left(\dfrac{4.6}{85}\right)$ **ecf** for vertical velocity (1) $\theta = 3.1[^{\circ}]$ (1)		3		3	3	
	(c)	(i)	Greater (1) <u>Horizontal</u> velocity reduced (1)			2	2		
		(ii)	KE before $= 10.84\,\text{J}$ / KE after $= 1.35\,\text{J}$ (1) Difference in KE $= 9.49\,\text{J}$ (1) $F = \dfrac{9.49}{40} = 0.24\,[\text{N}]$ (1) **Alternative:** $F = 0.5 \times 3 \times 10^{-3} \times \dfrac{\left(85^2(1) - 30^2\right)}{40}$ (1) $F = 0.24\,[\text{N}]$ (1) **Alternative:** Using $v^2 = u^2 + 2as$, $a = 79\,\text{m s}^{-2}$ (1) Using $F = ma$ (1) $F = 0.24\,[\text{N}]$ (1)		3		3	3	
			Question 3 total	**1**	**10**	**2**	**13**	**11**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
4	*(a)*		0.8% accept 0.83%		1		1	1	1
	(b)		Use of $\frac{4}{3}\pi r^3$ (1)	1					
			$V = 9.(04) \times 10^{-7}\,\mathrm{m}^3$ **Units needed** / accept answer in cm³ with correct unit (1)		1				
			Uncertainty $3 \times$ (a) **ecf** / 2.5% accept 2.4% and 2% (1) Only accept 1 or 2 sig figs		1		3	3	3
	(c)		% uncertainty in mass = 1.4% (1) Only accept 1 or 2 sig figs		1				
			Density = 7 626 ± 300 [kg m⁻³] (1)		1				
			Material correctly identified as steel matches with calculations **ecf** (1)			1	3	2	3
	(d)		(%) uncertainty in diameter of wire [much] bigger than ball bearing / value calculated 4% for the wire (1) (%) uncertainty in resistance is the biggest / very large /value calculated 9% (1) bearing / diameter of wire [much] less than diameter ball bearing (1) **Alternative:** % uncertainty = %R + %A + %l (1) Substitution (1) 18% (1) Answer of 13% award 2 marks only			3	3	2	3
			Question 4 total	1	5	4	10	8	10

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
5	*(a)*	(i)	Only hadrons experience strong interaction (leptons don't) / Hadrons made up of quarks (leptons fundamental particles) (1)	1					
			Hadron example: proton / neutron / pion **and** Lepton example: electron/ neutrino **Both needed** for 1 mark Don't accept reference to mass or lepton number	1			2		
		(ii)	Baryons 3 quarks / antiquarks **and** Mesons <u>quark antiquark pair</u>	1			1		
	(b)	(i)	Similarity [rest] mass / energy (1) Difference opposite charge (1)	2			2		
		(ii)	Conservation of charge to show charge = 0 (1) Conservation of lepton number to show = +1 (1) Particle identified as [electron] neutrino (1)			3	3		
		(iii)	Weak because presence of neutrino / quark flavour change			1	1		
			Question 5 total	**5**	**0**	**4**	**9**	**0**	**0**

6

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
6	(a)		$\lambda_{max} = \dfrac{2.9 \times 10^{-3}}{9\,700}$ (1) 3.0×10^{-7} m (**units needed**) (1) Graph through origin and not touching axis and showing a peak (1) Skewed normal distribution towards (0,0) and peak λ labelled (1)	1 1 1	1 1		4	2	
	(b)	(i)	UV (1) No, maximum power emitted at blue or violet end of spectrum / The star looks blue (1)	1		1	2		
		(ii)	$E = \dfrac{hc}{\lambda} = 6.63 \times 10^{-19}$ [J] (1) 4.125 eV / 4.14 eV **ecf** (1)		2		2	2	
	(c)		$P = A\sigma T^4 = 9.08 \times 10^{27}$ [W] (1) $\dfrac{9.08 \times 10^{27}}{6.63 \times 10^{-19}}$ (1) Total = 1.4×10^{46} [s^{-1}] (1)	1 1	1		3	3	
			Question 6 total	**5**	**5**	**1**	**11**	**7**	**0**

7

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
7	(a)		Stress/ Strain If formula given symbols must be defined	1			1		
	(b)		**Molecules** M1 [Weak] intermolecular bonds / van der Waals / cross links broken (at A) M2 [Long chain] molecules straighten/ unravel/ rotate (at B) M3 Stretching of strong [covalent] bonds (at C) **Young modulus** Y1 Initial stiff region or large force needed / low extension at A Y2 Initial high Young modulus at A Y3 Low Young modulus material / easy to extend or small force needed at B Y4 Large extension for a small force/ stress at B Y5 Final high Young modulus/ difficult to extend / small extension for a large force/ stress at C **5-6 marks** 2 of M1 to M3 present **and** 2 of Y1 to Y5 present *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.* **3-4 marks** Any 1 of M1 to M3 **and** any 1 of Y1 to Y5 *There is a line of reasoning which is partially coherent, largely relevant and with some structure.* **1-2 marks** Any 1 of M1 to M3 **or** any 1 of Y1 to Y5 *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.*	6			6		

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(c)		Line below original, similar shape, finish at (0,0) / permanent set(1) Hysteresis/ less work done unloading / energy lost <u>as heat</u> (1)	2			2		2
	(d)		Either one of the following points P comment made (1) C concluding remark (1) they must be linked P1 (Yes) bad for the environment C1 Create landfill problems / harm wildlife / eaten by turtles / cause pollution P2 (Yes) use up natural resources (to make them) C2 These resources are non-renewable P3 (Yes) The money raised can be given to charities C3 This (money) can be used to repair damage done by the bags P4 (No) the bags are strong / reusable C4 Don't have to make as many as biodegradable ones P5 (No) The bags are cheap to make C5 They last a lot longer than biodegradable ones			2	2		
			Question 7 total	**9**	**0**	**2**	**11**	**0**	**2**

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COMPONENT 1: MOTION, ENERGY AND MATTER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	3	5	2	10	5	0
2	2	9	0	11	6	0
3	1	10	2	13	11	0
4	1	5	4	10	8	10
5	5	0	4	9	0	0
6	5	5	1	11	7	0
7	9	0	2	11	0	2
TOTAL	26	34	15	75	37	12

Eduqas Physics AS Component 1 MS/Summer 2016