GCE AS MARKING SCHEME

SUMMER 2017

AS (NEW)
PHYSICS AS COMPONENT 1
B420U10-1

INTRODUCTION

This marking scheme was used by WJEC for the 2017 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.

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.

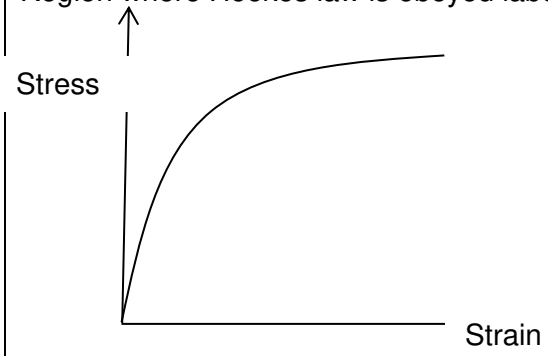
Extended response question

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)*		Amorphous (1) [Short range and] long range order / regular lattice / regular array of planes / ordered layers (1) Long chain molecules (1)	3			3		
	(b)		Shape i.e. linear followed by curve flattening out (1) Yield point labelled (1) Elastic limit labelled (1) Region where Hookes law is obeyed labelled (1)  	4			4		
	(c)	(i)	Load/weight = mg = 5 × 9.81 [N] Stress = $\frac{F}{A}$ / substitution correct **ecf** for load (1) Area = 8.175 × 10^{-7} [m^2] (1) Diameter = 1.0[2] × 10^{-3} m / 1.0[2] mm with units (1)	1 1	1 1		4	4	
		(ii)	Strain = $\frac{\Delta l}{l}$ = 0.02 (1) E = 3.0 GPa with units **no ecf** (1)		2		2	2	
		(iii)	Diameter increases by $\sqrt{10}$ (1) Diameter = 3.2[2] mm with units (1)	1	1		2	2	
			Question 1 total	**10**	**5**	**0**	**15**	**8**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
2	*(a)*	(i)	Rate of change of **displacement** / accept **displacement** ÷ time	1			1		
		(ii)	Circular motion with a constant speed / accept practical example (1) Object being thrown up in the air or object decelerating / accept practical example (1)		2		2		
	(b)	(i)	Gradient calculated (1) g = [-]9.8 m s^{-2} with units (1) **Alternative;** Use of $v^2 = u^2 + 2ax$ or other suitable equation of motion (1) g = [-]9.8 m s^{-2} with units (1)		2		2	2	
		(ii)	An attempt at an area calculation (1) Height = 11.[025] [m] (1) **Alternative:** Use of equation of motion (1) Height = 11.[025] [m] (1)		2		2	2	
		(iii)	Zero		1		1		
	(c)		Shape starts and ends at zero / graph is symmetric or parabolic (1) 11.025 m is the max height / gradient reduces to zero at max height (1) at a time of 1.5 s / time of flight is 3 s (1) Conclusion yes she is correct has to match with argument (1) Accept individual point checked as an alternative mark for either method			4	4	2	
			Question 2 total	**1**	**7**	**4**	**12**	**6**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
3	*(a)*		0 +0 = 0 -1 [+1] [Lepton conservation] (1) +1 +1 = +1 +1 [+0] [Charge conservation] (1) Neutrino (1)		1 1	1	3		
	(b)		Weak (1) Presence of neutrino / change of quark flavour (1)	2			2		
	(c)	(i)	Proton / p / $^{2}_{1}\mathrm{H}$	1			1		
		(ii)	Positron / e^{+} Allow anti-electron	1			1		
	(d)		Any 2 ×(1) from: • Economic argument given e.g. money better spent on welfare / health etc • Scientific consequence discussed e.g. need to know origin of universe • Benefits to mankind from advanced research / new technologies • Scientific investment generates money			2	2		
			Question 3 total	**4**	**2**	**3**	**9**	**0**	**0**

Question			Marking details		Marks available				
				AO1	AO2	AO3	Total	Maths	Prac
4	*(a)*	(i)	[A surface that] absorbs all em radiation falling on it / perfect absorber of em radiation	1			1		
		(ii)	Vega = 290 / 289 n[m] (1) Sun = 483 / 481 n[m] (1) Sun = visible (light) **and** Vega = ultraviolet (1)	 1	1 1		 3	 2	
		(iii)	Shape of one correct with peak (1) Vega shown with a shorter peak wavelength (1) Graph of Vega always above graph of Sun (1)	 3			 3		
	(b)		Use of Stefan's law (1) $A = 4\pi r^2$ used (1) Ratios taken: $\frac{2.71^2 \times 10\,000^4}{6000^4}$ **or** $\frac{7.3 \times 10^{16}}{1.30 \times 10^{15}}$ (1) Answer = 56.7 (1)	1 1 	 1 1		 4	 4	
			Question 4 total	**7**	**4**	**0**	**11**	**6**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
5	*(a)*	(i)	0.8%		1		1	1	1
		(ii)	0.51 must be to 2 s.f. no unit penalty (1) 2.9 / 3 % max of 2 s.f. (1)		2		2	2	2
		(iii)	Rearrangement to: $g = \frac{2h}{t^2}$ (1) g = 9.61 m s^{-2} 2 or 3 s.f. with units **ecf** from (a)(ii) 0.5133 gives 9.49 m s^{-2} (1) % uncertainty 6.6 / 6.8 % **ecf** on (i) + 2 × (ii) (1) ± 0.6[3] / 0.6[5] (1)		4		4	4	4
		(iv)	Lower due to air resistance. Accept ball not starting at rest			1	1		1
	(b)	(i)	Yes (no marks) easy to spot anomalous results (1) Mean obtained from line of best fit / larger height reduces [%] uncertainty (1)			2	2		2
		(ii)	h [on y-axis] vs t^2 [on x-axis] or $\sqrt{h}$ vs t (1) gradient = $\frac{g}{2}$ (1) **Alternative (1)** h on x-axis vs t^2 on y-axis (1) gradient = $\frac{2}{g}$ (1) **Alternative (2)** $2h$ on x-axis vs t^2 on y-axis (1) gradient = g (1)			2	2	1	2
			Question 5 total	**0**	**7**	**5**	**12**	**8**	**12**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	*(a)*			Diagram showing force and <u>perpendicular</u> distance to pivot clearly labelled (1) Moment = force × perpendicular distance to pivot (1)	2			2		
	(b)	(i)		Distances correct 85 cm and 40 cm (1) Weight = 1.7 [N] / correct use of principle of moments (1) Mass = 0.17 / 0.2 [kg] (1)		3		3	2	3
		(ii)	I	Measure at both ends to ensure same height / spirit level / any suitable method			1	1		1
			II	Application of principle of moments (1) F = 4.26 [N] / accept 4.25 N or 4.3 N (1)		2		2	2	2
	(c)			[Clockwise] moments increase [with larger mass] (1) Mass needs to be moved towards the pivot / newton meter moved away from pivot (1) **Alternative (1)** Raise the clamp holding the newton meter / lower the pivot (1) this is because a greater upward force is needed so the extension of the newton meter spring would be greater (1) **Alternative (2)** Move the pivot towards the centre of mass (1) So this will decrease the moment (1)			2	2		2
				Question 6 total	**2**	**5**	**3**	**10**	**4**	**8**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
7			**When ball first thrown** When ball is thrown boat moves to left (backwards) When released boat initially accelerates (to left) [Forward] force applied to ball Mention of N3 / conservation of momentum / N2 **Ball in mid-air** When ball in mid-air boat travels with constant velocity After release no forces acting **When ball caught** When caught boat decelerates When ball caught boat comes to rest When caught force in opposite direction Conservation of momentum / N2 / N3 AO1 allocation – basic force analysis AO2 allocation – application of forces and motion analysis **5-6 marks** Description of what happens to the boat when the ball is first thrown, in the air and caught by Ryan along with reference to at least one physics law at any stage *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.* **3-4 marks** Description of what happens to the boat for any 2 of the following 3 stages: the ball is first thrown, in the air or when caught by Ryan along with reference to at least one physics law at any stage *There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure.* **1-2 marks** Description of motion of the boat at any stage or reference to at least one physics law at any stage *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.*	2	4		6		
			Question 7 total	**2**	**4**	**0**	**6**	**0**	**0**

AS COMPONENT 1: MOTION, ENERGY AND MATTER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	10	5	0	15	8	0
2	1	7	4	12	6	0
3	4	2	3	9	0	0
4	7	4	0	11	6	0
5	0	7	5	12	8	12
6	2	5	3	10	4	8
7	2	4	0	6	0	0
TOTAL	**26**	**34**	**15**	**75**	**32**	**20**