GCE AS MARKING SCHEME

SUMMER 2018

AS
PHYSICS AS COMPONENT 1
B420U10-1

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.

AS COMPONENT 1 – MOTION, ENERGY AND MATTER

SUMMER 2018

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)	Ruler and micrometer **or** Vernier callipers	1			1		1
		(ii)	Area = $\pi \times (0.505 \times 10^{-3})^2 = 8.01 \times 10^{-7}$ [m^2] (1) $E = \frac{Fl}{\Delta l A} = \frac{7.5 \text{ x } 0.2}{(28 \text{ x } 10^{-6} \text{ x } 8.01 \text{ x } 10^{-7})}$ (1) $E = 6.6 \times 10^{10}$ Pa / N m^{-2} with units (1) Accept in N mm^{-2}	1	1 1		3	3	3
		(iii)	Hazard and Risk – thin glass could shatter and cut the skin (1) Control measure – handle with care / wear gloves or protective clothing (1) **Alternative:** Hazard and Risk – [broken glass is sharp] thin glass could shatter and enter the eyes (1) Control measure – handle with care / wear goggles (1)			2	2		2
		(iv)	Work done = energy stored = ½$F\,\Delta l$ (1) $0.5 \times 7.5 \times 28 \times 10^{-6} = 1.05 \times 10^{-4}$ [J] (1)	1	 1		2	2	2
	(b)		Surface cracks (1) All force concentrated on a single / few bonds below the crack (1) When under tension (1)	3			3		
			Question 1 total	**6**	**3**	**2**	**11**	**5**	**8**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
2	*(a)*	(i)	600 cm^2 or 0.06 m^2 with units (1) 0.8[3] % or 1 % (1)		2		2	2	2
		(ii)	Mean = 0.30 mm (1) Thickness of one sheet = 0.019 or 0.01875 or 0.0188 mm or 0.0019 cm (1) % uncertainty = 12% or 10 % (1) [accept any no. of s.f.]		3		3	3	3
		(iii)	Volume = 1 125 or 1 140 m^2 or 1.125 or 1.14[0] cm^3 (1) % uncertainty (i) + (ii) (1)		2		2	2	2
	(b)		% uncertainty in mass 0.36 or 0.4% (1) Density = 2.4[6] or 2.5 g cm^{-3} or 0.025 g mm^{-3} with units (1) Absolute uncertainty = 0.3[3] (1) Density to 2 s.f. and uncertainty to 1 s.f. (1)		4		4	4	4
	(c)		Measurement of thickness of sheet (1) Measure more sheets / fold more / more accurate device / thicker sheet of aluminium (1)			2	2		2
			Question 2 total	**0**	**11**	**2**	**13**	**11**	**13**

Question			Marking details		Marks available				
				AO1	AO2	AO3	Total	Maths	Prac
3	*(a)*		Use of $s = \frac{1}{2}(u+v)t$ (1) t = 14.6 [s] (1)	1	1		2	2	
	(b)		Gain in KE = 4 020 – 962 = 3 058 [J] (1) Gain in PE = 95 × 9.8 × 4 = 3 728 [J] (1) Total = 3 058 + 3 728 = 6 786 [J] **ecf** (1)		3		3	3	
	(c)	(i)	Use of $E = VIt$ (1) 3 679 or 3 680 [J] **ecf** (1)	1	1		2	2	
		(ii)	Useful energy of motor = *(b)* – 6 500 = 1 286 [J] (1) Efficiency $= \frac{1286}{3679} \times 100 = 35$ [%] (1) **ecf** from (c)(i)		2		2	2	
		(iii)	Friction within motor / between front tyre and road (not just 'friction') (1) Air resistance on bike and Helen (1) Do not accept just heat / sound loss	2			2		
	(d)		Yes compared to petrol vehicles no [direct] emissions (1) ..and power station emissions [of CO_2, PM2s etc] much less than petrol vehicles			2	2		
			Question 3 total	**4**	**7**	**2**	**13**	**9**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
4	*(a)*		Rearrangement $\sigma = \frac{P}{AT^4}$ and convincing algebra / cancellation of m^2 (1) P has units $kg\,m^2\,s^{-3}$ (1) A has units m^2 and T^4 units K^4 (1)	 1 1	1		 3	1	
	(b)	(i)	$\lambda_p = 930 \pm 20$ nm (with units) (1) $T = \frac{2.9 \times 10^{-3}}{930 \times 10^{-9}} = 3\,120$ K (1) $A = 1.1 \times 10^{17}\ m^2$ (1) $d = 1.87 \times 10^{8}$ m (1)	1	 1 1 1		 4	 3	
		(ii)	Appears red and infra-red section			1	1		
			Question 4 total	**3**	**4**	**1**	**8**	**4**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
5	*(a)*		**Differences** **Hadrons** H1 Made up of quarks H2 Affected by strong interaction H3 e.g. protons / neutrons / mesons **Leptons** L1 Fundamental particles L2 Not affected by strong interaction L3 e.g. electron / electron neutrino **Similarities** S1 Both have a rest mass / gravitational attraction S2 Both can be affected by the weak interaction S3 Both can be affected by the electromagnetic interaction **Sub group** G1 Hadrons can be split into Baryons and mesons G2 Baryons contain 3 quarks G3 Mesons contain a quark antiquark pair **5 – 6 marks** 2 points from each of H L S and G *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.* **3 – 4 marks** 1 point from each of H L S and G *There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure.* **1 – 2 marks** 3 points from any group *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
	(b)	(i)	Charge +1 -1 = 0 + 0 (1) Lepton number 0 +1 = 0 +1 (1) Hence, x is an uncharged lepton, … … Hence Particle identified as an electro neutrino (1)		3		3		
		(ii)	u changes to d / uud to udd		1		1		
		(iii)	Weak interaction because of the presence of a neutrino / change in quark flavour	1			1		
			Question 5 total	**7**	**4**	**0**	**11**	**0**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
6	*(a)*		The point through which the whole of the weight of the object can be considered to act	1			1		
	(b)	(i)	Principle of moments used i.e. 30 F = 40 × 150 (1) F = 200 [N] (1)	1	1		2	2	
		(ii)	Moments taken about the front wheel, which is further from the handles (1) 100 F = 30 × 150 (1) F = 45 [N] (1)			3	3	3	
		(iii)	Increase the size of the base / distance between the wheels (1) Lower cog of the buggy / increase the weight of the base / lower the centre of gravity (1)	2			2		
			Question 6 total	**4**	**1**	**3**	**8**	**5**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
7	*(a)*		Horizontal remains constant (1) vertical decreases to zero then increases / downward component increases (1)	2			2		
	(b)	(i)	$u_y = u\sin 20$ and $u_x = u\cos 20$ (1) $t = 0.035u$ or $t = \dfrac{21}{u\cos 20}$ (1) Horizontally $x = u\cos 20\ t$ (1) $v = 25.3\,[\text{m s}^{-1}]$ (1)		4		4	4	
		(ii)	Use of $v^2 = u^2 + 2ax$ (1) Use $v^2 = 0$ and manipulation (1) $x = 3.82\,[\text{m}]$ ball is above the bar (1)			3	3	3	
		(iii)	Ball wouldn't go as high / horizontal velocity decreases (1) [Vertical] velocity falls to $v = 0$ quicker / ball on the way down by the time it crosses the line (1)			2	2		
			Question 7 total	**2**	**4**	**5**	**11**	**7**	**0**

AS COMPONENT 1: MOTION, ENERGY AND MATTER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	6	3	2	11	5	8
2	0	11	2	13	11	13
3	4	7	2	13	9	0
4	3	4	1	8	4	0
5	7	4	0	11	0	0
6	4	1	3	8	5	0
7	2	4	5	11	7	0
TOTAL	**26**	**34**	**15**	**75**	**41**	**21**