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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Physics 5456

Specification B

PHB1 Foundation Physics

Mark Scheme

2008 examination - June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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NOTES
Letters are used to distinguish between different types of marks in the scheme.

M indicates OBLIGATORY METHOD MARK
This is usually awarded for the physical principles involved, or for a particular point in the argument or definition. It is followed by one or more accuracy marks which cannot be scored unless the M mark has already been scored.

C indicates COMPENSATION METHOD MARK
This is awarded for the correct method or physical principle. In this case the method can be seen or implied by a correct answer or other correct subsequent steps. In this way an answer might score full marks even if some working has been omitted.

A indicates ACCURACY MARK
These marks are awarded for correct calculation or further detail. They follow an M mark or a C mark.

B indicates INDEPENDENT MARK
This is a mark which is independent of M and C marks.

e.c.f is used to indicate that marks can be awarded if an error has been carried forward (e.c.f. must be written on the script). This is also referred to as a 'transferred error' or 'consequential marking'.

Where a correct answer only **(c.a.o.)** is required, this means that the answer must be as in the Marking Scheme, including significant figures and units.

c.n.a.o. is used to indicate that the answer must be numerically correct but the unit is only penalised if it is the first error or omission in the section (see below).

Only **one** unit penalty **(u.p.)** in this paper unless there is a mark allocated specifically for giving a correct unit in the marking. Note that the unit is only penalised in the final answer to the question.

Only **one** significant figure penalty **(s.f.)** in this paper.
Allow 2 or 3 s.f. unless otherwise stated. s.f. penalties include recurring figures and fractions for answers.

Marks should be awarded for **correct** alternative approaches to numerical question that are not covered by the marking scheme. A correct answer from working that contains a physics error (PE) should not be given credit. Examiners should contact the Team Leader or Principal Examiner for confirmation of the validity of the method, if in doubt.

Quality of Written Communication

Before accessing marks for the Quality of Written Communication (QWC) a candidate must first score a minimum of one mark for the physics that is being communicated – this will allow access to 1 mark for QWC. If the candidate scores more marks for physics (a minimum of two or three – depending upon the total mark for that part of the question) then this will allow access to 2 marks for QWC.

Good QWC: the answer is fluent/well argued with few errors in spelling, punctuation and grammar	**2**	
Poor QWC: the answer lacks coherence or spelling, punctuation and grammar are poor	**1**	**Max 2**
Very Poor QWC: the answer is disjointed, with significant errors in spelling, punctuation and grammar	**0**	

GCE Physics, Specification B, PHB1, Foundation Physics

Question 1			
(a)	$R = V/I$ or I = 1.9 A	**C1**	**2**
	1.58 or 1.6 Ω not 1.5	**A1**	
(b)	resistance increases (for higher currents or voltages)	**B1**	**2**
	(resistance increases as) resistor heats up/idea of increased number of collisions between charge carriers and ions or atoms (not particles)	**B1**	
		Total	**4**

Question 2				
(a)	(i)	energy (transformed) per unit charge/$V = W/Q$ with terms defined	**B1**	**2**
	(ii)	idea that 1 J of energy is transformed per C of charge/ 1 JC^{-1}	**B1**	
(b)	(i)	= 720 s **or** $Q = It$	**C1**	**4**
		936 C or 940 C **unit required**	**A1**	
	(ii)	$E = VQ$ **or** 9 × (i)	**C1**	
		8420 J **or** 8400 J **or** 8460 J **or** 8500 J **e.c.f.**	**A1**	
			Total	**6**

Question 3				
	(i)	chooses 1200 Ω and 900 Ω **or** adds their values	**C1**	**6**
		2100 Ω **c.a.o.**	**A1**	
	(ii)	chooses 50 Ω and 240 Ω	**C1**	
		$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$	**C1**	
		41(.4) Ω	**A1**	
	(iii)	cold and dark	**B1**	
			Total	**6**

Question 4			
(i)	$I = nAvq$	**C1**	**5**
	rearrangement or correct substitution	**C1**	
	9.3 (9.26) $\times$ 10^{-4} m s^{-1}	**A1**	
(ii)	more free or delocalised electrons (per m^3) not charge carriers	**B1**	
	greater (cross-sectional) area/thickness	**B1**	
		Total	**5**

Question 5			
(a)	reference to reduction in signal strength	**B1**	**3**
	power or energy loss/$I^2 R$ heating/electrical heating/ $I^2 R$ losses	**B1**	
	repeater stations boost or re-amplify signal or increases energy of signal	**B1**	
(b)	parameter or device + situation + reason (accessibility or safety)	**B1**	**2**
	different parameter or device + situation + reason (accessibility or safety)	**B1**	
		Total	**5**

Question 6				
(a)	(i)	both weights correct: 930 N **or** 931 N and 1370 N **or** 1372 N	**B1**	
		both distances correct: 0.75 m from **A** and 0.95 m from **A** or **B**	**B1**	
	(ii)	recognisable moments equation: force × distance = force × distance	**C1**	
		correct equation: $F \times 1.9 = (930 \times 0.75) + (1370 \times 0.95)$	**C1**	**8**
		1050 N or 1100 N	**A1**	
		halve their value/F_B = 527 N or 530 N **sig fig penalty – allow 2 or 3 e.c.f.**	**A1**	
	(iii)	resolves vertically/takes moments again form BC	**C1**	
		625 N or 1250 N **e.c.f.** from (i) **or** (ii) do not penalise again for forgetting to halve	**A1**	
(b)		**C**	**M0**	
		idea that C is furthest from (heavier) weight	**C1**	**2**
		C of G of heavier person is furthest from **C**	**A1**	
			Total	**10**

Question 7			
(a)	correct renewable source (including geothermal) correct non-renewable source (including nuclear)	**B1** **B1**	**2**
(b)	a correct method e.g. ducks or air column or proper alternative b explains how a turbine or generator is turned c rotation of generator, or movement of coil in magnetic field, produces electricity d Sun heating of atmosphere, land or sea e movement of air (caused by differential heating) or convection (current) f wind over water produces waves	**B1** **B1** **B1** **B1** **B1** **B1**	**max 5**
	At least 2 marks for physics + **Good QWC** At least 2 marks for physics + **Poor QWC** At least 2 marks for physics + **Very Poor QWC** 1 mark for physics + sufficient attempt + **Good or Poor QWC** 1 mark for physics + insufficient attempt or **Very Poor QWC** No marks for physics or **Very Poor QWC**	**2** **1** **0** **1** **0** **0**	**max 2**
		Total	**9**

Question 8				
(a)	(i)	0 to 2 or 3 s, constant speed	**B1**	**6**
		0 to 7.4 (or 7.5) or 2 or 3 – 7.4 (or 7.5): acceleration	**B1**	
		> 7.4 or 7.5: at rest	**B1**	
	(ii)	uses gradient	**M1**	
		uses gradient at 7.5 s and extracts data correctly – even for poor gradient	**A1**	
		19 to 28 m s^{-1} **unit required**	**A1**	
(b)	(i)	2.9 m s^{-1} at t = 0	**B1**	**6**
		curve falling to zero…	**B1**	
		…between 25 and 30 s	**B1**	
	(ii)	uses area of graph	**C1**	
		42 to 44 squares or 25 m per square	**C1**	
		1050 to 1100 m	**A1**	
			Total	**12**

Question 9				
(a)	(i)	147000 – 140000 (N) seen	**B1**	**6**
		$F = ma$ seen	**B1**	
		0.49 seen	**B1**	
	(ii)	use of $s = (ut) + ½\ a\ t^2$	**C1**	
		correct substitution including t = 180 s	**C1**	
		7900 to 8100 m	**A1**	
(b)	(i)	14000 N	**B1**	**5**
	(ii)	correct use of Pythagoras for their values of force	**C1**	
		correct use of tangent for their values of force	**C1**	
		16000 (15700) N **c.a.o.**	**A1**	
		at 27° (to horizontal) or 63° (to vertical) **c.a.o.**	**A1**	
			Total	**11**

Question 10			
	musket/cannon ball a acceleration the same/falls at the same speed b effects of different masses and weights cancel out (reference to $F = ma$) c air resistance insignificant/affects both in the same way **musket/table tennis ball** d table tennis ball is (significantly) affected by air resistance e which reduces acceleration/table tennis ball lands second/has slower speed f appropriate comment about air resistance with reference to size, weight, density or surface quality	**B1** **B1** **B1** **B1** **B1** **B1**	**max 5**
	At least 2 marks for physics + **Good QWC** At least 2 marks for physics + **Poor QWC** At least 2 marks for physics + **Very Poor QWC** 1 mark for physics + sufficient attempt + **Good or Poor QWC** 1 mark for physics + insufficient attempt or **Very Poor QWC** No marks for physics or **Very Poor QWC**	**2** **1** **0** **1** **0** **0**	**max 2**
		Total	**7**