Version 1.0

General Certificate of Education
June 2010

Physics B: Physics in Context PHYB2

Physics Keeps Us Going

Unit 2

Final

Mark Scheme

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.

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

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

cnao 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).

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.

GCE Physics, Specification B: Physics in Context, PHYB2, Physics Keeps Us Going

Question 1			
	resolving one force correctly – 410 sin (65) seen doubling the force (eg 743.1 or 346.5 seen) 2 sf answer (740 (N) or 370 (N))	**C1** **C1** **A1**	**3**
		Total	**3**

Question 2			
(a)	light output of CFL = 3.0 W seen or implied in working efficiency of CFL (= 3/18) = 0.167 or 16.7%; 0.17 or 17%	**C1** **A1**	**2**
(b)	shows appreciation of what efficiency means TFL operates at much higher temperature (than CFL) greater energy losses	**B1** **B1**	**2**
		Total	**4**

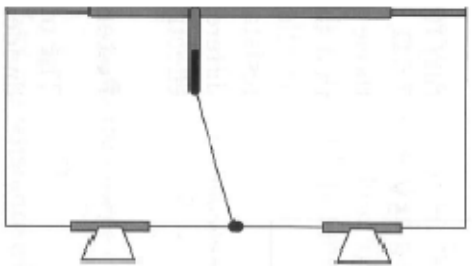
Question 3			
(a)	visible	**B1**	**1**
(b)	read-off peak 480 – 520 nm 500 (× 10^{-9}) × T = 0.0029 seen T = 5800 (K) allow 5686 – 5920	**B1** **B1** **B1**	**3**
		Total	**4**

Question 4			
(a)	conversion to seconds seen (60 × 40) or velocity =300/40 seen or energy gain in 40 mins = 750 × 300 = 2.25 × 10^5 (J) use of $p = Fv$ power = 750 × (300)/(2400) or 750 × their velocity (eg seen 750 × 300/40) 94 (93.8) (W) cnao	**C1** **C1** **A1**	**3**
(b)	$k = \frac{750}{15 \times 10^{-3}}$ (allow use of m or mm) use of $k = F/\Delta L$ 5.0 × 10^4 N m^{-1} (allow if calculation not attempted or incomplete)	**C1** **A1** **A1**	**3**
		Total	**6**

Question 5			
	use of area × temperature difference × U-value (calculates either 95.04 W or 23.76 correctly)	**C1**	**3**
	(2.2 × 1.2) × 15 × (2.4 – 0.6) or two separate sums and **attempt** at subtraction	**C1**	
	71 (71.3) (W) or ($J\,s^{-1}$) cnao	**A1**	
		Total	**3**

Question 6				
(a)	(i)	½ v^2 = gh seen (condone mass included on *both* sides of equation)	**C1**	**3**
		$8.4^2/2g$	**C1**	
		3.6 or 3.60 (m) allow 3.5 (from rounding off ke early)	**A1**	
(a)	(ii)	height of centre of mass 0.9 m seen	**C1**	**2**
		4.5 (m) ecf answer (a)(i) + 0.9	**A1**	
(b)	(i)	any **three** from		**3**
		energy dissipated/work done overcoming air resistance **during upward movement**	**B1**	
		energy lost **in the pole**	**B1**	
		PE given to pole itself (as it rises)	**B1**	
		kinetic energy required to move forward over bar	**B1**	
(b)	(ii)	**technique** exert downwards force on pole during upward movement or reference to use of own stored energy	**B1**	**3**
		effect of technique to provide (extra) upward acceleration/momentum/ke/ energy	**B1**	
		arches body (owtte) to have centre of body mass below bar	**B1**	
			Total	**11**

Question 7			
(a)	any **three** from		
	voltmeter resistance is high	**B1**	
	current in circuit is 0 or low	**B1**	
	no (low) energy lost in voltmeter	**B1**	**3**
	no lost volts/volts lost overcoming internal resistance	**B1**	
	'load'/voltmeter resistance >> internal resistance	**B1**	
	voltage across voltmeter >> voltage across int. resistance	**B1**	
(b) (i)	current = 14.5/470	**C1**	**2**
	0.031 or 0.0309 (A) amps penalise 1 sf	**A1**	
(b) (ii)	'lost' pd in cell = 0.5 V	**C1**	**3**
	internal resistance = 0.5 × 470/14.5 or (0.5/0.031 etc)	**C1**	
	16 (Ω) (16.2) (16.7)	**A1**	
	or 13.9(14) using 0.031 A to calculate total circuit resistance		
	15.4(15) using 0.0309 A		
	30 using 0.3		
		Total	**8**

Question 8			
(a)	potential divider or potentiometer	**B1**	**1**
(b)	minimum 4 (V)	**B1**	**4**
	variable *R* 8 Ω	**B1**	
	max I 12 V	**B1**	
	variable *R* 0 (Ω)	**B1**	
(c) (i)		**B1**	**1**
(c) (ii)	full amplitude/voltage/volume range in each speaker/only **limited range** in Figure 6	**B1**	**2**
	Figure 6 circuit would have **different ranges** in each speaker	**B1**	
	allow arguments related to relative values of resistors and speakers		
		Total	**8**

Question 9			
(a)	peak = 107/108 mW and load resistance = 290–310 Ω	**C1**	**3**
	use of I = (power/resistance)$^{1/2}$ with candidate values	**C1**	
	0.0186 – 0.0193 (A) (0.0190 or 0.019 (A) if 108 mW and 300 Ω used)	**A1**	
(b)	area of cell = 3.6×10^{-3} m^2 or 0.06 × 0.06 seen	**C1**	**4**
	solar power arriving = 730 × (an area) W	**C1**	
	0.108/2.63) seen or 0.108/(730 × 0.06 × 0.06)	**C1**	
	0.041 cnao lose if ratio given a unit	**A1**	
(c)	max **two** from		**2**
	absorption in atmosphere	**B1**	
	sunlight strikes cell obliquely	**B1**	
	cloudy/night time/times when no sun/cell in shadow due to…	**B1**	
		Total	**9**

Question 10			
(a) (i)	(F =) 1200g sin(9°)	**B1**	**2**
	1839.7 – 1841.5 (allow 1840)	**B1**	
(a) (ii)	1840 (N) (ecf)	**B1**	**2**
	up the slope ecf from (a) (i)	**B1**	
(b)	$a=F/m$ or a recognisable force/1200 seen	**C1**	**4**
	acceleration = 1.53 m s^{-2} or their (a) (ii)/1200	**C1**	
	time = 18/1.53 or 18/their acceleration or t = 18/a	**C1**	
	12/11.7 (s) cnao	**A1**	

(c)	The marking scheme for this question includes an overall assessment for the quality of written communication (QWC). There are no discrete marks for the assessment of QWC but the candidate's QWC in this answer will be one of the criteria used to assign a level and award the marks for this question. Descriptor – an answer will be expected to meet most of the criteria in the level descriptor. **Level 3 – good** answer supported by an appropriate range of evidence good use of information or ideas about physics, going beyond any given in the question answer well structured with minimal repetition or irrelevant points accurate and clear expression of ideas with only minor errors of grammar, punctuation and spelling **Level 2 – modest** answer partially supported by evidence good use of information or ideas about any physics given in the question but limited beyond this the answer shows some attempt at structure the ideas are expressed with reasonable clarity but with a few errors of grammar, punctuation and spelling **Level 1 – limited** valid points but not clearly linked to an argument structure limited use of information or ideas about physics unstructured errors in spelling, punctuation and grammar or lack of fluency **Level 0** incorrect, inappropriate or no response		**5-6** **3-4** **1-2** **0**

	A typical answer would include • risk is due to force on the passenger during deceleration • force = $\Delta(mv)/\Delta t$ • momentum change is mass of person x velocity (constant) • force reduced by increasing Δt • time reduced by: • mention of seat belts/air bags • mention of structural features of car or barrier eg bumper/ engine • cage sliding under car/crash barrier design etc • mention of external softer part/avoidance of sharp metal structure/soft facia • crash barriers deform on impact		
		Total	**14**