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General Certificate of Education (A-level)
January 2011

Physics B: Physics in Context PHYB2

(Specification 2455)

Unit 2: Physics keeps us going

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 events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process 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 standardisation each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised 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.

Further copies of this Mark Scheme are available from: aqa.org.uk

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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			
(a)	(has magnitude but) no direction/has only magnitude	**B1**	**2**
(b) (i)	1N: 3.9 or 4 cm/1 cm: 0.25 or 0.26 N	**B1**	**1**
(b) (ii)	completes parallelogram correctly/or 'nose to tail' measures/draw correct diagonal 2.1 ± 0.1 N	**M1** **M1** **A1**	**3**
		Total	**6**

Question 2			
(a)	constant horizontal (component of) velocity/no horizontal force or acceleration accelerates vertically/increasing vertical (component) of velocity	**B1** **B1**	**2**
(b)	appropriate curve starting at same place with shorter trajectory	**B1**	**1**
		Total	**3**

Question 3			
(a)	infrared/IR	**B1**	**1**
(b)	1×10^{-9} (m) to 400×10^{-9} (m)	**B1**	**1**
(c)	(increased risk of) cancer/sterilisation/mutation	**B1**	**1**
		Total	**3**

Question 4			
(a)	uses 1020/9.81 (to find mass)/$m = W/g$ divides by 1030/uses volume = mass/density 0.101 m^3 cao their 104 correctly multiplied by 9.81 (look for 1020 (N))	**C1** **C1** **A1**	**3**
(b)	floats (to surface) upthrust greater than weight	**B1** **B1**	**2**
		Total	**5**

Question 5			
	multiplies the efficiencies together as percentages or decimals 0.291 (29.1%) or 0.29 (29%)	**C1** **A1**	**2**
		Total	**2**

Question 6			
	collision between electrons and ions or atoms (electrons lose kinetic energy and) ions vibrate more or have more vibrational kinetic energy	**B1** **B1**	**2**
		Total	**2**

Question 7			
(a)	840 × 2.3 1900 (J)/1930 (J)	**C1** **A1**	**2**
(b) (i)	uses gradient data extraction correct – 350 N, 0.3 m 1170 $N\,m^{-1}$	**C1** **C1** **A1** **B1**	**4**
(b) (ii)	uses area 6.5 to 7.0 squares or 1 square is equivalent to 5 J/area is ½ base × height 32.5 to 35 (J)	**B1** **B1** **B1**	**3**
		Total	**9**

Question 8			
(a)	more charge carriers available	**B1**	**3**
	(internal) energy used to liberate electrons	**B1**	
	more electrons is more significant than additional vibration of lattice ions	**B1**	
(b) (i)	(resistance of LDR is) 400 (Ω) seen – may be on diagram	**C1**	**3**
	their 400 + 150 seen	**C1**	
	2.45 or 2.5 V	**A1**	
(b) (ii)	reduces resistance of LDR/correct example data from graph	**B1**	**2**
	increase share of voltage taken by variable resistor (owtte)	**B1**	
		Total	**8**

Question 9			
(a)	substitutes into $E = UA\Delta\theta$ for any part – insulated or not	**C1**	**4**
	uses standard values	**C1**	
	adds their values for all four parts	**C1**	
	2660 W cao but condone sf	**A1**	
(b)	walls	**B1**	**3**
	area × (difference between insulated and non-insulated) *U*-value is recognised or calculated **or** *Q* **or** change in *Q* is calculated for new values	**B1**	
	walls = 36 (432), windows = 32 (403), roof = 21 (252)	**B1**	
		Total	**7**

Question 10			
(a)	0.0029 or **use of** $c = f\lambda$	**C1**	**3**
	5760 K **cao** condone sf	**C1**	
	changes their 5760 correctly to °C (5490)	**A1**	

(b)	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** ● claims supported by an appropriate range of evidence ● good use of information or ideas about physics, going beyond those given in the question ● argument well structured with minimal repetition or irrelevant points ● accurate and clear expression or ideas with only minor errors of grammar, punctuation and spelling **Level 2 – Modest** ● claims partly supported by evidence ● good use of information or ideas about physics given in the question but limited beyond this ● the argument 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 about physics ● unstructured ● errors in spelling, punctuation and grammar of lack of fluency **Level 0** ● incorrect, inappropriate or no response **Examples of the sort of information or ideas that might be used to support an argument:** ● Sun's peak frequency in the visible range ● …because Sun is hot ● (much) energy radiated by Earth is IR ● …because Earth is cooler ● energy radiated by Earth is trapped by (atmospheric) gases ● carbon dioxide and/or water vapour and/or methane in atmosphere have an effect ● these gases permit short wavelength radiation though they prevent longer wavelength radiation from escaping		**5-6** **3-4** **1-2** **0**

Question 11			
(a) (i)	divides a speed (from the table) by 10.9	**C1**	**3**
	converts speed to $m\,s^{-1}$ (26.7)	**C1**	
	2.4/2.45/2.5 ($m\,s^{-2}$)	**A1**	
(a) (ii)	multiples 2.10 by a mass from the table	**C1**	**2**
	2810 (N)	**A1**	
(b)	**any two from**		**max 3**
	fuel consumption is high	**B1**	
	emissions will also be high	**B1**	
	max speed is very high	**B1**	
	any one from		
	wasteful of resources	**B1**	
	links high emissions to global warming/specified environmental issue	**B1**	
	road safety implications of high speed	**B1**	
		Total	**8**

Question 12			
(a)	$0.5 \times 1500 \times 1.23 \times 14^3$	**C1**	**2**
	2.53×10^6 (W)	**A1**	
(b) (i)	**uses** $V = A \times d$ eg 7.5 3.4 seen	**C1**	**3**
	uses $E_p = mg\Delta h$	**A1**	
	4.4×10^{12} (condone 8.8×10^{12})	**A1**	
(b) (ii)	their (b) (i)/any time (eg 5 or 3600 or 18000)	**C1**	**2**
	2.4×10^8 (W) **ecf**	**A1**	
(b) (iii)	**any two from**		**2**
	lack of available/appropriate sites	**B1**	
	high capital cost (compared with power o/p)	**B1**	
	environmental objections	**B1**	
	not available 24 hours/day	**B1**	
	not insufficient tide range in UK		
		Total	**7**