Version 1.0

General Certificate of Education (A-level)
June 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		uses gradient at $t = 0$ 5.5 to 12.5 6.2 to 8.5 to 1 or 2 sf	**B1** **C1** **A1**	**3**
b	i	greater acceleration **and** greater speed	**B1**	**1**
b	ii	greater muscle mass/bigger muscles can exert bigger forces or forces for more time	**B1**	**1**
b	iii	increased cholesterol/heart disease/liver cancer/sterility/increase blood pressure/performance ban	**B1**	**1**
			Total	**6**

Question 2			
	clear attempt to use area under graph/statement that distance is equivalent to area under graph 38 to 40 squares/1 square is equivalent to 0.05 m 1.9 to 2.0 m	**C1** **C1** **A1**	**3**
		Total	**3**

Question 3				
	i	(straight) line with positive gradient and positive value at 0°C accept some curvature, but should be quite straight above 0°C sudden drop to zero resistance at a temperature marked T or 'critical temp'	**B1** **B1**	**2**
	ii	80 K to 180 K **not in** °C	**B1**	**1**
			Total	**3**

Question 4				
a		32.5 × 0.156 **or** 65 × 0.156: any mass × velocity 10.07/10.1/10 ignore sf kg m s^{-1} (accept Ns)	**C1** **A1** **B1**	**3**
b		their a/3.80 (× 10^{-3}) ignore power of 10 error 2670 (N) **ecf**	**C1** **A1**	**2**
			Total	**5**

Question 5			
	thrust, drag, lift and weight correctly labelled and positioned and in correct directions	B1	3
	thrust > drag – allow even if arrows not touching aircraft	B1	
	lift > weight – allow even if arrows not touching aircraft	B1	
		Total	3

Question 6			
a i	air resistance/drag	B1	2
	(normal) reaction (of the ground on the skier)	B1	
a ii	no resultant force (in any direction)/forces in equilibrium	B1	1
b	any closed triangle with *W* as a complete side	M1	4
	closed triangle with correct lengths or angles even if *P* and *Q* are reserved	A1	
	correct triangle by eye	A1	
	force correct 490 ± 20 N	B1	
c i	appropriate force/87 **ecf**	C1	2
	5.4 to 5.9 m s^{-2} **cao**	A1	
c ii	deceleration would decrease	B1	2
	resistance forces increase with speed/are proportional to speed^2/ resultant force gets smaller as speed gets less	B1	
		Total	11

Question 7			
a	$l = RA/\rho$ or correct calculation of area 5.8×10^{-7}	C1	3
	correct sub condoning powers of ten eg $5.6\pi \times 4.3^2/4.9 \times 10^{-7}$	C1	
	6.64 (m)	A1	
b i	1.5/0.247	C1	2
	6.0 or 6.07 (Ω)	A1	
b ii	0.47 (Ω) **cao** allow 0.5	B1	1
		Total	6

Question 8			
a i	$P = V^2/R$ with substitution: 144/any resistance	**C1**	**2**
	37.9 (W)	**A1**	
a ii	use of $1/R$ formula with substitution of some data even if not all five resistors	**C1**	**3**
	correct calculation of $1/R$ (giving 0.897)	**C1**	
	1.11 (Ω)	**A1**	
a iii	144/their aii	**C1**	**2**
	129 to 131 (W) **ecf**	**A1**	
b	lower resistance needed	**B1**	**2**
	(to achieve) higher current (for I^2R to be the same)/correct use of V^2/R	**B1**	
		Total	**9**

Question 9			
a	$3.8 \times 10^{26}/4\pi\ (1.5)^2$ condone power of 10 or missing 'squared'	**C1**	**4**
	$3.8 \times 10^{26}/4\pi\ (1.5 \times 10^{11})^2$	**C1**	
	1340	**A1**	
	$W\,m^{-2}$	**B1**	
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		**5-6**

	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:** ● radiation absorbed in the atmosphere ● different intensities of sunlight ● UK further north so greater distance to penetrate through atmosphere ● clouds (more frequent in the UK) absorb more radiation ● inefficient energy transformation using solar panels/needs very large area ● land pressure greater in UK ● UK more suited to other types of renewable ● examples of alternatives ● reasons why alternatives are appropriate (particularly explanations in terms of physics principles)		**3-4** **1-2** **0**
		Total	**10**

Question 10			
a	heat transfer is effected by a moving fluid	**B1**	
	natural convection – fluid that moves due to change in density	**B1**	**3**
	force convection – fluid is moved (by external device)	**B1**	
b i	uses 45°C – seen on graph	**B1**	**2**
	400 (s)	**B1**	
b ii	uses the idea of 'half life'	**C1**	
	4 × half life (gives 23.25°C)	**A1**	
	1600 s (allow slightly more is stated for cooling the other 0.25 K)	**A1**	**3**
	or uses an exponential equation even if not exactly correct, eg $T = T_0e^{-kt}$	**C1**	
	takes logs	**C1**	
	1600 s	**A1**	
		Total	**8**

Question 11			
a	global warming caused by (increase in) greenhouse effect or describes greenhouse effect	**B1**	**2**
	named example of human activity producing named greenhouse gases, eg agricultural producing methane or burning fossil fuels producing CO_2	**B1**	
b	**any four from**		**4**
	greenhouse gases produced more in developed world	**B1**	
	developing world produces less greenhouse gas (less transport/ industry)	**B1**	
	rise in sea levels – more people affected (live in low lying coastal areas) in developing world	**B1**	
	less developed world more prone to drought or other agricultural failure	**B1**	
	poorer countries have less resource to cope with change eg flood defences	**B1**	
	wealthier countries have high tech abilities to cope with change	**B1**	
		Total	**6**

	UMS conversion calculator www.aqa.org.uk/umsconversion		