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General Certificate of Education (A-level)
June 2012

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.

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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

1	a		no resistance (at or) below critical temperature alternative: allow a labelled diagram which indicates features, allow T_c for transition temp in diagram	M1 A1	2

1	b		**Use** eg mri scanner, transformer, generator, maglev train, particle accelerators, microchips, computers, energy storage with detail **Reason** eg **strong** magnetic field , no energy dissipation (mri scanner / maglev / particle accelerator) higher (processing) speeds, smaller, no energy dissipation (microchip / computer) smaller, no energy dissipation, no fire risk (transformer / generator) no energy dissipation(power transmission / energy storage with detail)	B1 B1	2

2	i		radio	B1	1

2	ii		x-rays	B1	1

2	iii		microwave	B1	1

3			soles compress/ increases distance to stop/ stopping occurs over a longer time momentum change occurs over a longer time/ smaller rate of change of momentum/ same energy absorbed but over a longer distance / smaller deceleration smaller force	B1 B1 B1	3

4	a		use of $\varepsilon = E / V$ condone power 10 errors in sub *allow rearrangement to* $E = \varepsilon V$ $14.8 \times 15.5 \times 10^3$ seen 2.29×10^5 (J) / 2.3×10^5 (J)	C1 A1	2

4	b		use of $P=\Delta W / \Delta t$	condone power 10 errors in sub *Allow rearrangement to* $\Delta t = \Delta W / P$ 2.3×10^5 / 30 or 7647 seen	C1
			2.12 (hours) cao		A1
					2

5	a		ratio of voltage (across component) to current (through component) or R = V/I **with** terms defined and R as subject		B1
					1

5	b	i	correct curve		B1
					1

5	b	ii	resistance increases / increase in resistivity		B1
			energy **transfer increases lattice vibration/** temperature rise **increases lattice vibration** / electron collisions **increases lattice vibration**		B1
			more **frequent** collisions/ ions now a larger target for electrons		B1
					3

6	a		attempts to find area		B1
			12-14 squares or 1 square = 25 (allow evidence of square counting such as shading/ticks etc in Figure 1)		M1
			325 to 350 (m) inside range stated		A1
					3

6	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 of 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		3-4

			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 or lack of fluency **Level 0** incorrect, inappropriate or no response **State** Slows down rapidly at first Rate of slowing decreases Until acquires lower constant speed Graph of velocity against time **Explain** **Stage 1 (instant opens)** More surface area/ larger drag when parachute opens Large Resultant force upwards Large Acceleration upwards with downward velocity/ decelerates **Stage 2 (subsequent motion)** Drag depends on speed **Resultant force decreases** Continues to slow Drag = weight at lower speed Resultant force decreases to zero / equilibrium		1-2 0

7	a		**floating** object displaces fluid equal to its own weight	B1	1

7	b	i	use of $\rho=m/V$ *condone power 10 error* *rearrange to make m subject(m = ρV)* 3.06×10^{-2} (kg) / 3.1×10^{-2} (kg)	C1 A1	2

7	b	ii	states mass of (displaced) water = mass of (floating) ice/ or use of $\rho=m/V$ with sub for ρ_w and m volume displaced water = 2.35 x 10^{-5} / 2.38 x 10^{-5} (m^3) volume of block of ice above surface = 1.05 x 10^{-5} (m^3) / 3.4 x 10^{-5} minus candidate's volume below surface **alternative:** ratio of densities determined / ratio of V_{DW} to V_i determined volume displaced water = 2.35 x 10^{-5} / 2.38 x 10^{-5} (m^3) volume of block of ice above surface = 1.05 x 10^{-5} (m^3) / 3.4 x 10^{-5} minus candidate's volume below surface	C1 A1 B1 C1 A1 B1	3

7	b	iii	increased smaller volume water **displaced** to (make **upthrust)** = **weight** owtte	B1 B1	2

8	a		Δh = 2.51 – 1.00 = 1.51 (m) / (s =) 1.51 m seen use of appropriate kinematics formula correctly makes t subject time = 0.555 (s) / 0.56 (s) (allow 0.55 (s))	M1 M1 A1	3

8	b	i	use of appropriate kinematics equation to find vertical v v = 5.4 (ms^{-1}) (accept 5.4 to 5.9)	C1 A1	2

8	b	ii	any use of Pythagoras where v_h = 18 or use of appropriate trig ratio where v_h = 18 and angle is to horizontal velocity= 18.8 / 18.9 / 19 (ms^{-1}) angle = 16.8 to 18.1 (º)	C1 A1 A1	3

9	a	i	**advantage** eg higher average wind speed / less pressure for space / less visual pollution/ less noise pollution/ easier to transport large components to site etc **disadvantage:** eg long transmission lines / maintenance problems / navigation hazard / cost of construction etc	B1 B1	2

9	a	ii	increase efficiency of power distribution / minimises energy losses/ saves energy/ increases power delivered from farm decrease current in cables reduce heating effect / reduces I^2R losses / decreases voltage dropped across cables	B1 B1 B1	3
9	b	i	use of area x speed to find volume per sec / 5.7 x 10^4 / 9 x 6361 / 9 x πr^2 *condone use of r =22.5 m for 1 mark* mass = 7.4 x 10^4 (kg)	C1 A1	2
9	b	ii	use of $ke = ½ mv^2$ / 30 times any ke (or power) seen / 3.01 x 10^6 seen total ke = 9.04 x 10^7 (J) / 9.0 x 10^7 (J)	C1 A1	2
9	c	i	use of $\rho = RA/L$ (in any form) or correct rearrangement to make A subject sub with correct powers of ten area = 2.7(2) x 10^{-5} (m^2) **cao**	C1 C1 A1	3
9	c	ii	resistance = 0.91 (Ω)	B1	1
9	d	i	use of $P = VI$ or rearrangement to make I subject current = 733 / 730 (A) **cao**	C1 A1	2
9	d	ii	use of $P = I^2R$ P = 4.9 x 10^5 (W) 4.8 x10^5 to 4.9 x 10^5	C1 A1	2
10	a	i	uses trigonometry (*mg sin*5 or *mg cos*85 seen) 829.3 / 828.5 (N) at least 3 sf	B1 B1	2
10	a	ii	tension= 830 (N) $E = ½ F\Delta L$ **and** $F = k\Delta L$ identified / or combined to $E = ½ (F^2/k)$ correct sub condone power 10 error 13.8 (J) range 13.9 to 13.7	C1 C1 C1 A1	4
10	b		lower speed less extension less energy stored (in rope)	B1 B1 B1	3

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