

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

**MARK SCHEME for the October/November 2011 question paper
for the guidance of teachers**

0625 PHYSICS

0625/32

Paper 3 (Extended Theory), maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

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NOTES ABOUT MARK SCHEME SYMBOLS & OTHER MATTERS

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| M marks | are method marks upon which further marks depend. For an M mark to be scored, the point to which it refers must be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent marks can be scored. |
| B marks: | are independent marks, which do not depend on other marks. For a B mark to be scored, the point to which it refers must be seen specifically in the candidate's answers. |
| A marks | <p>In general A marks are awarded for final answers to numerical questions. If a final numerical answer, eligible for A marks, is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are normally awarded.</p> <p>It is very occasionally possible to arrive at a correct answer by an entirely wrong approach. In these rare circumstances, do not award the A marks, but award C marks on their merits. However, correct numerical answers with no working shown gain all the marks available.</p> |
| C marks | <p>are compensatory marks in general applicable to numerical questions. These can be scored even if the point to which they refer are not written down by the candidate, provided subsequent working gives evidence that they must have known it. For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct substitution or working which shows he knew the equation, then the C mark is scored.</p> <p>A C mark is not awarded if a candidate makes two points which contradict each other. Points which are wrong but irrelevant are ignored.</p> |
| brackets () | <p>around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets.</p> <p>e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given.</p> |
| <u>underlining</u> | indicates that this <u>must</u> be seen in the answer offered, or something very similar. |
| OR / or | indicates alternative answers, any one of which is satisfactory for scoring the marks. |
| e.e.o.o. | means "each error or omission". |
| o.w.t.t.e. | means "or words to that effect". |
| Spelling | Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit. |
| Not/NOT | Indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate i.e. right plus wrong penalty applies. |
| Ignore | Indicates that something which is not correct or irrelevant is to be disregarded and does not cause a right plus wrong penalty. |

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| ecf | <p>meaning "error carried forward" is mainly applicable to numerical questions, but may in particular circumstances be applied in non-numerical questions.</p> <p>This indicates that if a candidate has made an earlier mistake and has carried an incorrect value forward to subsequent stages of working, marks indicated by ecf may be awarded, provided the subsequent working is correct, bearing in mind the earlier mistake. This prevents a candidate being penalised more than once for a particular mistake, but only applies to marks annotated ecf.</p> |
| Sig. figs. | <p>Answers are normally acceptable to any number of significant figures ≥ 2. Any exceptions to this general rule will be specified in the mark scheme. In general, accept numerical answers, which, if reduced to two significant figures, would be right.</p> |
| Units | <p>Deduct one mark for each incorrect or missing unit from an answer that would otherwise gain all the marks available for that answer: maximum 1 per question. No deduction is incurred if the unit is missing from the final answer but is shown correctly in the working.</p> |
| Arithmetic errors | <p>Deduct one mark if the only error in arriving at a final answer is clearly an arithmetic one.</p> |
| Transcription errors | <p>Deduct one mark if the only error in arriving at a final answer is because given or previously calculated data has clearly been misread but used correctly.</p> |
| Fractions | <p>These are only acceptable where specified.</p> |

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| 1 | (a) $\Delta h = 0.068 \text{ m}$ <u>use of mgh</u> 0.054 J/Nm | | C1 C1 A1 [3] |
| | (b) $\frac{1}{2}mv^2 =$ candidate's (a) 1.2 m/s ecf from (a) | | C1 A1 [2] |
| | (c) (i) <u>use of</u> distance \div time $= 1.1 \text{ m/s}$ | | C1 A1 |
| | (ii) air or wind resistance / friction / heat / thermal energy OR correct mention of experimental error e.g. width of cylinder | | B1 [3] |
| 2 | (a) (i) <u>use of</u> $a = \Delta v/t$ in any form 23.3 m/s^2 ignore sign | | C1 A1 [2] |
| | (b) (i) $336\,000 \text{ J}$ | | B1 [1] |
| | (ii) <u>use of</u> power \times time $= 180\,000 \text{ J}$ | | C1 A1 [2] |
| | (iii) 54% OR 0.54 ecf from (i) and (ii) accept ($= 180\,000/840\,000$) 21% OR 0.21 | | B1 [1] |
| | (c) anything sensible for a moving vehicle, e.g. flywheel / capacitor / battery appropriate change <u>for this device</u> , for example: flywheel: speed or kinetic energy capacitor: voltage or charge or electrical energy battery: voltage or charge or electrical or chemical energy | | M1 A1 [2] |
| 3 | (a) ρgh in symbols, words or numbers 700 Pa or N/m^2 | | C1 A1 [2] |
| | (b) <u>use of</u> $F = pA$ 14.7 N ecf from (a) | | C1 A1 [2] |
| | (c) $(30.9 - 14.7 =)16.2 \text{ N}$ OR evidence of calculation of resultant <u>use of</u> $a = F/m$ 5.24 m/s^2 | | C1 C1 A1 [3] |

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- 4 (a) molecules/atoms move more slowly B1
fewer collisions OR less hard collisions with walls / balloon B1
lower pressure B1 [3]
- (b) larger surface area of walls OR atoms further apart OR atoms travel further B1
fewer collisions with walls/balloon (only penalise missing walls once in (a) or (b)) B1
lower pressure B1 [3]
- 5 (a) conduction rod / target / anode B1
copper / thickness of rod B1
good conductor / increases amount of conduction (of thermal energy) B1 [3]
- (b) convection fins B1
large surface area / number of fins / spaces between fins B1
large contact with air / allows air to rise between fins B1 [3]
- (c) radiation fins / black surface / end of rod B1
black surface / large surface area B1
good emitter / large radiating surface ignore absorber B1 [3]
- 6 (a) incident ray correct at 59° B1 [1]
- (b) (i) use of $n = \sin i / \sin r$ C1
($r = \sin^{-1}(\sin 59 / 1.33)$) = 40.1° condone no unit
only accept 40° if working shown e.g. $\sin 59 / 1.33$ A1 [2]
- (ii) ray from A to B AND angle of refraction = 40° B1 [1]
- (c) reflected ray at B, correct by eye B1 [1]
- (d) emerging ray refracted away from normal B1 [1]
- 7 (a) (i) 320-350 m/s condone 100 – 999 m/s B1
(ii) 3×10^8 m/s condone $2 - 4 \times 10^8$ m/s B1 [2]
- (b) use of $v = f\lambda$ C1
correct evaluation of candidate's (a)(i)/1.2
(330 m/s gives 275 Hz) A1 [2]
- (c) (i) correct evaluation of candidate's (a)(i) $\times 4.8$
(330 m/s gives 1584m) B1

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- (ii) clear statement that light travels instantaneously o.w.t.t.e.
 OR distance of thunderstorm same as distance travelled by sound
 OR thunder and lightning caused by same event
 OR negligible wind B1 [2]
- 8 (a) compression B1
 rarefaction B1 [2]
- (b) cone moves forward / in direction of travel of wave
 OR cone pushes air particles closer o.w.t.t.e. B1
 cone moves backwards / away from direction of travel of wave
 OR cone causes empty spaces o.w.t.t.e. B1 [2]
- (c) (i) loudness increases AND pitch same B1
 (ii) loudness same AND pitch increases B1 [2]
- 9 (a) (i) $1/R_p = 1/R_1 + 1/R_2$ OR $(R_p =) R_1 R_2 / (R_1 + R_2)$ in any form B1
 (ii) 1.5Ω B1 [2]
- (b) (i) correct position, allow across ammeter as well B1
 (ii) use of $V = IR$ in any form C1
 2.4 V OR $1.6 \times$ candidate's $R_p \text{ V}$ A1 [3]
- (c) reduced accept current decreases B1 [1]
- 10 (a) decreases / low / very low / zero B1 [1]
- (b) (i) ecf from (a), both answers must be consistent with candidate's (a) B1
 e.g. decreases / low / very low / zero increases / high / v. high / > 5V
 light high OR 1 light low OR 0
 AND dark low OR 0 AND dark high OR 1
- (ii) switch position P high OR 1
 AND switch position Q low OR 0 B1 [2]
- (c) AND gate B1 [1]
- (d) transistor B1 [1]

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- (e) any 2 of:
 (input) A high
 (input) B high
 C high
 transistor switches on/works
 yes / it would work
 M1
 A1 [2]
- 11 (a) magnetic flux changes / rod cuts magnetic field
 emf / voltage induced ignore current induced
 B1
 B1 [2]
- (b) Mark (i) & (ii) together
 deflection increases/to R in (i) B1
 deflection increases/to R in (ii) B1
 correct reason in (i) or (ii) AND consistent with deflection:
 in (i) or (ii) rate of change of flux (linkage) increases
 in (i) more (magnetic) field lines cut/stronger (magnetic) field cut
 in (ii) rod moves faster/field lines cut faster
 B1
- (iii) no deflection AND no (magnetic) field lines cut/no change of flux (linkage) B1 [4]
- 12 (a) (i) $x = 88$
 AND $y = 38$ B1
- (ii) 50 B1
- (iii) 38 B1 [3]
- (b) different numbers of neutrons / nucleons NOT different no of protons / electrons
 (strontium-90 has) 52 neutrons / 90 nucleons OR 2 more neutrons / nucleons
 C1
 A1 [2]