**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**International General Certificate of Secondary Education**

# MARK SCHEME for the May/June 2010 question paper

# for the guidance of teachers

## 0625 PHYSICS

**0625/33** Paper 33 (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.

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**Notes about Mark Scheme Symbols and Other Matters**

B marks are independent marks, which do not depend on any other marks. For a B mark to be scored, the point to which it refers must actually be seen in the candidate's answer.

M marks are method marks upon which accuracy marks (A marks) later 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 A marks can be scored.

C marks are compensatory method marks which can be scored even if the points to which they refer are not written down by the candidate, provided subsequent working gives evidence that they must have known it e.g. if an equation carries a C mark and the candidate does not write down the actual equation but does correct working which shows he knew the equation, then the C mark is scored.

A marks are accuracy or answer marks which either depend on an M mark, or which are one of the ways which allow a C mark to be scored.

c.a.o. means "correct answer only".

e.c.f. means "error carried forward". This indicates that if a candidate has made an earlier mistake and has carried his incorrect value forward to subsequent stages of working, he may be given marks indicated by e.c.f. provided his subsequent working is correct, bearing in mind his earlier mistake. This prevents a candidate being penalised more than once for a particular mistake, but **only** applies to marks annotated "e.c.f."

e.e.o.o. means "each error or omission".

brackets ( ) 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 e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given.

**1** **(a)** mgh in any form, numbers, words, symbols C1
5.4 J OR 5.297 J OR 5.292 J OR 5.3 J OR 5.29 J A1

**(b)** ½mv$^2$ in any form, numbers, words, symbols C1
14.7 (J) C1

(energy given by player =) 9.3 J OR his **(b)** – **(a)** correctly evaluated A1

**(c)** **(i)** friction with <u>floor / inside ball</u> OR energy to deform ball OR sound OR idea of hysteresis of rubber
ignore heat / air resistance B1

**(ii)** 78% OR ratio of PEs
accept (14.7 × 0.78 =) 11.47 (J) OR (0.78 × 0.9 =) 0.702 (m) C1

3.12 m to at least 2 sig figs A1

**(iii)** idea of (some of) energy <u>lost</u> / <u>becomes</u> / <u>converted</u> / <u>transferred</u> to heat in ball
ignore friction <u>B1</u> [9]

**2** **(a)** Mark **(i)** and **(ii)** together. Note <u>both</u> M1s required to score the A1 mark

**(i)** B M1

**(ii)** idea of greater / different (NOT less) increase in length for each additional load
accept load not proportional to extension or reverse argument M1

at 4$^{th}$ or 5$^{th}$ reading / value between 2.0 – 2.5 N / 11.6 – 12.6 cm A1

**(b)** **(i)** 1.0 cm B1

**(ii)** 5.7 cm B1

**(c)** 2.5 (cm) OR 1.25 (N) OR 5.0(cm) ignore 2.5N e.c.f. from **(b)** if clear C1
8.2 cm e.c.f. from **(b)** if clear <u>A1</u>
e.g. 10.7/2 (= 5.35) scores 0/2 [7]

**3** **(a)** M = V × D in any form OR $10^3 \times 10^{-3}$ C1
1 kg A1

**(b)** mgh OR his **(a)** × 10 × 0.8 C1
8 J (Nm) OR 7.85 J OR 7.84 J e.c.f. from **(a)** A1

**(c)** P = E/t OR (his 8 × 90) / 60 e.c.f. from **(b)** C1
12 W (J/s or Nm/s) OR 11.77 W OR 11.76 W A1

**(d)** ρgh in any form, words, letters, numbers C1
8000 Pa (N/m$^2$) OR 7850 Pa OR 7840 Pa A1 [8]

**4** **(a)** **(i)** change in length / distance moved (accept "how much it expands")
per unit / given temp rise OR equivalent B1

**(ii)** large bulb OR thin / narrow bore / tube / capillary
NOT thin / narrow thermometer B1

**(b)** **(i)** difference between the highest and lowest temperatures
ignore reference to fixed points B1

**(ii)** tube (sufficiently) long / not too short
OR bore wide/not too thin
OR little/not too much liquid/bulb
NOT change liquid B1

**(c)** **(i)** idea of equal size divisions/expansion for equal temperature rises
OR $\Delta l$ / Δθ constant OR reference to $l$ against θ graph straight line
ignore 1 division = 1 °C B1

**(ii)** uniform bore OR alcohol/liquid expands uniformly (with temp) B1 [6]

**5** Ignore upthrust throughout this question

**(a)** paper:
drag / air resistance / friction (upwards) (seen anywhere in **(a)**) B1
drag /air resistance / friction = weight / force of gravity B1
no resultant (force) / forces balance / upwards force = downwards force
AND no acceleration B1

coin:
weight / force of gravity (always) bigger than air resistance
OR force down bigger than force up
OR air resistance hasn't time / distance to equal weight B1

**(b)** fall at same speed / acceleration / rate, ignore fall at same time )
hit bottom at same time/together )
paper now accelerates (all the way) ) any 1 B1
paper no longer flutters side-side )
they/paper NOT coin fall(s) faster )
the paper (ignore coin) hits sooner )
NOT constant speed/rate [5]

**6** **(a)** single wavelength/frequency accept single colour B1

**(b)** refraction B1

**(c)** 29° unit needed B1

**(d)** n = sin$i$ / sin$r$ in any form OR n = sin$r$ / sin $i$ in any form OR sin$i$ / sin$r$ C1
sin 45 / sin 29 OR sin 29 / sin 45 e.c.f.from **(c)** C1

1.458524649 to at least 2 sig figs c.a.o.
accept incorrect rounding of answer to more than 3 S.F.
e.g. do not accept 1.4 or 1.45 do accept 1.46 or 1.5 or 1.458 A1

**(e)** (at B) greater than critical angle OR ray is totally internally reflected B1
less than critical angle at C B1

**(f)** AB continued straight by eye, to RH glass surface, drawn with ruler B1
refracted up at RH surface C1
horizontal A1 [11]

**7** **(a)** **(i)** approximately 330 m/s
(correct order of magnitude) B1

**(ii)** 300 / 5000 OR t = d/v NOT t = 2d/v C1
0.06 s A1

**(b)** sound through air and sound through steel NOT echo B1

speeds in air and steel are different NOT if faster in air
accept sound in steel/rail heard first B1 [5]

**8** **(a)** same/like/similar charges repel (ignore poles repel) B1
unlike/opposite/different charges attract (ignore poles attract) B1

**(b)** idea of car/person (being) charged (by friction) B1
idea of charge/electrons going to/from/through person B1

**(c)** **(i)** electrons / -ve charges move towards the rod / to R (ignore just "attracted")
ignore any mention of +ve charges moving
any mention of +ve electrons gets B0 B1

**(ii)** opposite charges attract OR electrons / -ve charges attracted to +ve / rod B1

attraction between opposite charges > repulsion between like charges
OR – ve charges (are) close(r) (to the rod) B1

**(iii)** electrons / -ve charges flow (up) from earth/wire no e.c.f. from **(i)**
ignore +ve charges moving, NOT +ve electrons B1
ball becomes –vely charged B1 [9]

**9** **(a)** diode B1

**(b)** **(i)** 2 Ω B1

**(ii)** 24 OR 22 + 2 (Ω) seen C1
$1 / R = 1 / R_1 + 1 / R_2 (+ 1 / R_3)$ OR $(R =) \frac{R_1 R_2}{R_1 + R_2}$
seen or used with any 2 resistors
ignore extra resistance added to expression for R in equation C1

6 Ω A1

**(c)** N.B. marks may be scored anywhere in **(c)**

(current =) zero / very small M1

diode reverse biased
OR polarity wrong OR facing wrong way
OR diode only conducts R / + to L / - A1

**(d)** use $I = V / R$ OR $P = VI$ OR $P=V^2 / R$ symbols, numbers or words M1
use of R = 8 (Ω) & correct calculation to give 2W
OR R = 4 / 0.5 = 8 (Ω) OR $R = 4^2 / 2 = 8$ (Ω)
OR any other calculation(s) using ($I = V / R$ & $P = VI$) OR $P = V^2 / R$ to deduce 8 (Ω) M1

switch position B (NOTE: this is dependent on both M1s being scored)
ignore any calculations using 2 Ω A1 [10]

**10 (a)** waves clearly more bunched
condone poor accuracy / shape or waves not filling screen C1
3 waves drawn, with first 4 half-wavelengths having 2.0 (±0.2)cm interval A1
all waves drawn same amplitude (±0.2)cm as original AND
at least 1 peak and 1 trough drawn B1

**(b)** volts/cm: increased / any value > 5 (V / cm) B1
factor of 2, increase or decrease / 10 (V / cm) / 2.5 (V / cm) B1

N.B. 10 (V / cm) scores B1, B1

time base: no change / 10 ms / cm B1 [6]

**11 (a)** *γ* straight up B1
*α* to left AND *β* to right B1

**(b)** into or out of paper C1
into paper A1 [4]