MARK SCHEME for the May/June 2010 question paper

for the guidance of teachers

0625 PHYSICS

0625/32   Paper 32 (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) $\frac{1}{2}mv^2$ 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 4th or 5th 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 $10^3 × 10^{-3}$ — 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/m²) 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 Δl / 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 / <u>force</u> of gravity   B1
        no resultant (force) / forces balance / upwards force = downwards force
        <u>AND</u> no acceleration   B1

        coin:
        weight / <u>force</u> 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 <u>C</u>   B1

    (f) AB continued straight by eye, to RH glass surface, drawn with ruler   B1
        refracted up at RH surface   C1
        horizontal   <u>A1</u> [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 <u>and</u> 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   <u>B1</u>   [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 <u>move</u> 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 <u>+ve / rod</u>   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) <u>from</u> earth/wire   no e.c.f. from **(i)**
  ignore +ve charges moving, NOT +ve electrons   B1
  ball becomes –vely charged   <u>B1</u>   [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 $(R =) \dfrac{R_1 R_2}{R_1 + R_2}$

  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 / <u>very</u> small   M1

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

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(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 <u>both</u> M1s being scored)
ignore any calculations using 2 Ω   <u>A1</u> [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   <u>B1</u>   [6]

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

(b) into or out of paper   C1
into paper   <u>A1</u>   [4]