MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

0625 PHYSICS

0625/21   Paper 2 (Core 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.

NOTES ABOUT MARK SCHEME SYMBOLS & 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.

underlining   indicates that this must 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.

Spelling   Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit.

Significant figures   Answers are acceptable to any number of significant figures ≥ 2, except if specified otherwise, or if only 1 sig.fig. is appropriate.

Units   Incorrect units are not penalised, except where specified. More commonly, marks are allocated for specific units.

Fractions   These are only acceptable where specified.

Extras   Ignore extras in answers if they are irrelevant; if they contradict an otherwise correct response or are forbidden by mark scheme, use right + wrong = 0

Ignore   Indicates that something which is not correct is disregarded and does not cause a right plus wrong penalty.

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.

1 **(a)** 60.4 – 44.2   C1
      16.2 (cm^3)   A1

    (b) (density =) mass/volume in any form, letters, words, numbers   C1
       40.5/16.2   e.c.f.   C1
       2.5   e.c.f.   A1
       $g\,/\,cm^3$ B1
       (accept correct conversion $kg\,/\,m^3$, with unit)

    (c) 60.4 and 40.5 both ticked   –1 e.e.o.o.   B2   [8]

2 **(a)** molecules/particles/atoms moving   (accept vibrating/oscillating)   C1
      molecules colliding (accept with each other)   C1
      molecules colliding with walls   A1

    (b) **(i)** LH graph – temperature/T/θ / °C/K on horizontal axis
           RH graph – volume/V / m^3/cm^3 on horizontal axis   } M1

       (ii) X on LH graph at intersection of line and vertical axis   A1   [5]

3 **(a)** idea that non-renewable sources are finite / get used up   B1

    (b) **(i)** solar/sun/<u>sun</u>light   (ignore just light)
           wind/éolienne   accept windmill
           waves (ignore sea)
           tidal   (ignore sea)   } any 1   M1
           hydro(electric) (ignore water)
           geothermal
           biomass

       (ii) high cost/low effectiveness
           small output   } any 1   (ignore efficiency)   A1
           environmental impact
           cannot be relied upon (wind/solar)

(c) (i) fossil fuel
coal
oil
petrol
(natural) gas   any 1   M1
peat
nuclear
lignite

    (ii) plentiful/regular/constant/reliable supply
cheap/cost effective   any 1   A1
high output   [5]

4 (a) cool air more dense   OR   cool <u>air</u> falls
OR warm air rises <u>so it can be cooled</u>   B1

(b) energy/heat removed from store must be released outside store   B1
heat developed by refrigeration unit   B1

(c) reduce/prevent heat coming in from outside <u>NOT</u> cold getting out   B1
reduce/prevent conduction NOT convection/radiation   B1

(d) idea that heat gained from outside = heat removed by refrigeration unit   B2
allow B1 for idea of thermostatic control   [7]

5 (a) boxes 1 and 4 ticked   −1 e.e.o.o.   B2

(b) sound/wave reflected/bounces back (from surface) NOT just "returns"   B1

(c) (i) cliff A   B1

    (ii) $(s =) vt$ OR $(s =) vt/2$ in any form...........   allow $s = ut + \frac{1}{2}at^2$ C1
330 × 1.5   OR 495
OR 330 × 0.75 OR 247.5
OR 330 × 2.5   OR 825
OR 330 × 1.25 OR 412.5   C1
OR 330 × 4   OR 1320
OR 330 × 2
660 (m)   A1

    (iii) both echoes at the same time   OR   one echo   OR   louder   B1
time value quoted between 1.5s and 2.5s   B1   [9]

6 **(a)** ray bent down at 1st surface, but not beyond/along normal   B1
ray bent down at 2nd surface, but not beyond/along surface   B1
MAX 1 mark if any suggestion of a spectrum shown

(b) spot/dot/line AND of one colour   accept a single named colour e.g. red   B1

(c) spectrum/colours/light dispersed   ignore rainbow   C1
red at top <u>and</u> violet at bottom   in words in space provided   A1   [5]

7 **(a)** spheres closer together   allow touching spheres   B1

(b) **(i)** charging (of anything) by friction/rubbing   B1
plastic/furniture (becomes) charged   OR   electron/charge transfer   M1
<u>plastic/furniture</u> attracts dust/fluff   A1

     (ii) idea of charge leaking   B1
water is a conductor   B1   [6]

8 **(a)** **(i)** parallel   B1

     (ii) 4.2 (V)   B1

     (iii) V=IR in any form OR V/R   C1
4.2 / 3   e.c.f. **(ii)**   C1
1.4   e.c.f. **(ii)**   A1
A OR amp(s) OR ampere(s)   B1

     (iv) 1. bigger OR the sum of the two currents OR 2 (A)   B1
2. same/equal   B1

(b) clear series connection of all 3 across battery in one circuit   B1
clear parallel connection of all 3 across battery in other circuit, and must not be
shorted out   B1
allow B1 max in (b) if correct series/parallel circuits both shown, but with more or
less than 3 resistors in either/both   [10]

9 (a) all 3 lamps in parallel across battery + switch   **B2**
    (–1 if any lamps in series,   –1 if connections across battery only)

   (b) (i) molecules vibrate over bigger distance OR molecules separate
        OR   bigger space <u>between molecules</u>
        NOT just "molecules need more space"
        ignore breaking bonds   **B1**

      (ii) 1. bends   ignore expands   **B1**
            bends/moves to the right/away from contact/outwards/towards invar strip   **B1**
          2. idea that something gets hot   **M1**
            idea that bimetallic strip/invar/brass bends/breaks circuit   **A1**
            idea that something cools (when no current)   **M1**
            idea that bimetallic strip/invar/brass straightens/makes contact   **A1**   **[9]**

10 (a) (i) Fig. 10.1   **B1**

      (ii) Fig. 10.3   **B1**

   (b) 2 complete cycles, any shape   (if full-wave rectified, must be 4 humps)   **B1**
       cyclical and equal amplitude above & below axis   **B1**
       uniform spacing   **B1**
       intention of sinusoidal shape   accept sinusoidal full-wave rectification   **B1**   **[6]**

11 (a) thermionic emission   **B1**

   (b) (i) S_2 OR 2

      (ii) S_1 OR 1   ignore mention of S_2 any 1 correct B1 / all 3 correct B2   **B2**

      (iii) S_3 OR 3   ignore mention of S_1 and/or S_2

   (c) reverse polarity of plates (however expressed)/make upper plate positive
       OR correct description of use of magnet   **B1**   **[4]**

12 (a) (radio)activity OR count rate OR counts/s OR particles emitted/s
       OR rate of decay OR number of <u>undecayed</u> atoms/nuclei
       OR radiation OR original number of atoms/nuclei   **B1**
       NOT mass/substance/material, unless clearly specified
       to decrease to half (original value)   NOT   half the time   **B1**

   (b) (i) 53 ± 1 (s)   **B1**

      (ii) 84 ± 1 (s)   **B1**

      (iii) candidate's **(ii)** + candidate's **(i)**   **C1**
         correct evaluation of candidate's **(ii)** + candidate's **(i)**   **A1**   **[6]**