MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

0625 PHYSICS

0625/31   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.

Cambridge is publishing the mark schemes for the May/June 2011 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

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.

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.

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   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.**

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) all points correctly plotted ±½ small square   B1
straight line of best fit for candidate's points   B1

(b) (i) candidate's correct value with unit (± 0.2), (expect 1.2 N)   B1

    (ii) remains stationary / nothing happens / no acceleration NOT constant speed   B1

(c) Correct data from candidates <u>graph</u> for ΔF and Δm, used in $\Delta F/\Delta m$ B1

(d) (i) $F = ma$ in any form, letters, words   B1

    (ii) gradient = F/a OR   gradient = m ignore $m=F/a$ C1
candidate's **(c)** with correct unit   A1

(e) straight line of positive gradient   B1   [9]

2 (a) distance/height   AND   tape measure/(metre) rule(r)   B1
weight   OR   load   OR   force
AND   balance/scale(s)   OR   newton-meter/spring balance/force meter   B1
time   AND   watch/clock/timer   B1

(b) power = work/time OR energy/time in any form
OR Pt words or numbers seen anywhere e.g. 528 x 5   C1
(work =) force × distance in any form   C1
11   A1

(c) efficiency = E_{out}/E_{in} OR P_{out}/P_{in} seen anywhere, clearly identified
OR 520 × (20/11) × 5
OR (work done =) 800 × 20 × 0.3 OR 800 × 20 × 30 OR 4800 (J) OR 720 (J)   C1
(energy used =) 32,000 J   A1   [8]

3 **(a)** **(i)** smaller because <u>area</u> smaller   B1

    (ii) smaller because depth/height smaller   ignore less water   B1

  (b) **(i)** $h\rho g$ OR   12 × 1000 × 10   C1
         1.2 × 10^5 Pa OR 1.1772 × 10^5 Pa OR 1.176 × 10^5 Pa accept N/m^2 A1

    (ii) candidate's **(i)** + 1.0 × 10^5 Pa correctly evaluated with unit (correct value
        2.2 × 10^5)   B1

    (iii) $p_1V_1 = p_2V_2$ in any form   C1
        1.1 cm^3
        OR   0.5 × candidate's **(ii)**/10^5 correctly evaluated   A1

    (iv) value in **(iii)** too small OR volume larger o.w.t.t.e.   B1   [8]

4 **(a)** rheostat/<u>variable</u> resistor AND control/vary/change/ limit
      current /resistance/power/voltage <u>across heater</u>   B1

  (b) **(i)** $P = VI$ in any form OR (I=) P/V C1
       1.25 A   A1

    (ii) (R =) V/I in any form words or numbers   C1
       (voltage across X =) 2.4 (V) OR 6 - 3.6 (V)   C1
       1.92 Ω   e.c.f. from **(b) (i)**   A1

  (c) battery running down/going flat/energy <u>of battery</u> used up OR V or e.m.f. less
      OR more/increasing resistance (of heater) NOT resistance of X increases   B1

  (d) **(i)** transformer condone step-up OR potential divider/potentiometer NOT extras   B1

    (ii) diode   OR   rectifier   OR   L.E.D.   NOT extras   B1   [9]

5 **(a)** **(i)** potential difference OR e.m.f. OR voltage ignore volts ⎫

    (ii) frequency accept cycles/s ignore waves/s ⎬ all 3   B1

    (iii) power accept energy/s ⎭

(b) **(i)** case/frame/outside/base/parts that can be touched ignore metal parts   B1

    (ii) electric shock/electrocution/death by electricity o.w.t.t.e. ignore anything else   B1
         live wire touches case   B1

(c) heaters in parallel with any supply
    (M0 if no supply, clear break in circuit, short across supply or heater)   M1
    one switch controlling both heaters <u>and</u> one switch controlling one heater
    OR   one switch in series with each element   A1

    special case: heaters in series with supply and <u>one</u> switch shorting out <u>one</u>
    resistor AND another switch in series with supply   B2   [6]

6 **(a)** A and C   B1

   (b) **(i)** 4.2×10^{10} years   B1

    (ii) idea of decay OR changes proton/neutron/nucleon number
        OR change into another nuclide/isotope/element/type of atom
        OR emits α/β particle (ignore γ / radiation)   B1

    (iii) idea of insignificant change in activity during stated time up to 5×10^{9} years
        OR experiment time insignificant c.f. 1.4×10^{10} years OR long half life
        OR long time to decay   B1   [4]

7 **(a)** idea of fine ray/beam shone into (glass) block / pins appropriately placed
shown in diagram or described   B1
angles i & r or C measured OR correct i & r or C marked on diagram   B1
$\sin i/\sin r$ OR $\sin r/\sin i$ OR $1/\sin C$ OR $\sin C$ B1
n = speed in air/speed in glass OR $c/v = \sin i/\sin r$ OR $n = 1/\sin C$ OR $c/v = 1/\sin C$ B1

(b) **(i)** $v = f\lambda$ OR $240/1.9 \times 10^5$ OR $T=d/s$ AND $f=1/T$ B1
0.00126 Hz OR 0.0013 Hz   NOT 0.0012 Hz
ignore more than 3 s.f.   accept s^{-1} A1

(ii) distance = speed × time   in any form accept $s = 2d/t$ C1
(time for tremor =) 240 (s) or 4 mins   also gives first C1   C1
(time for tsunami =) 2500 (s) or 41 mins 40 s   also gives first C1   C1
(warning time =) 2260 (s) or 37 mins 40 s   A1   [10]

8 **(a)** **(i)** total (internal) reflection OR reflection but no refraction/doesn't emerge   B1
angle (of incidence} > critical angle   B1

(ii) initial reflection + 0 or 1 further reflection only, not at lower surface
must be straight and reach within 1cm of end   B1

(b) **(i)** bends easily/less likely to break (ignore stronger) OR smaller pixels/
more detail/greater resolution/see smaller objects/wider field of view   B1

(ii) light travels down/along/through fibres   B1

(iii) light/image returns up/along/through fibres ignore cameras   B1   [6]

9 **(a)** **(i)** down
down OR anti-clockwise ⎤ both
                        ⎦   B1

(ii) BC is parallel to the field/doesn't cut field or vice-versa/not at angle to field
ignore BC not perpendicular to field   B1

(b) continues moving/turning   NOT reverse/other direction   M1
idea of moving things continue moving   OR   reference to Newton's Laws
OR   reference to momentum/KE/inertia NOT reference to force still acting   A1

(c) more turns/several coils
iron core
increase current/voltage
stronger magnet
smaller air gap   any 1   B1
curved poles
more efficient brushes
poles closer
use split-ring commutator   [5]

10 (a) release of electrons due to heating/high temperature/heater   B1

    (b) X- and Y-plates labelled   B1
anodes either order, labelled, either plates/cylinders with holes   B1
closed tube of sensible shape
AND cathode AND anode(s) AND X- & Y- plates, all three features in correct order
labels not needed for last mark but if given must be correct   B1

    (c) change current in filament/cathode/heater   IGNORE limit
OR   change temperature/heat/power/energy of filament/cathode/heater
OR   change cathode-anode p.d./voltage
OR   change charge/voltage of grid   B1

    (d) (i) $(I=)Q/t$ in any form   C1
0.0019 A   OR 1.9×10^{-3} A   OR   1.9 mA   A1

        (ii) $(E=)VIt$ OR VQ in any form, words, symbols, numbers (accept t=5s)   C1
190 J   OR   candidate's $I \times 100\,000$ correctly evaluated   A1   [9]

11 (a) Pt OR $1.2 \times 10^4 \times 9$ OR $1.2 \times 10^4 \times (11 - 2)$ C1
$(l=)E/m$ OR $E/0.36$ OR Pt/m OR $Pt/0.36$ C1
3×10^5 J/kg   A1

    (b) (i) liquid ignore vapour/gas/water   A1

        (ii) move around more rapidly / faster / more KE
ignore **start to** vibrate etc but accept starts to vibrate faster
move further apart / spreads out (NOT molecules expand)   any 2   B1
break free / evaporate / overcome bonds / overcome forces of
attraction /escape / change state (accept boils)
convection (current)   [6]