MARK SCHEME for the May/June 2009 question paper

for the guidance of teachers

5054 PHYSICS

5054/02   Paper 2 (Theory), maximum raw mark 75

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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CIE is publishing the mark schemes for the May/June 2009 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

1 unit penalty per question.
Allow 2 or more sig. figs throughout paper. 2 or 3 sig. fig. answers must be correctly rounded.

Section A

1 **(a)** (speed) increases or (paper) accelerates   B1
(speed) becomes constant/uniform or acceleration zero (after 0.5 s)   B1

    (b) any clear change in distance/time or 1.87 (m/s) (allow 1.9)   C1
2.3–2.5 m/s   A1

    (c) PE at beginning of a change   B1
heat/internal energy/thermal energy at end of a change/K.E. of air   B1   [6]

2 **(a)** **(i)** conduction   B1

      (ii) molecules hit each other or molecules pass vibration on
or free electrons move (through metal) and hit molecules   B1

    (b) **(i)** downwards at or near X   B1

      (ii) hot water less dense or cold water more dense   B1
hot water rises (not heat rises) or cold water falls   B1
convection current mentioned or water flows to replace hot water that rises
or rising and falling described or water cools at surface   B1   [6]

3 **(a)** ($E =$) $P.t$ in any algebraic form or 85 × 120 or 85 × 2 or 170   C1
10200 J or 2.8 × 10^{-3} kW h   A1

    (b) ($H =$) mL seen in any algebraic form or **(a)**/31 or **(a)**/0.031   C1
330 or 329 J/g or 3.29 × 10^5 J/kg   ecf **(a)**   A1

    (c) heat/time needed to warm ice to 0°C/melting point/freezing point   B1   [5]

4 **(a)** solid more regular/ordered etc. or less space/separation between molecules or vv
or solid molecules fixed and liquid molecules move throughout   B1

    (b) **(i)** solids: strong(er) forces/bonds or energy not enough to break molecules free
or vv   B1

      (ii) fast(er)/high(er kinetic) energy molecules escape/evaporate   B1
molecules left are slower/less kinetic energy (on average)   B1

      (iii) (hotter) molecules move faster/higher energy   B1
more molecules have energy/speed to break bonds/overcome forces   B1   [6]

5 **(a)** **(i)** correct ray   B1

     (ii) correct angle marked to normal   B1

     (iii) (the angle) between the incident ray and the normal (at the point of contact)   B1

   (b) correct ray from hat to eye   B1
      0.85–1.15 m   B1   [5]

6 **(a)** (sound) too high a frequency to be heard or (frequency) above 20 kHz   B1

   (b) ($f =$) v/λ or $v = f\lambda$ algebraic or numerical   C1
      1 250 000 Hz   A1

   (c) vibrate/oscillate   C1
      vibration etc. in same direction as/parallel to wave/energy or horizontally   A1

   (d) pressure increases and decreases or compressions and rarefactions mentioned
      in **(d)** or particles come together and move apart   B1   [6]

7 **(a)** NS marked on each piece correctly   B1

   (b) NS/unlike/opposite poles attract   B1
      switch closes or soft-iron/contacts touch   B1

   (c) **(i)** resistance decreases   B1

     (ii) current increases clearly in coil/through thermistor   B1
       magnetic field (in coil) (and contacts close)   B1   [6]

8 **(a)** number of protons and neutrons   B1
      protons and neutrons in the nucleus   B1

   (b) **(i)** 2   B1

     (ii) 4   B1

     (iii) 90 or 92–**(i)** and **(iv)** 234 or 238–**(ii)**   B1   [5]

Section B

9 (a) circuit diagram showing power supply, lamp and ammeter in series   B1
        voltmeter across lamp   B1
        ensure voltage is 24 V in some way e.g. power supply 24 V   B1
        $V × I$ or voltmeter × ammeter readings   B1

   (b) (i)   P 0.63(2) A   B1
             Q 1.26(3) A   B1
             R 1.89(5), 1.9 A or sum of candidate's P and Q   B1

        (ii) 240/current at R or $1/R = 1/R_1 + 1/R_2$ C1
             127, 130, 126.7 Ω   ecf **(i)**   A1

   (c) (i)   (I =) V/R numerical or algebraic   C1
             0.42 A   A1

        (ii) 80 V or 79.8 V   ecf **(i)**   B1

   (d) one lamp goes out/blows/fuses/switched off they do not all go out/others stay on   B1
        lamps are working at correct/more brightness/voltage/current power   B1
        reference to voltage is 240 V across each lamp or voltage shared in series/<240 V
        or current value(s) quoted   B1 [15]

10 (a) (i)   air resistance increases (as speed increases)   B1
             (at constant speed) becomes equal to driving force/applied force etc. B1

        (ii) driving force (forward force) larger (than air resistance/backwards force)   B1

   (b) (i)   (E =) $½ mv^2$ algebraic formula   C1
             $½ × 75 × 4^2$ C1
             600 J   A1

        (ii) (a =) F/m algebraic seen or 10 (N) used as force   C1
             0.13 m/s^2 A1

   (c) (i)   friction (in chain/axles) or rubbing of surfaces   B1
             heat or thermal energy produced   B1

        (ii) (efficiency = useful) energy output/energy input algebraic or numerical or 380
             seen   C1
             0.95 or 95%   A1

(d) lower mass/weight of cycle   B1

less force needed	same acceleration/get up hill/to stop cycle/lift cycle
greater acceleration/easier to acc.	for same force or $F = ma$ quoted
less energy/work (input)	to go uphill/due to less friction/½ mv^2 less
less kinetic energy	less stopping distance/less force to stop
more efficient/less energy wasted	going uphill/less friction
less friction	easier turn handlebars/higher (top) speed
less pressure (on ground)	sinks less into ground M1A1 [15]

11 (a) (i) coil and magnet (poles) in a correct orientation – no label needed   B1
2 slip rings correct and labelled   B1
brushes touching 2 slip rings, labelled   B1

    (ii) induction of voltage or current   B1
(magnetic) flux change or field/flux lines cut wire/coil   B1

  (b) (i) attach (generator to) voltmeter   B1
measure voltage (e.g. gives 1.0 V, ±0.5 V)   B1
measure trace height (e.g. gives 0.5 div, ±0.25 div)   B1
clear 2 V moves up 1 div   B1
OR
observe trace/line/spot with no input   B1
apply battery/voltage (to y input)   B1
measure voltage applied (with voltmeter) or battery has known voltage   B1
check distance moved up/down for voltage supplied e.g. 2 V moves up 1 div   B1

    (ii) volts/div (vertically) changed (e.g. 2 V/div decreased, changes to 0.2 V/div)
or y-gain changed to expand trace vertically   B1
time/div (horizontally) changed
or time base/x-gain changed to expand trace horizontally   B1
y-shift used to move trace up   B1

        (if no mark – y gain and time base/x gain mentioned B1
                  trace expanded vertically and horizontally B1)

    (iii) hot/heated filament/cathode or by thermionic emission   B1
anode   B1
electrons attracted by/accelerated towards positive voltage/anode   B1 [15]

MARK SCHEME CODE

B1	Independent mark.
C1	Compensation mark; given automatically if the answer is correct, i.e. the working need not be seen if the answer is correct; also given if the answer is wrong but the point is seen in the working.
M1	Method mark: if not given subsequent A marks fall (up to next B, M or C mark).
A1	Answer mark.
e.c.f.	error carried forward; it usually is even where not specifically indicated, i.e. subsequent working including a previous error is credited, if otherwise correct.
vv	vice versa