UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education O Level

MARK SCHEME for the June 2004 question papers

5054 PHYSICS

5054/01	Paper 1 (Multiple Choice), maximum mark 40
5054/02	Paper 2 (Theory), maximum mark 75
5054/03	Paper 3 (Practical Test), maximum mark 30
5054/04	Paper 4 (Alternative to Practical), maximum mark 30

These mark schemes are published as an aid to teachers and students, to indicate the requirements of the examination. They show the basis on which Examiners were initially instructed to award marks. They do not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

- CIE will not enter into discussion or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the June 2004 question papers for most IGCSE and GCE Advanced Level syllabuses.

GCE O Level

MARK SCHEME

MAXIMUM MARK: 40

SYLLABUS/COMPONENT: 5054/01

PHYSICS
Paper 1 (Multiple Choice)

Question Number	Key	Question Number	Key
1	**A**	21	**A**
2	**A**	22	**D**
3	**C**	23	**C**
4	**D**	24	**A**
5	**C**	25	**C**
6	**D**	26	**B**
7	**C**	27	**B**
8	**A**	28	**D**
9	**D**	29	**B**
10	**A**	30	**A**
11	**C**	31	**B**
12	**B**	32	**D**
13	**A**	33	**D**
14	**A**	34	**B**
15	**D**	35	**C**
16	**B**	36	**A**
17	**B**	37	**A**
18	**B**	38	**D**
19	**D**	39	**A**
20	**C**	40	**B**

TOTAL 40

JUNE 2004

GCE O Level

MARK SCHEME
MAXIMUM MARK: 75
SYLLABUS/COMPONENT: 5054/02 **PHYSICS** **Paper 2 (Theory)**

Section A

1 (a) (i) weight / gravity / gravitational (force)   B1

  (ii) **air / wind** resistance or drag or friction / upthrust   B1

 (b) (i) 9.8 or 10 m/s^2 or N/kg   B1
  (ii) air resistance increases   (**not** if parachute open)   B2
    less resultant force **or** sensible statement about upwards force   C1
    e.g. resistance opposes gravity or decreases acc.   C1
    slope of line decreases   C1

  (iii) air resistance = weight / no **resultant / net / overall** force / downwards
     force balances upwards force   B1
                                                                            Total [6]

2 (a) (i) radiation   B1
  (ii) no molecules or medium (to vibrate, conduct, convect) / vacuum   B1
 (b) **hot air** rises   B1
    (hot) air expands / density decreases   B1
 (c) fiberglass or air is a bad conductor/ insulator / lags / reduces heat flow
    fiberglass traps air or prevents convection   B1
    (ignore radiation statements)   B1

                                                                            Total [6]

3 (a) rise in temperature / hot / heated   B1
    road / bridge / rail / metal expands or gap reduces   B1
    no buckling / deformation / breaking / cracking / twisting / tilting   B1
 (b) any **other** problem + solution
    e.g. concrete cracks – leave a gap, telephone wires sag – put them high / tight
    hot water cracks glass – use thin glass / car engines seize up – cool them
    water freezes in pipes – lag them or use antifreeze / tyres burst – let air out
    pipes bend – use **flexible** joints / dashboard deforms – car in shade
    wrong readings on measuring cylinder – use correct temp.   B1

                                                                            Total [4]

4 (a) distance traveled per unit time **or** in one second / distance ÷ time
    or rate of change of distance   B1
 (b) s = d/t in any algebraic or numerical form   C1
    any doubling of distance or final time   C1
    0.48 s   (allow 0.24s 2/3 accept 0.5s)   A1
 (c) 60/0.48 (5)   C1
    123.75 accept 120, 123, 124   (ecf **(b)**)   A1
                                                                            Total [6]

5 (a) (i) magnetic (field) of current / coil / recording head
    or head is magnetized / an electromagnet   B1
  (ii) magnetism / magnetic field or current or poles on head reverses /
    changes direction   (**accept** "due to alternating current")   B1
  (iii) each direction / one cycle longer (on tape)   B1
 (b) (i) need to keep record / tape stored or played   B1
  (ii) iron, steel etc   B1
                                                                            Total [5]

6 **(a)** **(i)** voltage past maximum or 3V / off scale / outside range   B1

        (ii) reading less accurate or sensitive / not far up scale or smaller deflection

   (b) **(i)** V = I R in any algebraic format   B1

          4/12   C1

          0.33 A   (accept 1/3 A)   A1

        (ii) **(i)** * 30 **or** **(i)** * 18 + 4 **or** 30*4/12   C1

          9.9 – 10 V   (e.c.f **(i)**, e.g. if **(i)** = 0.3, 0.3*30 = 9V or 0.3*18+4 = 9.4 V)   A1

          only 1 unit error in this question

                                                       Total   **[7]**

7 **(a)** **(i)** filament is hot / heated (by current from 6V supply) / thermionic emission   B1

        (ii) anode is positive / anode attracts electrons / electrons attracted to + (electric) field from anode to cathode   B1

       (iii) otherwise electrons stopped / deflected / slowed down / collide (with air atoms)   B1

                (accept no opposition to movement, to reach screen, to avoid air resistance)

   (b) up and down vertical **or** side to side movement   (**not** on both axes)   B1

          electrons deflected by electric field **or** attracted to + or repelled by –

          or plates are charged (e.g. plates are +ve and –ve)   B1

                                                        Total   **[5]**

8 **(a)** radon (gas)   B1

   (b) cancer / mutation / **cell** damage **or** death

       radiation sickness **or adds** to readings   B1

       (accept count with no source)

   (c) (outer) space / stars / Sun   (**not** sunlight)   B1

   (d) number of protons and neutrons (**not** no. nucleons)   B1

   (e) 84   216   (values reversed B1)   B2

                                                        Total   **[6]**

SECTION B

9 **(a)** **(i)** Any three other parts of spectrum radio, microwaves, u.v., X, γ   M3
(-1 any wrong if>3 **ignore** t.v.)
correct order for all including visible (accept colours) and I.R.   A1

(ii) reflection **of infra-red or radiation** (from shiny material)   B1
more energy hits food **or** reflection towards food
cooks food faster
avoids wasting heat / energy **or** more efficient
avoids heating outer case or burning hand   ANY 2   B2

(b) connected to (outer metal) case   B1
if live touches case **or** case becomes live   B1
allows current / charge to earth / ground   B1
blows fuse (and disconnects circuit)
or no current through person **or** no electrocution / electric shock   B1

(c) **(i)** P = V I in any algebraic form   B1
(ii) 230 * 8.3   C1
1900 W (accept 1910 W but **not** power 1/4)   A1
(iii) current decreases (halves) **or** power 1/4   B1

Total   [15]

10 **(a)** mass of bar (measured)   M1
using (top-pan) balance / spring balance / scales etc.   A1
length, breadth and height measured
or volume water + bar measured **or** displacement can (full) with water   M1
volume = length x breadth x height
or subtract volume water alone   **or** collect water displaced   A1
using ruler / calipers / micrometer **or** measuring cylinder   A1
density = mass / volume   B1

(b) **(i)** melts / changes state / becomes liquid   B1
(ii) (initial) increase in vibration / K.E. of molecules (to 600s)   B1
then later / after 600s or on melting
bonds broken (accept molecules break free / overcome attraction / not fixed in place)   B1
(iii) E = mc (Δ)T algebraic form seen   C1
645 – 655 (°C) seen)   C1
17 160 J   (allow 1700, 17200, 20000)   A1

(iv) 30*400 or 12 000 (J) seen)   C1
E = mL any algebraic form seen **or** 12 000/0.3   C1
40 000 J/kg   A1

Total   [15]

11 **(a)** **(i)** P.E. decreases   (A to B or C to D or downhill or initially)   B1
K.E. gained   (P.E. → K.E….2)   B1
K.E. to P.E. **change** must be clear and from B to C or uphill   B1

      (ii) mgh algebraic form seen   C1
500*10*30   C1
150 000 J   A1

      (iii) conservation of energy cited **or** clear that loss of P.E.
has become K.E.   C1
500*10*20 or 500*10*10 or 50 000 seen   C1
100 000 J   (allow g=9.8)   A1

    (b) **(i)** velocity involves direction **or** is a vector (speed does not)   B1
direction (of carriage) changes / carriage turns   (accept on diagram)

      (ii) force towards centre (of curve) / inwards   (accept centripetal)   B1

    (c) F = ma in any algebraic form or 3000 = 500a   C1
3000/500   C1
6(.0) m/s^2 A1

                                                                        Total   **[15]**

                                                  Total for paper :   **[75]**

GCE O Level

MARK SCHEME

MAXIMUM MARK: 30

SYLLABUS/COMPONENT: 5054/03

PHYSICS
Paper 3 (Practical Test)

1. (a), (b) & (c) Repeat measurements taken for either t_1 or t_2.   B1

                                Correct T_1 in the range 1.40 s to 1.60 s to 0.01 s   B1

                                Correct T_2 within $\pm$ 0.1 s of T_1 B1

    (d)   Comment on
Either reaction time – however expressed
Or range of values   B1

    (e)   Sensible conclusion based on their results e.g.
Time for one oscillation is independent of the mass.
(if periods are the same within the limits of uncertainty)
        Or   Time for one oscillation increases / decreases with increase
in mass. (Allow direct or inverse proportion)
(provided their results show this)   B1

Total [5]

2. (a)   Power supply, ammeter and switch in series with gap
between A and B, voltmeter in parallel with power supply. B1

    (b), (c) & (d) *I* values in region of 0.3 A and 0.45 A with unit seen at
least once and at least one current to 0.01 A.   B1
(Allow Centre variation)
Both *V* values in the region of 4.5 V with unit seen at least
once and at least one voltage to 0.1 V.   B1
(Allow Centre variation)
R values in the region of 15 Ω and 10 Ω with unit seen at
least once.   B1

    (e)   Resistance increases as diameter decreases.   B1
(Allow resistance is inversely proportional to diameter or area)

Total [5]

3.   (a) and (b)   Sensible temperatures with unit seen at least once.   B1

                       At least one reading attempted to better than 1 ˚C   B1

                       V_F numerically to (1.0 to 3.0) x temperature drop
and correct calculation of V_I with unit seen at least once.
m_I numerically equal to V_I.   B1

   (c) and (d)   Sensible values for all the thermal energy changes with
unit seen at least once.   M1

   (e)   Energy gained greater than energy lost as cold water gains
thermal energy from beaker / surroundings   A1

Total [5]

4. **Initial readings.**

   (b) x 0.60 $\pm$ 0.05 m with unit.   B1

   (c) y 0.20 $\pm$ 0.05 m with unit.   B1
               (Penalise missing unit once only)
               x and y recorded to 0.001 m or better.   B1

Table

   (d)   Table with units for d, D and $1/D$.   B1

               At least one reading with D greater than or equal to 1.00 m. B1

               At least one reading with D less than or equal to 0.70 m   B1

               Correct calculation of $(d/D)^2$ and $1/D$ to at least 2 s.f.   B1

               Five good values judged according to the table below.   B1

D	Range of $(d / D)^2$	$1 / D$
0.65	0.06 – 0.10	1.54
0.70	0.12 – 0.16	1.43
0.75	0.18 – 0.22	1.33
0.80	0.23 – 0.27	1.25
0.85	0.27 – 0.31	1.18
0.90	0.31 – 0.35	1.11
0.95	0.35 – 0.39	1.05
1.00	0.38 – 0.42	1.00

<u>Graph.</u>

(e)   Axes labelled with unit and correct orientation.   B1

Suitable scale y axis 1 cm = 0.02 / 0.025
                   x axis 1 cm = 0.1 or 0.05 m^{-1} M1

Two points plotted correctly – check the two points furthest
from the line.   A1

Best fit fine line and finely plotted points.   B1

<u>Calculations.</u>

(f) and (g)   Large triangle.   B1

Correct calculation of S and f (ignore sign)   B1

Value of f in range 0.130 m to 0.170 m with unit.   B1

Total [15]

GCE O Level

MARK SCHEME

MAXIMUM MARK: 30

SYLLABUS/COMPONENT: 5054/04

PHYSICS
(Alternative to Practical)

Question 1

(a) Uses two rays from X and Y (clear <u>*intention*</u> to touch hole edges)   M1
    One X and one Y ray "touch" an edge of the hole and meet screen   C1
    Any one X and one Y are neat lines (rule and sharp "pencil") allow apparent
    "refraction" or "diffraction" at hole   B1
    One correct X and the corresponding Y labeled on screen
    Arrows on rays; no broken lines penalty -1 (max).   B1

(b) XY in range 54 to 56 mm (unit required), accept in cm   B1

Total [5]

Question 2

(a) 4 items correct, 3mks; 3 items = 2mks; 2 items = 1mk. Accept historical symbols
    Accept any other component provided that the function of the circuit is not
    compromised.
    Penalise -1 (max) :- short circuit (e.g. line behind component, unless signs of use
    of rubber) or any compromised circuit function.   B3

(b) Correct polarities, +ve signs for correct terminals of cell and ammeter
    (re diode).   B1

(c) No current / I = 0, (do not accept "nothing"), accept very small "reverse" current
    / lamp does not light.   B1

(d) One from: limit current / prevent overheating / current indicator / provides
    resistance   B1

Total [6]

Question 3

(a) Any method <u>based</u> on rule reading at 25°C – rule reading at top of
    thermometer bulb.
    NB / required. Mark text or diagram or <u>Fig 3.1</u>   B1
    Rule as close as possible to thermometer (on diagram < 1 cm) /
    uses fiducial aid   B1
    With the eye/line of sight perpendicular to the rule/end of mercury thread   B1

(b) (i) l_0 = 5.6 – 5.8 (cm), l_{100} = 22.6 – 22.8 (cm) ignore unit   B1
    (ii) Δl / 100, clear, correct arithmetic ecf, 2 or 3 dcp, ignore unit, accept any
        correct Δl / Δθ from graph.   B1
    (iii) linearly, or (l – l_0) ∝ θ accept/line has a constant/uniform m, note that…
        "directly proportional" automatically looses the mark.   B1

Total [6]

Question 4

(a) (i) V initial = a volume between 40cm^3 and 60cm^3 : (allow use of beaker)   B1
   must be able to displace 40cm^3 / prevents overflowing /
   exceeding cm^3 limit   B1
  (ii) {V_{max} - $V_{initial}$} / change in volume is found / change in volume obtained is
       = V_{metal} / any related answer that has an association of measurement of
       volume.   B1
   (iii) Any good point e.g. tap cylinder to release air / how avoiding parallax /
       water at 20°C / careful pouring / avoid splashing / use set square / repeat
       average / reading the position of the bottom of the meniscus.   B1
(b) Scale calibration of cylinder is correct at 20°C / liquid needs to be at 20°C   B1

(c) Water (on the metal would be) included in the (repeat) volume of the metal;
   or something that means the same, not just erroneous.   B1

Total [6]

Question 5

(a) Axes correct, scale that cannot be x2 / is not "awkward" and with units   B1
   Correct plotting, nearest ½ small square, check first point and obvious
    plot errors.   B1
   Line judgement re plots (line does not go through all correctly plotted points,
    so accept smooth line through 5 points i.e., one point not on the line)   B1
   Neat smooth thin line   B1

(b) Mark cands diagram <u>or Fig 5.1</u>:
   (i) Object displace downwards OR screen displaced downwards   B1
      Any ray from the top of object through the lens to meet screen.
      Be generous re art and accuracy of position,   B1
   (ii) put centres in line   B1

Total [7]

Paper Total 30