UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2009 question paper

for the guidance of teachers

5054 PHYSICS

5054/03 Paper 3 (Practical Test), maximum raw mark 30

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.

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International Examinations

1 **(a)** Distance from 0.0 cm to centre of mass in the range 48.0 cm to 52.0 cm recorded to the nearest mm or better with unit seen here or in **(b)**. B1

(b) One of x and y recorded to the nearest mm or better and each in the range 20.0 cm to 30.0 cm with $x + y$ less than answer to **(a)** by at least 0.5 cm with unit seen here or in **(a)**. B1
(In **(a)** and **(b)**, penalise missing unit once only)

(c) Took readings at either side of the mass and took the average to find the position of the centre /
Used the slot in the mass to indicate the line on which the centre fell /
Found diameter and divided by 2 to find centre. B1

(d) w in the region of 2.5 cm, t in the region of 0.5 cm, both measurements repeated and correctly averaged with unit on one of the quantities. B1

(e) Correct calculation of M and density giving a value in the range 0.30 g/cm^3 to 0.95 g/cm^3 with unit for density. B1 [5]

2 **(a)** Circuit showing power supply, switch, LED, ammeter and resistor connected in series with the voltmeter in parallel with the LED. Ignore incorrect polarity of LED. Allow diode or LED symbol but not arrows going towards LED. B1

(b) I in the range 5.0 mA to 13.0 mA measured to 0.1 mA or better with unit. B1

V in the range 1.5 V to 2.5 V measured to 0.01 V or better with unit. B1

(c) I in the range 0.20 mA to 0.50 mA and to 0.1 mA or better.
Value of V from (b) ≥ Value of V from (c) ≥ 1.0 V. B1
(Ignore units here provided given in part (b))

(d) Large drop in current but only a small change in voltage, hence resistance of LED must have increased. B1 [5]
(Accept calculated resistances. Ignore missing units or unit errors, e.g. Ω instead of kΩ)

3 **(a)** θ_1 sensible and θ_2 less than 15°C with unit seen somewhere. B1

(b) Final volume in the range 85 ml to 100 ml and correct calculation of m_1 with unit. B1

(c) Correct calculations of thermal energy changes, with Q_1 having a value according to the following table
(ignore units). B1

Temperature difference (°C)	Thermal energy (J)
5	1680
6	2016
7	2352
8	2688
9	3024
10	3360
11	3696
12	4032
13	4368
14	4704
15	5040
16	5376
17	5712
18	6048
19	6384
20	6720

(d) Correct calculation of L with value 265 to 405. M1
Value for L in range 295 to 375 with unit. A1 [5]

4 Preliminary Results

(c) *x* measured to the nearest mm or better with unit. B1

Scale readings shown. B1

(d) Any two from the following;
Vertical half metre rule checked with set square /
aligned with vertical indicator, e.g. door frame or clamp stand /
Eye level when taking reading on vertical rule /
Set square used against vertical rule with point at top or bottom of horizontal rule /
Half-metre rule placed close to metre rule /
Repeat readings shown. B2 [4]

Table

(e) Table with units for *M* and *x* B1

In awarding the next marks good results should be judged as being ± 2 mm from the examiners best line.

3 good values for *x*.(Result from **(c)** to be counted even if not tabulated). B1

A 4th good value of *x.* B1

A 5th good value for *x.* B1 [4]

M/kg	*x*/cm
0.100	0.4
0.200	0.8
0.300	1.2
0.400	1.6
0.500	1.9

x values are only given as a guide and will be dependent on the thickness of the rule.
Apply systematic error penalty if intercept greater than 2 mm on depression axis.

Graph

(f) Axes labelled with units. B1
(Allow e.c.f. from wrong unit in table but not no units)

Suitable scale, not based on 3, 6, 7 etc. with data occupying more than half the page in both directions. B1
(Allow the graph to start at the origin.)

Two points plotted correctly – check the two points furthest from the line. This mark can only be scored if the scale is easy to follow. B1
(Points must be within ½ small square of the correct position)

Best fit fine line and fine points or crosses. B1 [4]
(Line thickness to be no greater than the thickest lines on the grid)

Apply –1 penalty if the graph is plotted the wrong way round.

Calculations

(g) Use of large triangle with base ≥ 8 cm or height ≥ 13 cm. B1
(Base should be ≥ 13 cm or height ≥ 8 cm if grid is used landscape rather than portrait.)
Correct calculation 2/3 s.f. B1

Qualitative description of the results

Candidate's result	Expected comment
Straight line through the origin	x is directly proportional to M
Straight line with intercept	x depends linearly on M
Curve	x increases as M increases

(h) Or uses a correct statement of the gradient, i.e. the depression increases by 4 cm for every 1 kg increase in the mass. B1 [3]