CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the October/November 2013 series

5054 PHYSICS

5054/32 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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Section A

1 **(a)** l in the range 1.5 cm to 3.0 cm, measured to the nearest mm or better with unit. B1 [1]

(b) Sensible x recorded to the nearest mm or better with unit. B1 [1]
(To be sensible x must be less than y.)

(c) All of y, z and L recorded to the nearest mm or better with unit seen somewhere. B1

$L > l$, $y > x$ and $z < x$. B1 [2]

(d) Correct substitution for W and W in the range 5 N $\leqslant W \leqslant$ 30 N to 2/3 s.f. with unit. B1 [1]

2 **(a)** θ_1 recorded with unit and in the range 10 °C $\leqslant \theta_1 \leqslant$ 40 °C. B1

Attempt at measuring temperature to better than 1 °C seen somewhere. B1

$\theta_2 > 70$ °C **and** $\theta_3 - \theta_1 > 15$ °C **and** $\theta_2 - \theta_3 > 10$ °C. B1 [3]

(b) Correct calculations of thermal energy changes with unit seen somewhere. M1 [1]

(c) Sensible statement with reason based on the candidate's results, e.g.
Energy loss is greater than energy gain because apparatus is losing heat to the surroundings /
Energy gain is greater than energy loss because the cold water gains heat from the hot beaker /
Energy loss and gain are the same because heat loss to the surroundings is the same as heat gain from the beaker. A1 [1]

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3 **(a)** V_1 measured to 0.1 V or better with unit seen here or in **(c)**
and I_1 measured to 0.01 A (10 mA) or better and with unit seen here or in **(c)**
and 3.5 V > V_1 + 3.3 I_1 > 1.7 V. B1 [1]

(b) Correct calculation of R_1 with unit seen here or in **(d)**. B1 [1]
(Allow e.c.f. from incorrect V and I values.)

(c) $V_2 < V_1$ and $I_2 < I_1$ with units seen here or in **(a)**
and 3.5 V > V_2 + 33 I_2 > 1.7 V. B1 [1]

(d) Correct calculation of R_2 **and** $R_2 < R_1$. B1 [1]
(Allow e.c.f. from incorrect V and I values.)

(e) $R_2 < R_1$. M0
Some explanation of change in resistance, e.g.
The temperature of the filament is less /
The power dissipated in the filament is less /
Resistance increases as temperature increases /
Change in resistance because of change in current explained /
Ohm's law is not obeyed because the temperature is not constant. A1 [1]

Section B

4 **<u>Preliminary Results</u>**

(a) Correct normal and angle of incidence = 50° by eye. B1 [1]
(Correct i and r can be checked by looking at the table.)

(d) P_1 and P_2 labelled on any incident ray with one point within 2.0 cm of the block and the other point within 2.0 cm of the "For Examiner's Use" margin. B1

P_3 and P_4 labelled on any emergent ray with one point within 2.0 cm of the block. B1

Correct construction inside block with r in the range 28.0° to 32.0° seen here or in the diagram or in the table. B1 [3]

(**Special case:** If i = 40°, then allow r in the range 23.0° to 27.0°.)

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Table

(e) Table with units for *i* and *r* and no units for sin *i* and sin *r*. B1

As the angle of between the incident ray and the normal increases, the emergent rays leave block further to the right and all the rays correctly refracted away from the normal as they leave the block. B1

Correct calculation of sin *i* and sin *r* to > 1 s.f. B1

One angle ⩾ 60° **and** one angle ⩽ 30°. B1

At least 5 correct pairs of angles obtained as shown below. B1 [5]
(Do not count 0°, 0°)

Correct pairs of angles:

i / °	10	20	30	40	50	60	70	80
r / °	5–9	11–15	17–21	23–27	28–32	33–37	36–40	38–42

Graph

(f) Axes labelled with no units. B1
(Allow e.c.f. from wrong unit in table and allow sin (*i* / °).)

Suitable scale, not based on 3, 6, 7 etc. with data occupying more than half the page in both directions. B1

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.)

Calculations

(g) Triangle must use more than half the drawn line. B1

Correct calculation of gradient, with value in the range 1.45 to 1.60 (ignore s.f. and inclusion of unit). B1 [2]
(Range is 0.62 to 0.69 if sin *r* against sin *i* is plotted.)

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