# MARK SCHEME for the October/November 2015 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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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**1** **(a)(i),(ii)** $M$ = 500 g with unit **and** 150 cm$^3$ ≤ $V$ ≤ 200 cm$^3$ with unit
seen here or in **(b)(i)**. Allow cm$^3$ or ml. **B1**

    **(iii)** Do 2 or more fills of the measuring cylinder (and add the 2
together because the volume is greater than 100 cm$^3$)
**OR** 2 values seen in **(a) (ii)**. **B1**

        (Beware of one reading taken from a line on the beaker)

    **(iv)** Any two from
Read the volume from the bottom of the meniscus. /
Eye level with the meniscus when the reading is taken. /
Shake the masses whilst they are over the beaker. /
Do repeat measurements and average the results provided
Repeats seen in **(a)(ii)**.
(Answer must explain how, so avoid water sticking to the
masses is not enough). **B2**

  **(b)** **(i)** Volume of masses = 250 cm$^3$ – $V$ with unit seen here or
in **(a)(i)**.
**And**
    **(ii)** Correct calculation of density with unit. (Ignore s.f.) **B1** **[5]**

**2** Throughout this question ignore missing arrows or arrows
in the wrong direction on rays.

  **(a)** End X of line labelled X, AX at an angle of 30° to AB by
eye, line L perpendicular to AB by eye and 3.0 cm from A. **B1**

  **(b)** Reflected ray heading downwards and to the right with
one point between AX and AB and the other point to the
right of B. **B1**

  **(c)** New line AX at an angle of 60° to AB **and** new position
of the reflected ray to the right and towards the top of the
page (should be parallel to AX). **B1**

    Both rays projected backwards towards the left of the page. **M1**

    $\theta$ in the range 55° to 65° from a generally correct diagram. **A1** **[5]**

**3** **(a)(i),(ii)** Sensible $M$ and $m$ in 10 g steps and within ± 20 g of $M$
with unit seen somewhere **and** correctly evaluated ratio
(allow 1 s.f.) with no unit. **B1**

    **(iii)** Measured height above the bench in 2 places /
Aligned with horizontal object e.g. window frame. **B1**

**(b)** $20.0\,\text{cm} \leq h_2 - h_1 \leq 30.0\,\text{cm}$ and $49.0\,\text{cm} \leq l \leq 55.0\,\text{cm}$,
all measured to the nearest mm with unit seen on one of
the quantities.                                                                                             B1

Correct substitution and $R$ found (ignore unit).                                          B1

$\theta$ in the range 15° to 35° with unit.                                                          B1    **[5]**

## 4   Preliminary Results

**(a)  (i)**   $V_0$ recorded to 0.1 V or better with unit seen here or in
**(a)(ii)** and in the range 3.0 V to 5.5 V.                                             B1

**(ii)**   $V$ recorded to 0.1 V or better with unit seen here or in
**(a)(i)** and in the range 1.5 V to 2.8 V.                                           B1    **[2]**

## Table

**(b)**  Table with units for $R$ and $V$ and the results from **(a)(ii)**.
Included.                                                                                                         B1
(Ignore missing or wrong units for $1/V$ or $1/R$).

Correct calculation of $1/V$ and $1/R$ (check the point that
is furthest from the drawn line).                                                                     B1

In the following section $V$ values must always follow the
trend that as $R$ increases $V$ increases.

$V$ for 2.7 kΩ resistor in the range 2.0 V to 4.4 V.                                     B1

$V$ correct for one series combination from the following
three, $R$ = 2.0 kΩ, 3.7 kΩ and 4.7 kΩ.                                                   B1

$V$ correct for two further series combinations from the
following three $R$ = 2.0 kΩ, 3.7 kΩ and 4.7 kΩ.                                    B1

| $R$/kΩ | Voltage range/V |
|---|---|
| 2.0 | 1.8 to 4.0 |
| 3.7 | 2.1 to 4.8 |
| 4.7 | 2.2 to 5.0 |

$V$ for 0.73 kΩ (parallel arrangement) in the range
1.1 V to 2.6 V and < **(a)(ii)** value.                                                       B1    **[6]**

**Graph**

**(c)** Axes labelled with units and correct orientation.                                              B1

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

All data plotted and the two points furthest from the line
checked. 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**

**(d) (i)** Correct reading of the sides of the triangle used for the
gradient determination from a reasonable scale.                                                        B1

Triangle uses more than half the drawn line.                                                       B1

**(ii)** Value of $V_0 G$ in range 0.9 (k$\Omega$) to 1.1 (k$\Omega$) to 2/3 s.f.
(Ignore unit).                                                                                     B1      **[3]**