MARK SCHEME for the November 2005 question paper

5054 PHYSICS

5054/03   Paper 3, maximum mark 30

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which Examiners were initially instructed to award marks. It does 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*.

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1   **(a)**   Sensible l (2.25 cm to 2.74 cm) recorded to the nearest mm or better with unit.   **[B1]**

(b)   Sensible N (32 to 36) Allow fractional turns.   **[B1]**

(c)   Sensible D (1.45 cm to 1.74 cm) recorded to the nearest mm or better with unit.   **[B1]**

(d)   Sensible value for M (4.95 g to 6.04 g) and correct calculation of density.   **[M1]**

Density in range 7.0 to 9.0 g/cm^3 to 2/3 s.f. with unit.   **[A1]**

[5]

2   **(a)** e_1 or total length determined from the difference of two readings, with at least one of the readings taken to the nearest mm or better. (unit to be seen here or in **(b)**)   **[B1]**

Diagram to show;
Extension;
Or the use of a set square against the rule to show a reading being taken at the correct level;
Or eye level with a reading when it is being taken.   **[B1]**

Correct use of set square against rule at base to ensure rule is vertical.   **[B1]**

(b) e_2 or total length determined from the difference of two readings with at least one of the readings taken to the nearest mm or better and between 0.1 cm and 5.0 cm less the answer to **(a)**. (unit to be seen here or in **(a)**)   **[B1]**

(Penalise wrong or missing unit in both **(a)** and **(b)** once only. If a candidate is told how to find the extension, then the first mark in **(a)** and the mark in **(b)** are lost.)

(c)   Correct calculation of density to 2/3 s.f. with unit giving value in the range 7.0 to 10.0 g/cm^3.   **[B1]**

[5]

3   **(a)** V 4.5 V to 6.5 V and recorded to 0.1V or better and I 0.08 A to 0.16 A and recorded to 0.01 A or better, both with units.   **[B1]**

(b) V less than value in **(a)** and recorded to 0.01 V or better and I approximately twice value in **(a)** and recorded to 0.01 A or better, both with units. (Allow e.c.f.)   **[B1]**

(c)   Either; X has the higher resistance because it allows the least current to pass through it.
Or; Calculation showing the resistance of X and Y.   **[B1]**

(d) (i) V less than value in **(b)** and recorded to 0.1 V or better and I approximately three times value in **(a)** and recorded to 0.01 A or better, both with units. (Allow e.c.f.) **[B1]**

(ii) Either; The parallel arrangement of resistors allows the most current to pass and hence its resistance is the smallest.
Or; Calculation showing the parallel arrangement to have the smallest resistance. **[B1]**

(Penalise missing current units once only)
(Penalise missing voltage units once only)

[5]

4 Table

(a) Table with units for θ and t. **[B1]**

(b) Readings taken at half minute or shorter intervals, for a period of up to at least 5 minutes. **[B1]**

One attempt at a temperature taken to better than 1 °C **[B1]**
(Not allow all temperatures recorded to .0 °C)

Initial reading at $t = 0$ and correct trend with a larger drop in temperature at the start compared to the end. **[B1]**

[4]

Graph

(c) Axes labeled with units and correct orientation. **[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.
(Generally the graph should not start at the origin. Allow 2 cm = 60 s in the horizontal direction.) **[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.
(Points must be within ½ small square of the correct position.) **[B1]**

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

[4]

Calculations

(d) Tangent which touches the curve between 120 s and 180 s. **[B1]**

Use of large triangle with base greater than 8 cm when tangent has been attempted or straight line drawn.
(Base should be greater than 12 cm if grid is used, landscape rather than portrait.) **[B1]**

Correct reading of sides of triangle when tangent has been attempted or straight line down. **[B1]**

$\Delta y/\Delta x$ found with 2/3 s.f. and negative sign in final answer. **[B1]**

[4]

Description of experiment

(e) Volume recorded with unit (cm^3 or ml) and 20 cm^3 ≥ value ≤ 250 cm^3. **[B1]**

(f) Sensible precautions, e.g.
Water stirred (before taking readings). **[B1]**

Either; Thermometer read with the eye on the same (horizontal) level as the reading.
Or; Volume recorded with eye level with bottom of meniscus. **[B1]**

[3]