NANYANG GIRLS' HIGH SCHOOL
2022 Sec 4 Physics Practical 03
Potential Difference and Current in a Resistor & a Filament Lamp

Suggested Markscheme

Record of measurements
- Table with wide vertical columns (*to record readings in table immediately*)

- Headings with units **I** / A, **V** / V, and $\frac{\textbf{V}}{\textbf{I}}$/ VA^{-1} or Ω (*last column for filament lamp only*)

- Acceptable values and correct d.p. for **I** and **V** (precisions: 0.01 A and 0.05 V)

- correctly calculated ratio and s.f. of $\frac{\textbf{V}}{\textbf{I}}$ (least s.f. of **V** and **I, 2s.f.**) (*for resistor only*)

- Wide range (at least 0.3 A) and fairly well spread out values of **I**

Acronym to remember checklist for graph: **SPLACT**

Graph of **V** against **I**
- **S**cales are suitable, spaced out points
- **P**oints are correctly plotted: *plot different points if lines intersect*, e.g. "×" and "⊙"
- **L**ines are sharp/of uniform thickness
  - Resistor: best fit line: about equal no. of points on each side & points on each side are spaced out), not force line through origin
  - Filament lamp: smooth curve with about equal no. of points on each side, passing through origin
- **A**xes **V** against **I**, correct labelling, intersection labelled

Fig. 1: Fixed resistor

Gradient *G*
- **C**oordinates for the 2 points selected for gradient
  Large **T**riangle on graph for gradient   (>= ½ length of line)

- gradient of graph = $(y_2 - y_1) / (x_2 - x_1) \approx 0.45 \pm 0.05$

Conclusion
- I is directly proportional to V   (if graph passes through or close to origin)
- fixed resistor obeys Ohm's law.

OR V increases linearly as I increases   (if graph does not pass through origin)

Fig. 2: Filament lamp

Conclusion
- I increases as V increases
- Filament lamp does not obey Ohm's law

Questions

1.   To ensure that the current is a minimum at the beginning. This will prevent a <u>sudden surge of a large current</u> flowing through the circuit which <u>may damage circuit components</u>, when the circuit is closed.

2.   To <u>prevent the heating effect of the current</u> which would cause the <u>resistance of circuit components to change</u> and affect the V and I readings.

3.   This may cause the <u>voltmeter and the ammeter readings to fluctuate</u>.
      OR
      This may <u>increase the effective resistance of the circuit</u> and hence affect the V and I readings.

4.   R = V/ I is given by (gradient of graph)$^{-1} \approx 2.2 \pm 0.2$ Ω

5.   The I-V graph for the resistor is a <u>straight line passing through (or close to) the origin</u>, indicating that it has a <u>constant resistance</u>.
      The I-V graph for the filament lamp is a <u>curve with decreasing gradient</u>, indicating that its <u>resistance decreases with increasing current</u> (or p.d.).

Discussion

The statement is <u>only true if the resistor is an ohmic conductor</u>, as in the circuit in Fig.1.

<u>By definition</u>, the resistance is the <u>ratio of V to I</u>.