Instrument	Function	Precision (with units)	Range (with units)	Notes (proper use, precaution)
metre rule	To measure length	Length: smallest division! 1 mm or 0.1 cm	0 to 100.0 cm	
1st ammeter	To measure electrical current	Half the smallest division 0.01 A	0 to 1.00 A	*Range shows 1 A f.s.d.*
2nd ammeter	To measure electrical current	Half the smallest division 0.05 A	0 to 3.00 A	*Range shows 3 A f.s.d.*
voltmeter	To measure voltage (p.d. or e.m.f.)	Half the smallest division 0.05 V	0 to 3.00 V	*Range shows 3 V f.s.d.*

Note: f.s.d. means full scale deflection

Activity 5: Measurements in electricity experiments

Activity 5: Answers

Results

Results (sample readings)

(a) e.m.f.		(b) labelled value of resistance	
accumulator	2 dry cells in series	1st resistor	2nd resistor
2.05 V	3.00 V 1.55 V (1 dry cell)	3.3 Ω	10 Ω

(d)   length of x =   0.500 m or 50.0 cm or 500 mm

voltmeter reading, V = 0.75 V   to precision of voltmeter (0.05 V)

ammeter reading, I_1 = 0.32 A   to precision of ammeter (0.01 A)

(e)   **Calculation of R**

R = V / I = 0.75 V / 0.32 A   = 2.34 ≈ 2.3 Ω
Answer should follow least s.f. of the 2 values used
OR treat this as a normal calculation (2 or 3 s.f.)

(f)   Ammeter reading, I_2 = 0.30 A   to precision of ammeter (0.05 A)

Questions

1.
- The jockey was held such that it did not press too hard on the resistance wire as this may dent the wire and affect its resistance.
- The wire were disconnected (as there is no switch) when not taking any readings so as to prevent any components from heating up as this may affect their resistance.

2. I_1 is the better one to use as this reading has a higher precision.

3. Show how you would connect the rheostat to get maximum resistance in with the slider put either to the far left or the far right.
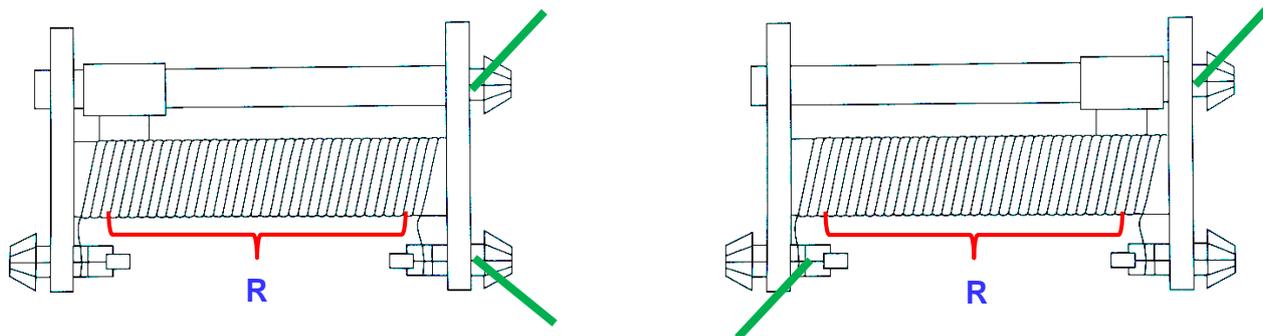
Note: The effective resistance **R** is between the wire connection at the base (at the bottom) and the slider (at the top).

Activity 6: Presentation of given experimental data

Checklist:

- Header: check <u>symbol</u> for physical quantity and <u>unit</u> (if any)

- Raw data (y & V):   same column has <u>same d.p.</u> (based on precision of instrument)
- Processed data ($\frac{1}{V}$):   apply rules for processed data, same column may have different d.p.

- $\frac{1}{V}$ has same s.f. as V e.g. $V = 0.80$ (2 s.f.)   so $\frac{1}{V} = 1.3$ (also 2 s.f.)

y / cm	V / V	$\frac{1}{V}$ / V^{-1}
98.0	0.80	1.3
64.0	1.00	1.00
35.8	1.15	0.870
18.0	1.40	0.714
10.0	1.50	0.667
4.9	1.65	0.606

C.   Analysis, conclusions and evaluation (ACE)

Students should be able to:

- analyse and interpret data or observations appropriately in relation to the task
- draw **conclusion**(s) from the interpretation of experimental data or observations and underlying principles
- make **predictions** based on their data and conclusions
- identify **significant sources of errors** and explain how they affect the results
- state and explain how significant errors may be **overcome or reduced**, as appropriate, including how experimental procedures may be improved.

Note: One or more questions in the Practical Exam may incorporate some assessment of skill area **Planning**, requiring students to apply and integrate knowledge and understanding from different sections of the syllabus. It may also require the treatment of **given experimental data** in drawing relevant conclusion and analysis of proposed plan.

How do we decide whether to start both axes of a graph from origin (0, 0) or otherwise?

	Case A: Start <u>both axes</u> from (0, 0)	**Case B:** Start <u>only horizontal axis</u> from 0	**Case C:** Both axes <u>need not</u> start from 0
This is a <u>given instruction</u>	Yes	Yes	If neither A or B is applicable
<u>Conclusion</u> based on the shape of the graph	Yes If conclusion is required & the theory (if given or known) suggests <u>Y is directly proportional to X</u>	Yes If conclusion is required & the lowest point suggests the <u>Y-intercept is far from the origin</u>	
<u>Y-intercept</u> <u>(vertical intercept)</u> is required		Yes if Y-intercept is required	

Note: calculating the gradient does not depend on whether axes start from 0.

Activity 7: Analysis of given experimental data

1. Graph of $\frac{1}{V}$ against *y:* $\frac{1}{V}$ (on Y-axis)   and   *y* (on X-axis)

    Case B in this example: Start <u>only horizontal axis</u> from 0 since
    - a <u>conclusion</u> is required based on the shape of the graph
    - and the lowest point suggests the <u>Y-intercept is far from the origin</u>

2. Tick against the checklist of **SPLACT** below:

    ☐ **S**cales are suitable, spaced out points

    ☐ **P**oints are accurately plotted (to nearest half a small square)

    ☐ **L**ines are sharp & uniform, and the straight line of best fit (*has about equal no. of points on each side & points on each side are spaced out*)

    ☐ **A**xes have correct labelling (similar to table headers), intersection of axes is labelled

    ☐ **C**oordinates of two points (chosen to calculate the gradient) are labelled clearly

    ☐ **T**riangle is drawn with dashed lines to cover at least 50% of the line of best fit

3. Ensure that *Coordinates* and a large *Triangle* are drawn on the graph!

    Sample answer:

    Gradient $= \frac{1.18-0.60}{90.0-0}$ $= 0.0064$ (2 s.f.)

4. $\frac{1}{V}$ <u>increases linearly</u> as y <u>increases</u>

Further Readings for Practical Exam Revision

- 2017 S3 Chapter 01 Physical Quantities & Measurements
  (Section 1.5 Presentation & Interpretation of Data)

- 2018 S4 Physics Practical Guidelines for Planning
  (pages 5 & 6 on Precautions)

- All practicals completed in 2017 and 2018.