



2022 Sec 4 Physics Practical Exam

Revision Exercise (2)

Name: _____ () Class: 4/ ___ Date: _____

Practical Assessments Skills

B. Presentation of data and observations (PDO)

Students should be able to:

- **present** all information in an appropriate form
- manipulate measurements effectively for analysis
- present all quantitative data to an appropriate number of **decimal places/significant figures**

Note: Always familiarise yourself with an instrument before using it!

Instrument	Function	Precision (with units)	Range (with units)	Notes (proper use, precaution)
metre rule		Length: smallest division!		
1 st ammeter		Half the smallest division		
2 nd ammeter		Half the smallest division		
voltmeter		Half the smallest division		

Activity 6: Measurements in electricity experiments

Apparatus

- battery of 2 dry cells in series
- 2 V accumulator
- plug-key switch
- voltmeter (0 – 3 V)
- ammeters (0 – 1 A & 0 – 3 A)
- R and two other fixed resistors
- jockey
- bare wire AB mounted on a metre rule
- connecting wires with crocodile clips

Diagram

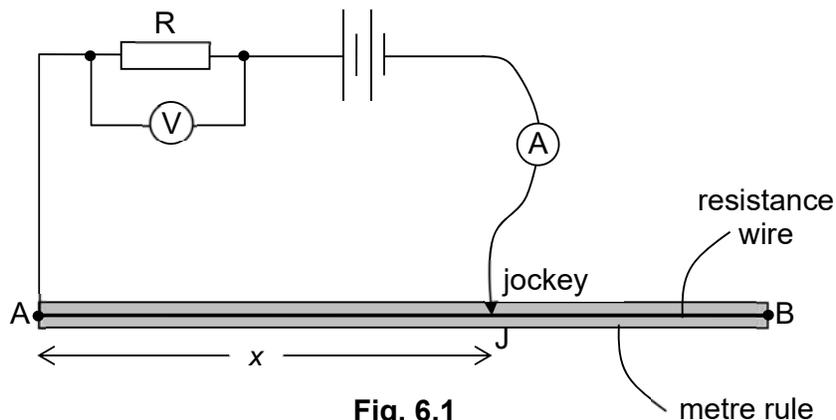


Fig. 6.1

Procedure

- (a) Measure and record the e.m.f. of the accumulator & the 2 dry cells in series.
- (b) Record the labelled values of the two fixed resistors.
- (c) Set up the circuit as shown in Fig. 6.1 using the 2 dry cells and the ammeter with 1 A at f.s.d. (full-scale deflection).
- (d) Place the jockey on the wire AB for a length x such that J is half way between A and B. Record the length x , the readings on the voltmeter, V and ammeter, I_1 .
- (e) Calculate the resistance of the fixed resistor, R , using the equation $R = V / I$
- (f) Replace the ammeter with the 3 A f.s.d. ammeter and record its reading I_2 .
- (g) Remove the fixed resistor R and replace it with the rheostat. Set the rheostat to its maximum resistance.

Results

(a) e.m.f.		(b) labelled value of resistance	
accumulator	2 dry cells in series	1 st resistor	2 nd resistor

- (d) length of $x =$
- voltmeter reading, $V =$
- ammeter reading, $I_1 =$

(e) Calculation of R

$R =$

- (f) Ammeter reading, $I_2 =$

Questions

1. State **one** precaution that you have taken in this experiment.

.....

2. Which ammeter reading, I_1 or I_2 , would be the better one to use in the determination of R . Explain your choice.

.....

3. For step (g), draw the two wire connections below to show how you would connect the rheostat to get maximum resistance with the slider either to the far left (Fig. 6.2) or to the far right (Fig. 6.3).

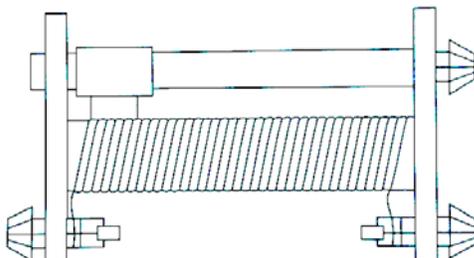


Fig. 6.2

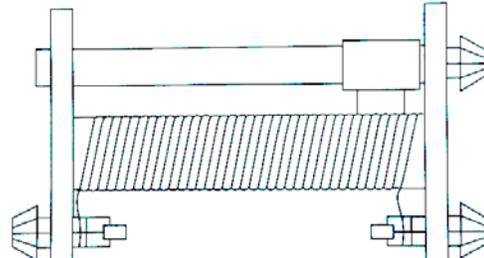


Fig. 6.3

Activity 7: Presentation of given experimental data

1. The table below shows some raw data collected from an experiment.

where y is a length of a potentiometer wire connected to a circuit measured in centimetres

V is the p.d. across the component in the circuit measured using the same voltmeter you are provided with.

2. Identify and correct all the “errors” in the table.

y	V	$\frac{1}{V}$
98	0.8	
64	1.0	
35.8	1.15	
18	1.4	
10	1.5	
4.9	1.65	

3. Calculate and record the values of $\frac{1}{V}$ in the above table.

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.

Activity 8: Analysis of given experimental data

1. Use the table of data in **Activity 7** to plot a graph of $\frac{1}{V}$ against y

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. Determine the gradient of the graph.

Gradient =

4. State a relevant conclusion based on the graph.

.....

Further Readings for Practical Exam Revision

- **2021 Sec 3 Chapter 01 Physical Quantities, Measurements & Practical Skills**
(from page 22, Section 1.5 Presentation of Data & Observations)
- **2022 Sec 4 Physics Practical Guidelines for Planning**
(pages 5 & 6, Precautions for Data Collection & for Safety)
- All experiments completed in 2021 and 2022.

2021 Sec 4 Physics Practical Exam – Revision Exercise (2)

Proposed Answers

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	
1 st ammeter	To measure electrical current	Half the smallest division 0.01 A	0 to 1.00 A	Range shows 1 A f.s.d.
2 nd 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 6: Measurements in electricity experiments

Results (sample readings)

(a) e.m.f.		(b) labelled value of resistance	
accumulator	2 dry cells in series	1 st resistor	2 nd resistor
2.05 V	3.10 V	3.3 Ω	10 Ω

- (d) length of $x = 0.500 \text{ m}$ or 50.0 cm or 500 mm
voltmeter reading, $V = 0.75 \text{ V}$ to precision of voltmeter (0.05 V)
ammeter reading, $I_1 = 0.32 \text{ A}$ to precision of ammeter (0.01 A)

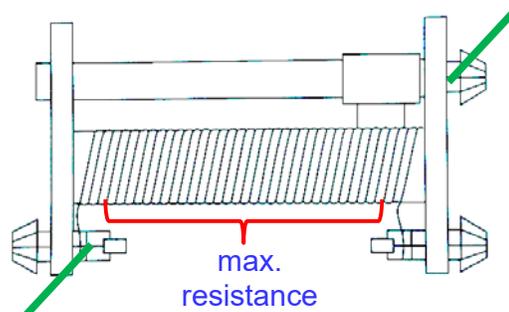
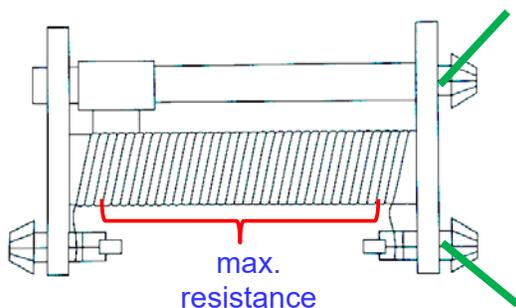
(e) Calculation of R

Answer should follow least s.f. of the 2 values used

- (f) Ammeter reading, $I_2 = 0.30 \text{ A}$ to precision of ammeter (0.05 A)

Questions

- 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.
 - A connecting wire next to the dry cells was 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.
- I_1 is the better one to use as this reading has a higher precision.
- 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 7: Presentation of given experimental data

Checklist:

- Header: symbol and units (if any)
- Raw data (y & V): whole column has same d.p. (based on precision of instrument)
- Processed data ($\frac{1}{V}$): apply rules for processed data, $\frac{1}{V}$ has same s.f. as V .

y / cm	V / V	$\frac{1}{V} / \text{V}^{-1}$
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

Activity 8: Analysis of given experimental data

1. Graph of $\frac{1}{V}$ against y

Note: $\frac{1}{V}$ (on Y-axis) and y (on X-axis)

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:

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

4. $\frac{1}{V}$ increases linearly as y increases