

Exercise walk-through

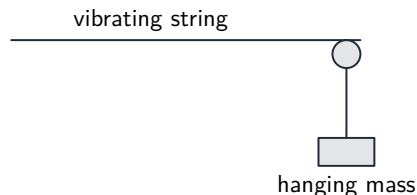
3.1

Planning valid practical investigations

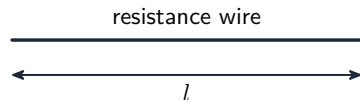
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Exercises 2.1·2.2

2.1 A student varies the hanging mass on a vibrating string and measures its fundamental frequency. Name the independent variable, dependent variable and one control variable.[3]

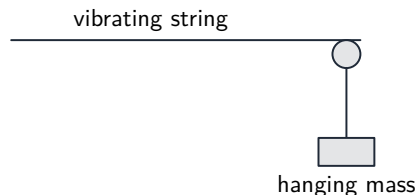


2.2 A student measures wire resistance while changing wire length. Explain why a small current, a zero-checked micrometer and secure contacts each improve the investigation.[3]



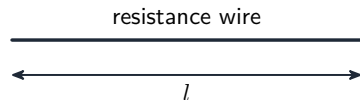
Exercises 2.1·2.2

2.1 A student varies the hanging mass on a vibrating string and measures its fundamental frequency. Name the independent variable, dependent variable and one control variable.[3]



2.1 Independent: tension, varied through hanging mass. Dependent: fundamental frequency. Keep vibrating length or string linear density fixed.

2.2 A student measures wire resistance while changing wire length. Explain why a small current, a zero-checked micrometer and secure contacts each improve the investigation.[3]



2.2 Small current limits heating and changing resistivity. The zero check allows a known diameter offset to be corrected. Secure contacts reduce variable contact resistance or intermittent readings.

Exercise 2.3

2.3 A student repeats a cell voltage measurement while the cell is supplying a large current. The readings steadily decrease. Explain why averaging alone is not enough and give two practical changes. [3]



voltage readings decrease

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2.3 The drift indicates changing cell conditions, rather than only random variation. Reduce current/use a larger load resistance. Open the switch between readings and allow conditions to stabilise.

Exercise 3.1

3.1 A student changes the angle between light and a solar cell, using a lamp as a model source. Describe three controls with a way to maintain each. Explain how to improve the estimate of the angle giving maximum power. [5]

lamp



solar cell



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lamp



solar cell

3.1 Keep lamp–cell distance fixed using a measured constant radius. Keep lamp output fixed using the same supply setting. Keep background light steady with shielding/darkened room, or keep cell load/temperature steady with a stated method. First sample a broad range to find the peak region, then add more closely spaced angle settings around the peak while maintaining controls.

Exercises 3.2-3.3

3.2 Plan how to measure the maximum load supported by small beams of equal dimensions but different fibre content. Include load measurement, failure detection, controls, repeatability and safety. [6]

3.3 Plan an investigation of how string fundamental frequency depends on vibrating length. Include apparatus, resonance identification, controls, graph, interpretation and a safety precaution. [6]

Exercises 3.2·3.3

3.2 Plan how to measure the maximum load supported by small beams of equal dimensions but different fibre content. Include load measurement, failure detection, controls, repeatability and safety. [6]

3.2 Place each beam across supports with the same separation. Add measured masses at the same loading position, converting total supported mass to force using $F = mg$ or reading a suitable force sensor. Increase in small steps near failure and record the highest supported load plus the next failing load as a bracket. Keep dimensions, support arrangement and other preparation conditions fixed. Use several comparable beams per composition because failure destroys a specimen; compare spread/mean rather than reusing a broken beam. Use a shield/eye protection and a tray to catch fragments or falling masses, naming the relevant risk.

3.3 Plan an investigation of how string fundamental frequency depends on vibrating length. Include apparatus, resonance identification, controls, graph, interpretation and a safety precaution. [6]

3.3 Use a vibration generator driven by a signal generator and measure the length between end nodes. Tune to the fundamental at each of several lengths; approach resonance from both sides/repeat. Keep tension and linear density fixed. Plot f against $1/L$; the model predicts a straight line through the origin with gradient $\frac{1}{2}\sqrt{T/\mu}$. Secure the stand/masses or protect against a named falling-mass hazard.