A Level · OCR · Physics

9 mins 9 questions

Multiple Choice Questions

# Experimental Design

Experimental Design / Control Variables / Refining of Experimental Design / Investigative Approaches & Methods / Using Practical Equipment & Materials / Appropriate Units for Measurements

| | |
|---|---|
| Medium (5 questions) | /5 |
| Hard (4 questions) | /4 |
| **Total Marks** | **/9** |

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# Medium Questions

**1** Which variables are to be identified in designing an experiment:

**A.** Independent Variable and Dependent Variable

**B.** Dependent Variable and Controlled Variable

**C.** Controlled Variable and Independent Variable

**D.** Independent Variable, Dependent Variable and Controlled Variable

**(1 mark)**

**2** When conducting an experiment to investigate the relationship between the initial horizontal velocity ($v$) and the horizontal distance traveled ($x$) by a metal ball in projectile motion, which of the following is an essential aspect of experimental handling to ensure accuracy and safety?

**A.** Wearing a lab coat and safety goggles

**B.** Using a calibrated measuring tape

**C.** Maintaining a clear and unobstructed landing area

**D.** Observing the experiment from a distance with binoculars

**(1 mark)**

**3** Four students each made a series of measurements of density of water $\rho_{water}$.

Which sets of results could be described as precise but not accurate?

| | Results , kg $m^{-3}$ | | | |
|---|---|---|---|---|
| **A** | 960 | 950 | 900 | 910 |
| **B** | 997.1 | 996 | 996.9 | 997 |
| **C** | 800 | 800.1 | 801.1 | 799 |
| **D** | 800 | 600 | 500 | 400 |

**(1 mark)**

**4** Which reduces the systematic error in the measurement?

**A.** Zeroing a digital caliper before taking a measurement

**B.** Using a laser rangefinder to measure the length from a distance

**C.** Comparing measurements from a steel ruler at different temperatures

**D.** Measuring an object's length multiple times and calculating the average

**(1 mark)**

**5** A student investigates the behavior of mercury inside a narrow tube, as shown in **Figure**

5

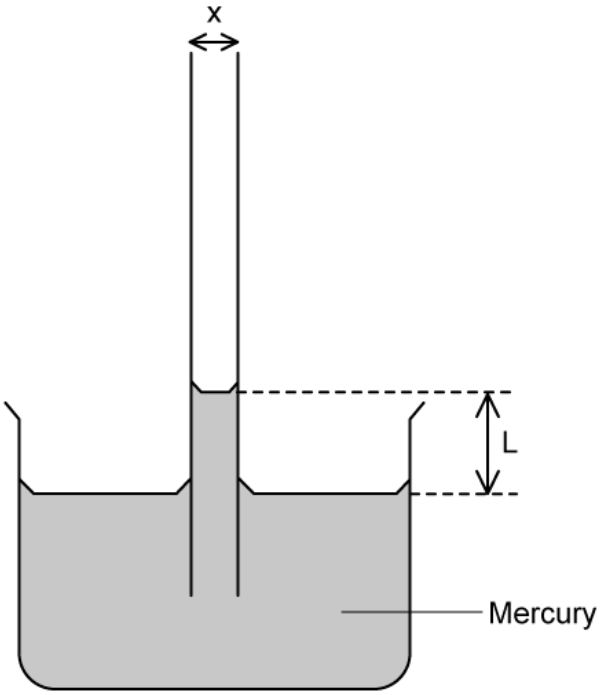


**Figure 5**

It has been suggested that the relationship between *L* and *x* is as follows

$$L = \frac{4\sigma}{x\rho g}$$

A graph is plotted between *L* (y-axis) and  (x-axis).

What would be the equation of the gradient?

**A.** $\frac{\sigma}{x\rho g}$

**B.** $\frac{4\sigma}{g}$

**C.** $\frac{4\sigma}{x\rho g}$

**D.** $\frac{4\sigma}{\rho g}$

**(1 mark)**

# Hard Questions

**1** The radius of an atom is 0.1 nm and the radius of a nucleus is 0.01 pm. The volume of the atom and nucleus is written $V_{atom}$ and $V_{nucleus}$ respectively.

What is the value of the ratio $\frac{V_{atom}}{V_{nucleus}}$?

**A.** $1 \times 10^{8}$

**B.** $1 \times 10^{4}$

**C.** $1 \times 10^{12}$

**D.** $1 \times 10^{-4}$

**(1 mark)**

**2** An experiment was conducted where a monochromatic light was shone at varying angles on an air-glass boundary. The results were used to determine the critical angle *C* of glass.

The table below shows the recordings of the angle of incidence *i* and the angle of reflection *r*.

| | **Angle of incidence, *i* / °** | **Angle of refraction, *r* / °** |
|---|---|---|
| Reading 1 | 60 | 40 |
| Reading 2 | 66 | 40 |
| Reading 3 | 63 | 31 |
| Mean | 63 | 37 |

Given that the known value for the refractive index *n* of glass is 1.50, which one of the following statements is true?

**A.** The results give an accurate measurement for the critical angle *C*

**B.** The results are precise

**C.** The dependent variable is the critical angle

**D.** The independent variable is the angle of refraction

**(1 mark)**

**3** An experiment is conducted to determine the specific heat capacity of a solid copper block. The copper block is attached to a voltmeter, ammeter and power supply. A thermometer is inserted inside the block and time intervals are recorded during the experiment.

Which statement is true?

**A.** The independent variable is time and the dependent variable is voltage

**B.** The dependent variable is time, the independent variables are voltage, current and temperature, and the control variable is the power from the supply

**C.** The independent variable is the work done by the power supply, the dependent variable is temperature, and the control variable is the power from the supply

**D.** The independent variable is the power from the supply, the dependent variables are voltage and temperature, and the control variable is time

**(1 mark)**

**4** An experiment is performed to determine the resistivity of a single thin wire connected to a constant power supply.

Which of the following is **true**?

**A.** A metre ruler is the best tool to determine the thickness of the wire

**B.** Repeating the experiment with several lengths of wire will reduce systematic error

**C.** Safety goggles should be worn in case the wire gets too hot

**D.** The independent variable is the length of the wire

**(1 mark)**