ALTERNATIVE TO PRACTICAL - P6

SAFETY PRECAUTIONS

- Live wires should not be touched.
- Hot objects should not be touched with bare hands - gloves should be used
- Circuit connections should be checked and approved by the teacher and then only the circuit should be switched on
- While changing components of the circuit the power should be switched so that one should not experience electric shocks.
- Safety googles, gloves and other safety components should be used while handling experiments.
- While handling a mercury thermometer one should take care of the mercury spills.

SPECIFIC HEAT CAPACITY

- **Apparatus:** Solid block, Drill, Thermometer, Heater (of known power), Cotton wool.
- **Procedure:**
  - Drill two holes in the block.
  - Measure the mass of the block.
  - Place the heater in one of the blocks, the thermometer in the other.
  - Use cotton wool to properly insulate/lag the block.
  - Note the initial temperature of block and turn on heater for $x$seconds
  - Calculate Heat Energy Supplied by heater using formula Q=Pt.
  - Note the final temperature of block.
  - $Specific\ heat\ capacity\ = \frac{Q}{m \times \Delta t}$.

COOLING RATE OF WATER

- **Apparatus:** Heater, Thermometer, Beaker, Stopwatch, Beaker containing Water.
- **Procedure:**
  - Place heater into beaker and turn it on to raise the temperature of water to 60°C
  - Stir the contents of the water and place thermometer into the beaker.
  - Note the starting temperature and turn on the stopwatch.
  - Take readings of the thermometer and stopwatch at regular intervals (e.g. 60 sec).
  - Draw up a table and plot a graph to conclude your experiment.

PICKING A BETTER INSULATOR

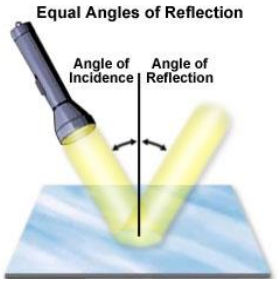
- **Apparatus:** Two large cans, two small cans, cotton wool, polystyrene beads, boiling water, thermometers, stopwatch
- **Procedure:**
  - Put the small cans into the large cans and insulate the small can with (i) cotton wool and (ii) polystyrene beads
  - Pour boiling water into the small cans and place the thermometers in them.
  - Start the stopwatch and take readings of temperature at regular intervals.
  - Record readings in a table for each insulator.
  - The small can that has the higher temperature over the fixed period is better insulated.
  - Hence, object that provides a less temperature loss over the period is the better insulator.

REFRACTION OF LIGHT

- **Apparatus:** Ray Box, Rectangular piece of glass, Plain paper, Pencil..
- **Procedure:**
  - Place the Plain paper below the rectangular piece of glass.
  - Project a ray towards the glass.
  - Make two points to mark the incident ray, two to mark the refracted ray and two to mark the emergent ray.
  - Join all the lines, measure the angles and calculate refractive index.
  - Repeat with different angles; Snell's law shown.

REFLECTION OF LIGHT

- **Apparatus:** Pins, Mirror.
- **Procedure:**
  - Shine beam from raybox to mirror
  - Use the pencil to carefully mark two dots in the center of the incident and reflected rays.
  - Join the dots and complete the ray
  - Draw a normal and measure the angles.
  - Angle i = Angle r, proving laws of reflection.



RESISTANCE AND TEMPERATURE

- **Apparatus:** Resistor, Battery, Connecting wires, Ammeter, Voltmeter, Oven.
- **Procedure:**
  - Make a circuit with the battery, connecting wires, ammeter and voltmeter, resistor.
  - Measure the resistance of the resistor using the formula R=V/I.
  - Heat the resistor in the oven. Place the resistor back into the circuit.
  - Measure the readings again and calculate R=V/I.
  - Draw up a conclusion about how the resistance increases as temperature increases.

SPEED OF SOUND

- **Apparatus:** Two observers, Gun, Stopwatch.
- **Procedure:**
  - Two observers are set apart at a known distance.
  - One observer has the gun, the other has the stopwatch.
  - Observer A fires the gun, Observer B starts the stopwatch when he sees the puff of smoke.
  - Observer B stops the stopwatch when he hears the sound and the time is noted.
  - $Speed = \frac{Distance}{Time}$ applied.
  - The observers swap positions and repeat the experiment.
  - The values are averaged and the speed of sound is obtained.

CENTRE OF MASS

- **Centre of mass of a plane lamina:**
  - Make a hole in the lamina.
  - Hang it so it can swing freely.
  - Hang a plumb line in the hole and mark the line it passes through.
  - Repeat the procedure again to get another line
  - Their intersection point is the center of mass.
- **Stability of simple objects:**
  - The position of the center of mass affects an object's stability. If the center of mass of an object is low, it is less likely to tip if tilted.
  - **To increase stability:** (i) Increase surface area (ii) make the object shorter.

IMPROVING ACCURACY

- **To produce more accurate or reliable results:**
  - Repeat experiment, to calculate average reading.
  - Avoiding parallax error, look perpendicular to the ruler.
  - If accuracy in measurement was asked, check for zero error.
- **To draw an image created from lens:**
  - Inverted from the original object.
  - Sides are multiplied by the magnification.
- **Centre of mass experiment (with the lamina):**
  - you view the string directly in front of card.

IMPROVING ACCURACY

- **Minimizing heating effect of a current:**
  - Lower current
  - Increase voltage
  - Add a lamp
  - Increase resistance of a resistor
- **To increase accuracy of ray diagrams:**
  - View bases of pins since pins may not be vertical
  - Keep pins further apart and use more pins
  - Avoid parallax, explain action and reason
  - Repeats and average

IMPROVING ACCURACY

- **Improvement made to experiments about heating/cooling effect and insulation**
  - Same initial temperature.
  - Same volume of water.
  - Same shape and type of beaker.
  - Same room temperature.
  - Stirring the water in the beakers.
  - Record max. temperature
- **Heat loss could be reduced by:**
  - Insulation of beaker.
  - Covering beaker with a lid.

IMPROVING ACCURACY

- **How to check if a rule is vertical:**
  - Use of set square or protractor
  - Plumb line
  - Spirit Level
- **Precautions taken in experiments about formation of images by a lens**
  - Use a darkened area
  - Object and lens same height on bench
  - Take more readings
  - Avoiding parallax error in measurement, and look perpendicular to the ruler.
  - Object/lens/screen perpendicular to bench

IMPROVING ACCURACY

- **Variables in experiments about springs and stretching effect:**
  - Number of coils
  - Length of spring
  - Diameter\thickness of spring or wire
  - Selection of loads
- **Improvement made to calculating circumference by string method**
  - Avoid parallax error
  - Repeats and average
  - Thinner string
  - Parallel winding of springs

IMPROVING ACCURACY

- **Precautions for circuit readings of I and V so that accurate:**
  - For I specifically:
    - Limit current so that temp. doesn't increase
    - Use a tapping meter
  - For I and V: Switch off between readings.
- **Fair test for pendulum experiments:**
  - Length of pendulum
  - Shape of bob
  - No. of swings
  - Amplitude

IMPROVING ACCURACY

- **Precautions and procedures in electrical experiments:**
  - Check for a zero error
  - Tap the meter to avoid sticking
  - Initially choose the highest range for the ammeter/voltmeter, then reduce the range for the ammeter so that the deflection is almost full scale
  - Always check polarities before closing the switch (completing the circuit)
  - Always check that connections are clean.
  - Switch off the current when not making a measurement.
  - When measuring resistance use low currents/voltages to avoid heating and changing the resistance you are measuring

INACCURACIES

- **Why angle i is NOT equal to angle r in ray experiment:**
  - Thickness of pins
  - Thickness of mirror
  - Protractor is not precise
- **Inaccuracy of ray box method:** thickness of rays.
- **Inaccuracy of pin method:** pins not straight, or too close, or thickness of lines drawn.
- **Measuring 10 oscillations rather than 1:**
  - Reduce human errors
  - Give more accurate value of time taken (T)
  - Gives an average of T

GRAPHS

- **Drawing graphs:**
  - Label axis
  - Choose a proper scale
  - Well judged best fit line
  - Thin and neat lines
- **Measuring the gradient:**
  - Draw a triangle on graph
  - Use clear lines
  - Triangle must be larger than half the line
- For 2 values to be **directly proportional**, graph of the values be a straight line from origin