INTRODUCTION

* These short experiments are designed to give an opportunity to use a range of practical equipment and to consider errors.

**AIMS:**

* make measurements using common laboratory apparatus, such as millimetre scales, protractors, stopwatches, top-pan balances, measuring cylinders, vernier calipers, micrometer screw gauges and thermometers
* use both analogue scales and digital displays.
* make and record accurate measurements.
* estimate, quantitatively, the uncertainty in their measurements
* express the uncertainty in a measurement as an actual, fractional or percentage uncertainty, and translate between these forms.

Part 1

OBJECTIVES:

* measure lengths using a ruler, vernier scale and micrometer
* calculate uncertainties
* make and record accurate measurements.
* estimate, quantitatively, the uncertainty in their measurements
* express the uncertainty in a measurement as an actual, fractional or percentage uncertainty, and translate between these forms.

MATERIALS

* Vernier calipers
* Mass balance
* Screw guage micrometer
* Ruler
* Length of wire
* Metal cylinder

Part 1

PROCEDURE

1. Measure the diameter of the wire using the screw guage micrometer.
2. Repeat the measurement at 5 places along the wire (Why?)
3. Measure the length of the wire using the ruler.
4. Repeat 3 times
5. Measure the mass of the wire
6. Record all of your data in a table include the uncertainty in column headings
7. Calculate average values and record them in your table
8. Calculate and state errors for the wire`s
	1. Cross sectional area
	2. Volume
	3. Density

Show all of your working

DATA

Part 2

OBJECTIVES:

* measure an angle using a protractor
* measure time intervals using clocks, stopwatches

MATERIALS:

* Length of card with mass attached
* Protractor
* Stopwatch
* Clamp stand
* 2 clamps

PROCEDURE

1. Attach the length of card to the clamp through the hole
2. Clamp the protractor so that the pendulum measures 0o in its rest position
3. Displace the pendulum through a small angle and measure the angle
4. Release the pendulum and time 10 swings
5. Repeat 3&4 two more times
6. Repeat 3-5 twice more for larger angles
7. Record all of your results in a suitable table including uncertainties in the column headings
8. Calculate the average time for 10 swings t10
9. Find error in t10 by examining the maximum and minimum values used in calculating the average, take the greatest difference of these as your error value.
10. For each of your measurements calculate the period (time for one swing) T and state the error in this value
11. By examining the results describe the effect of changing the angle on the period T.

*Note – due to time constraints this experiment does not have sufficient number of values of independent variable (angle) At least 6 readings should be taken. Also 20 swings should be measured rather than 10.*

DATA

CONCLUSION

Part 3- Newton`s law of cooling

OBJECTIVES:

* measure volume
* measure mass
* measure temperature

MATERIALS:

* boiling tube
* bung with thermometer
* measuring cylinder
* beaker
* iced water
* stopwatch

PROCEDURE

1. Measure the temperature of the ice water
2. Measure accurately about XXXXX cm3 of hot water.
3. Transfer the water to the boiling tube and insert the thermometer
4. Allow temperature to rise to a steady reading
5. Put boiling tube into the beaker of iced water
6. Record readings for temperature and time at 30 s intervals for 15 mins
7. Record all data with uncertainties
8. Calculate ln(Thot-Tcold)
9. Plot a graph of ln(Thot-Tcold) against time (x axis)

DATA

Conclusion