N5 Physics

“Required Experiments”

From 2017/18 the N5 Course Specification requires students to have knowledge of these experiments

Originally sourced from the *Higher Still* Intermediate 1, Intermediate 2 and Higher Support Notes

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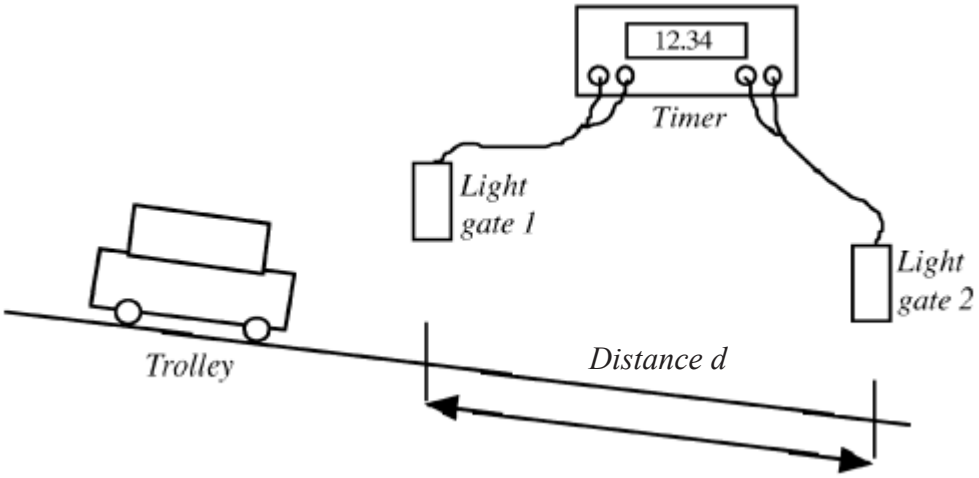
3rd edition: “mercury free”

EXPERIMENT 1

Title: Average Speed

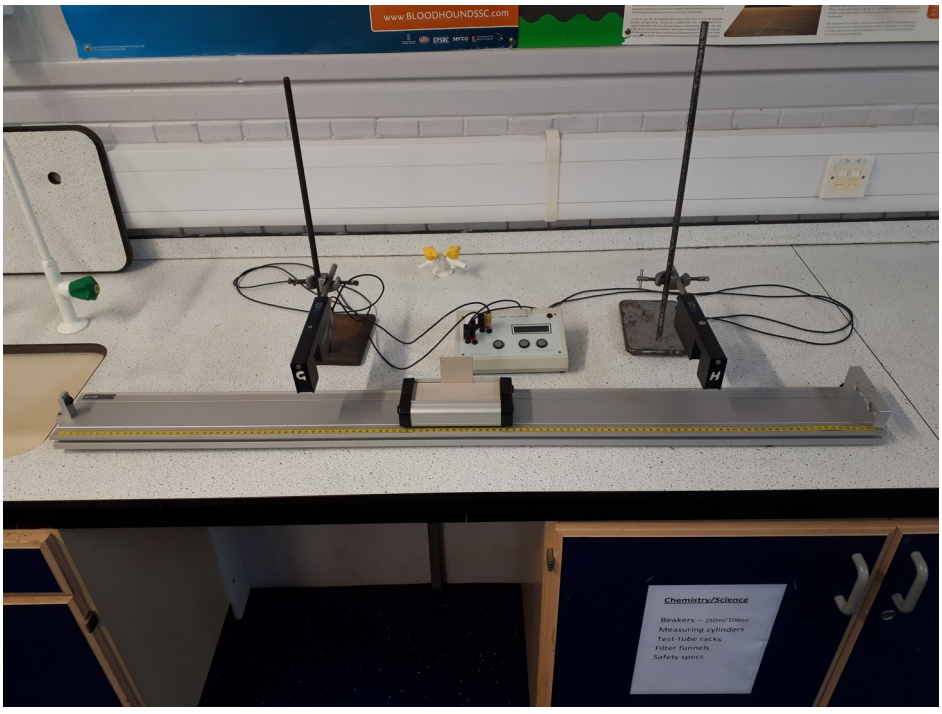
Aim: Measurement of average speed of a trolley

Apparatus: Runway, trolley with single mask, light gate, computer timer, metre rule.



Instructions

- Measure distance, d, between the two light gates.
- Set the computer to measure the time between the trolley passing through the light gates.
- Release the trolley and record the time, t.
- Calculate average speed $\tilde{v} = d / t$
- Repeat several times and calculate an average.

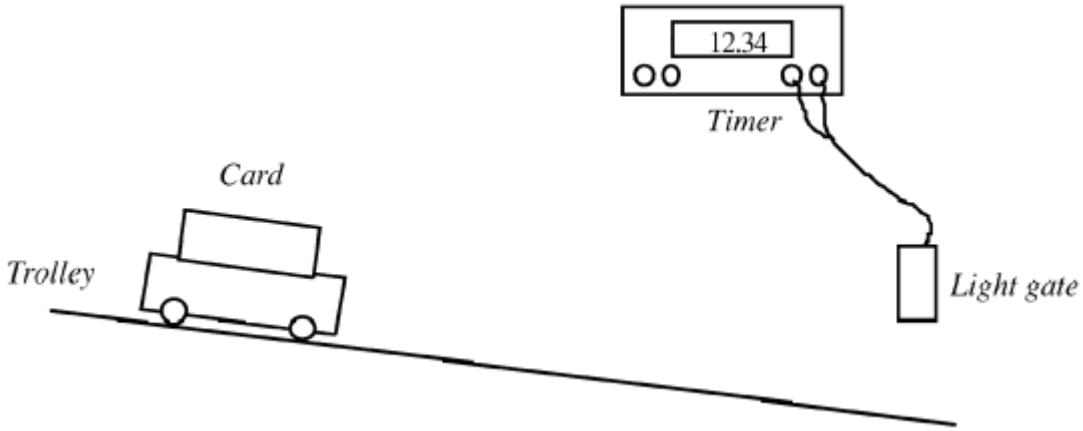


EXPERIMENT 2

Title: Instantaneous Speed

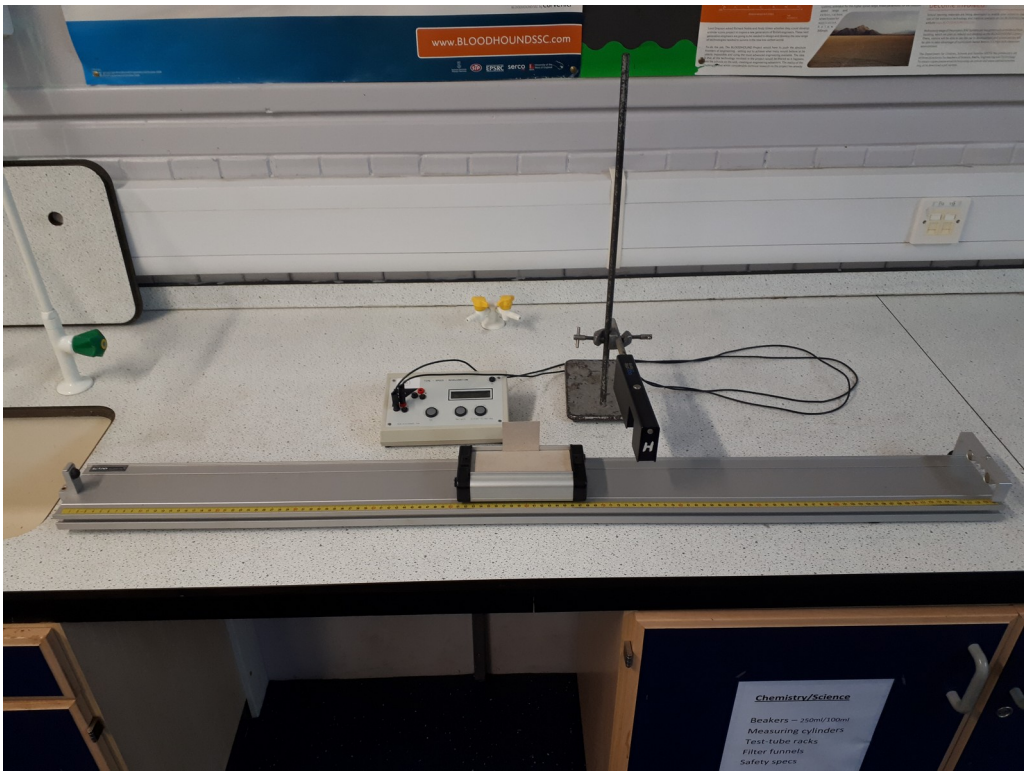
Aim: Measurement of instantaneous speed of a trolley

Apparatus: Runway, trolley with single mask, light gate, computer timer, ruler.



Instructions

- Measure length of card, d.
- Set the computer to measure instantaneous speed, and input d.
- Release the trolley and record the speed, v.
- The computer calculates instantaneous speed v = d / t, where t is the time for the card to pass through the light gate.
- Repeat several times and calculate an average.

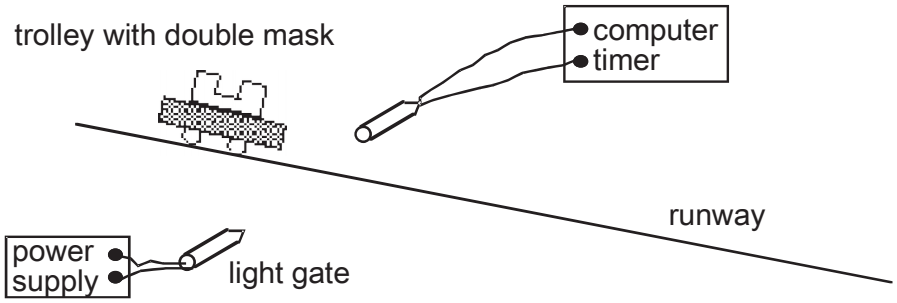


EXPERIMENT 3

Title: Acceleration

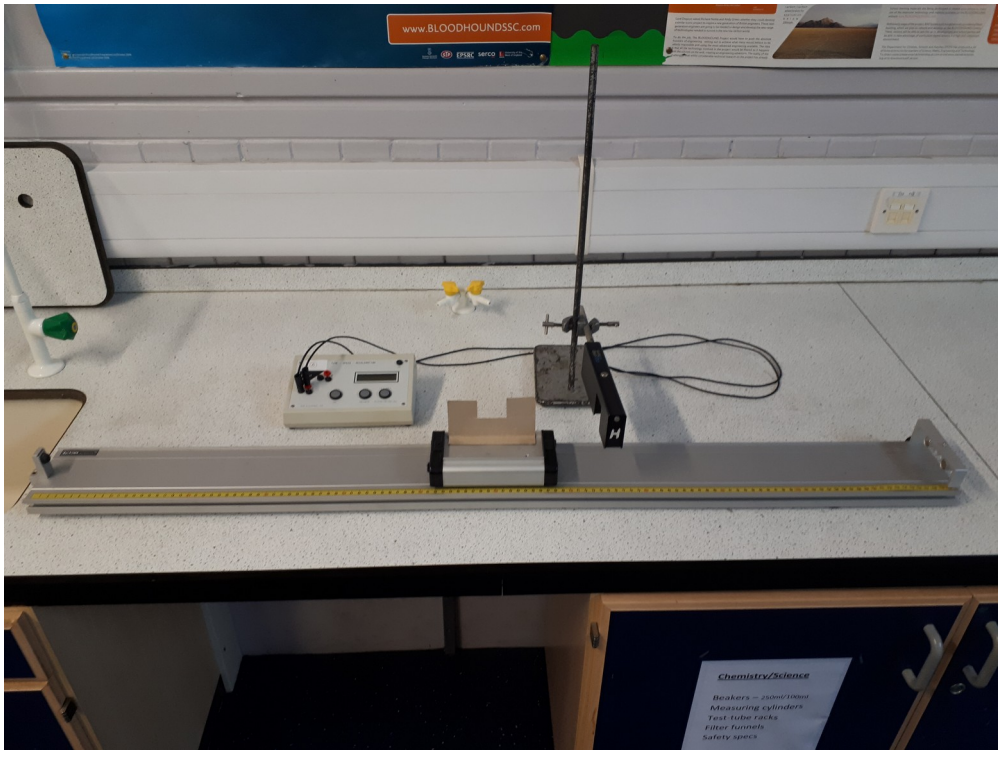
Aim: Measurement of acceleration of a trolley

Apparatus: Runway, trolley with double mask, light gate, computer timer, ruler.



Instructions

- Measure the length of the two parts of the double mask, d.
- Set the computer to measure acceleration, and input d.
- Release the trolley and record the acceleration, a.
- The computer measures the time for each part of the double mask to pass through the light gate, and the time between the two parts. It then uses these to calculate acceleration $a = (v - u) / t$.
- Repeat several times and calculate an average.

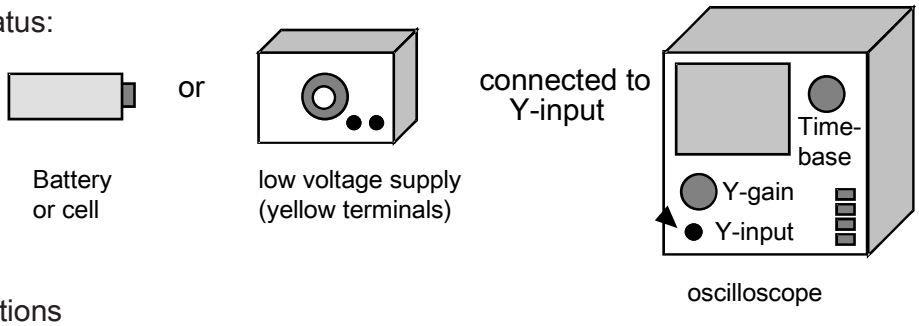


EXPERIMENT 4

Title: a.c. and d.c. electrical supplies

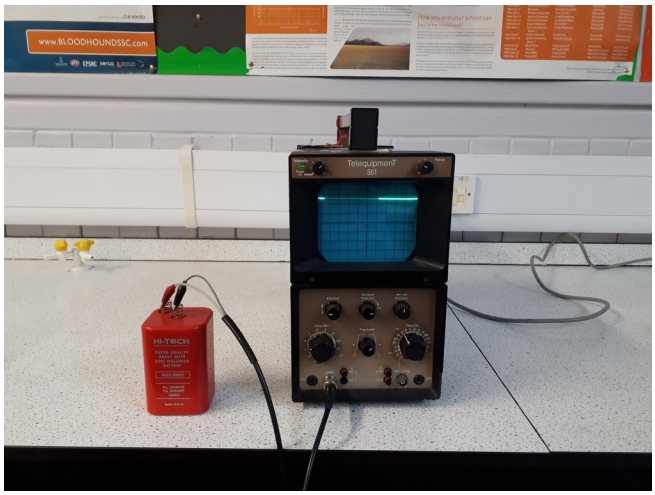
Aim: To compare the oscilloscope traces produced by a.c. and d.c. supplies

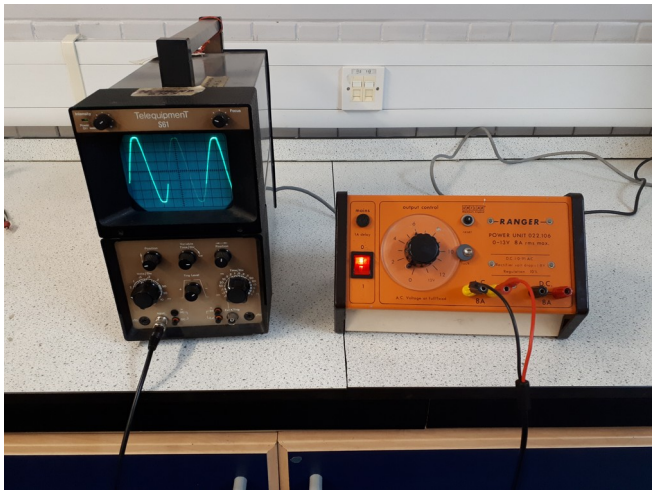
Apparatus:



Instructions

- Switch on the oscilloscope and adjust to give a horizontal line in the centre of the screen.
- Connect the battery or cell to the Y-input of the oscilloscope.
- Note that the battery or cell – a d.c. supply – produces a straight line above or below the centre of the screen.
- Replace the battery with the low voltage power supply, using the yellow terminals of the power supply.
- Adjust the oscilloscope to produce a steady, recognisable trace on the screen.
- Note that the a.c. supply produces a sine wave pattern on the screen.



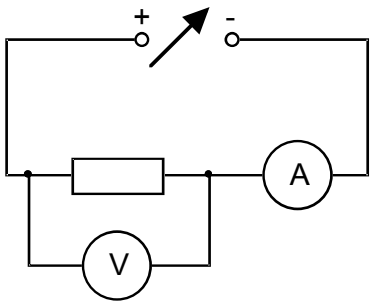


EXPERIMENT 5

Title: Current, Voltage and Resistance: Ohm's Law

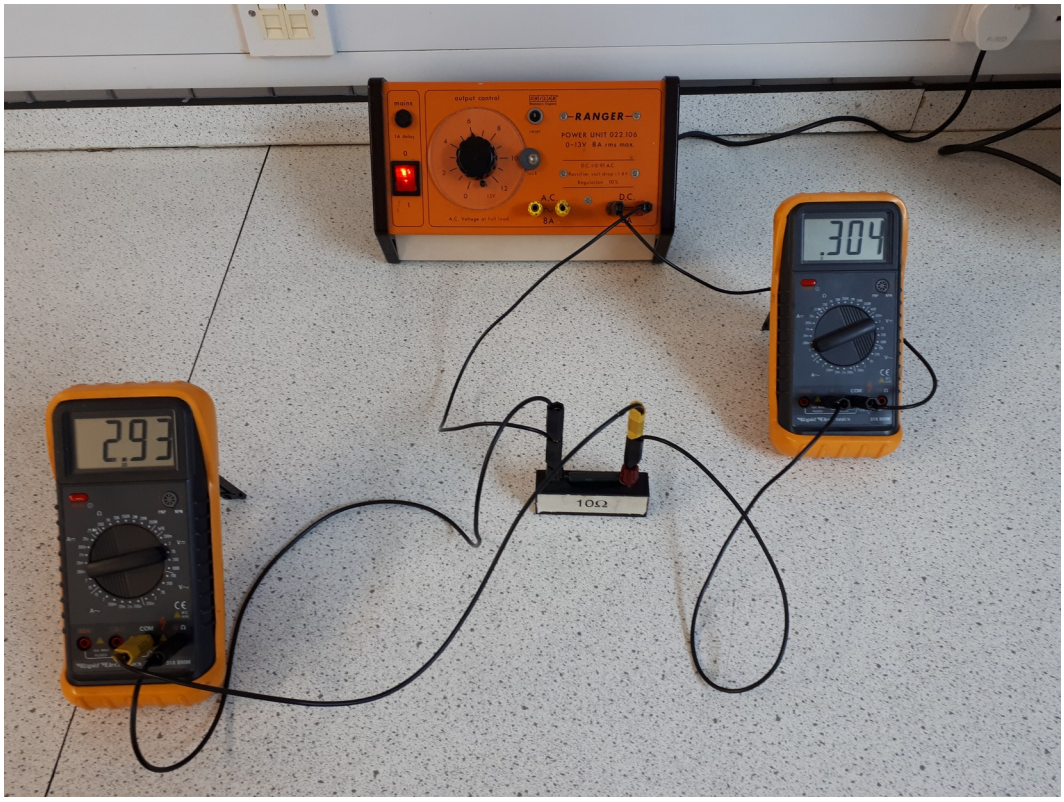
Aim: To verify Ohm's Law (V = IR)

Apparatus: Resistors, ammeter, voltmeter, variable power supply.



Instructions

- Set up the circuit above with one of the resistors and a variable power supply.
- Set the supply voltage to around 1 V and measure the current through the resistor and the voltage across it.
- Using the same resistor, increase the supply voltage to around 2 V and repeat the above measurements.
- Repeat the above, increasing the supply by 1 V each time up to 5 V.
- Draw a graph of voltage (y-axis) against current (x-axis). This should be a straight line through the origin.
- Compare the gradient of the graph with the value of the resistor. These should be equal, hence R = V / I or V = IR.
- Repeat for other values of resistors.

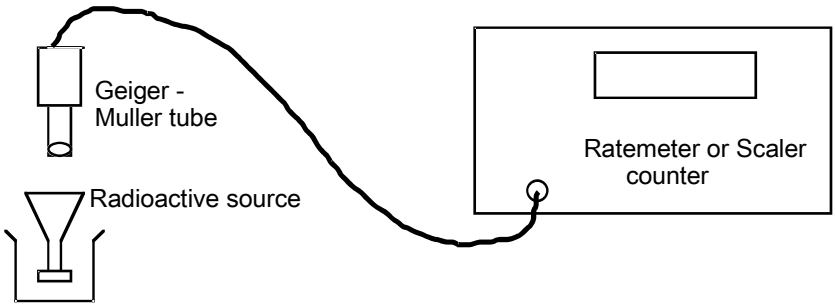


EXPERIMENT 6

Title: Radioactive half-life

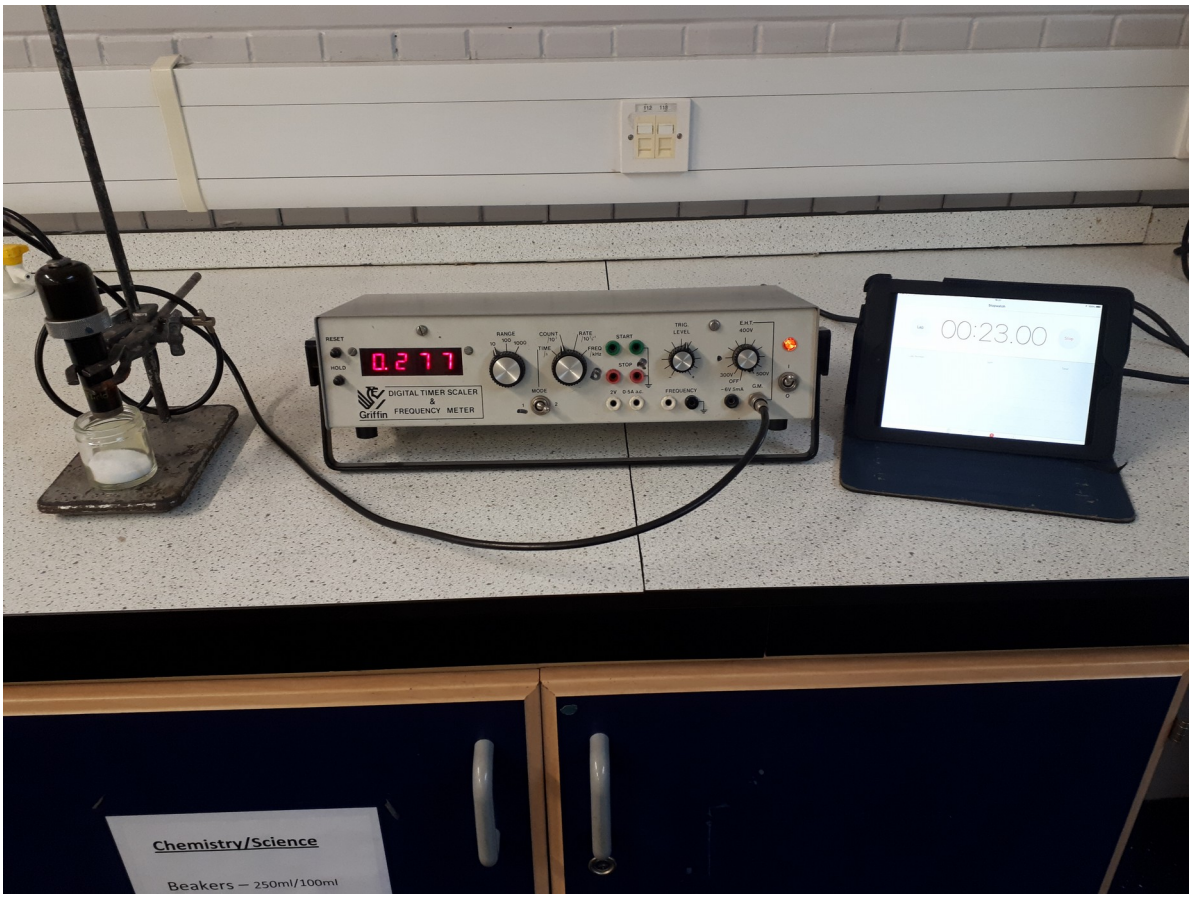
Aim: To measure the half-life of of a radioactive source

Apparatus: Geiger - Muller tube, counter, short-lived radioactive source.



Instructions

- Measure the background radiation count over a period (say 5 minutes).
- Measure the radiation from the source (say over each 5 minutes in an hour).
- Subtract the background count from each reading to get a corrected count.
- Plot a graph of corrected count against time to determine the half-life of the source.

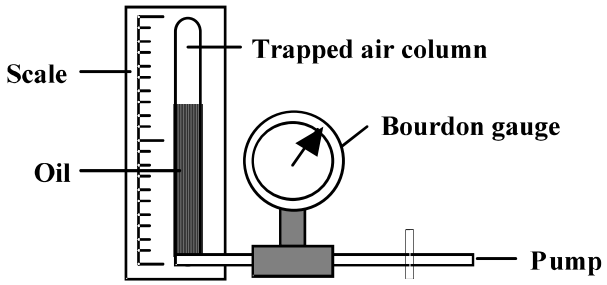


EXPERIMENT 7 (Analogue)

Title: Boyle's Law

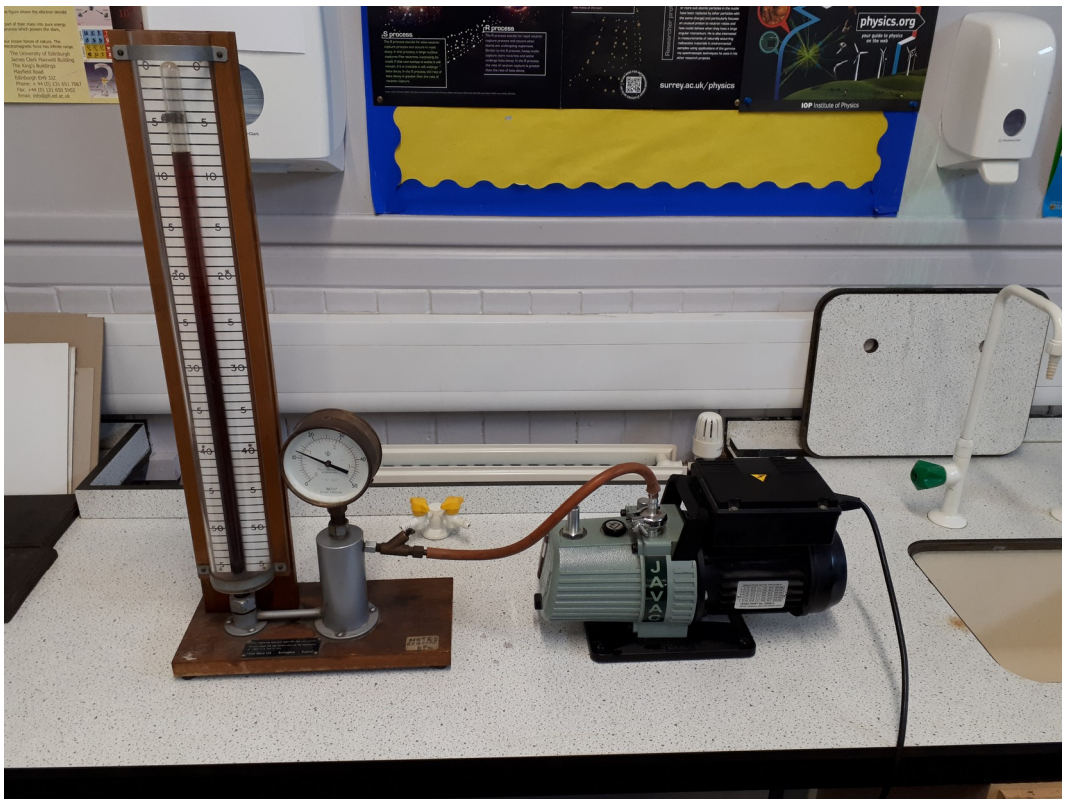
Aim: Determine the relationship between pressure and volume of a fixed mass of gas at a fixed temperature

Apparatus: Boyle's Law apparatus, pump.



Instructions

Use the pump to increase the pressure on the column of trapped air.
Seal the apparatus using the tap when the pressure is high.
Record the length of the trapped air column and the corresponding pressure.
Using the tap, slowly reduce the pressure on the oil and seal the apparatus at a ne value of length.
Record the new value of length and corresponding pressure.
Repeat for a range of values of length of trapped air column.
Use an appropriate format to show the relationship between pressure and volume of a gas at constant temperature.

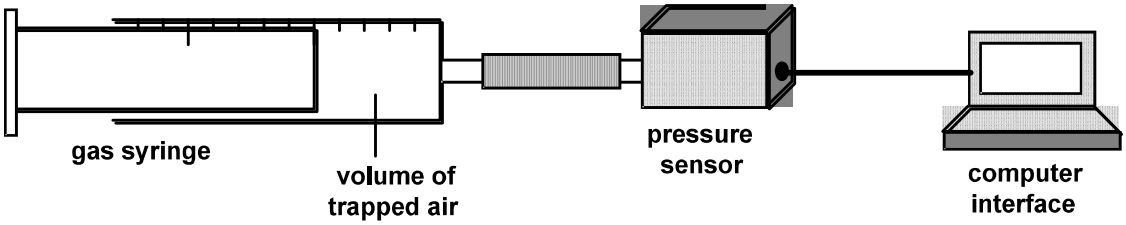


EXPERIMENT 7 (Digital)

Title: Boyle's Law

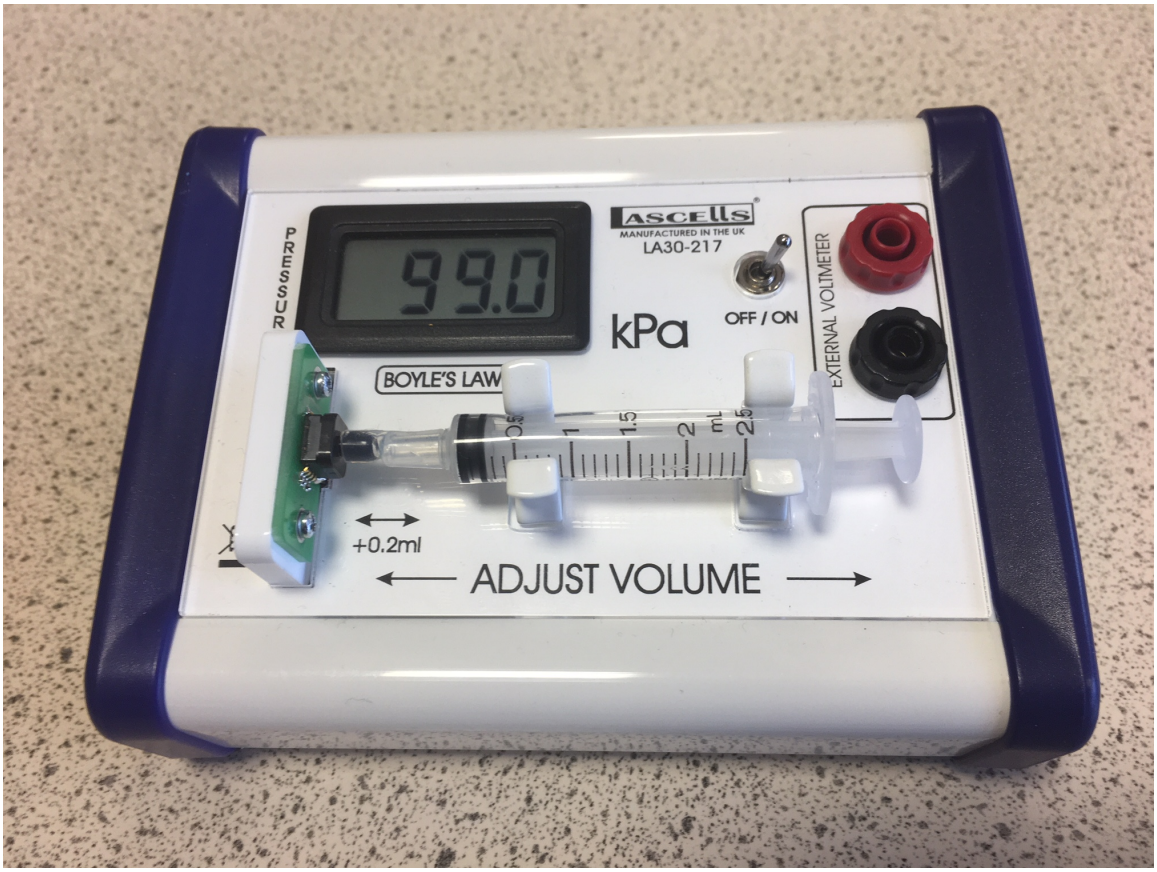
Aim: Determine the relationship between pressure and volume of a fixed mass of gas at a fixed temperature

Apparatus: gas syringe, rubber tubing, pressure sensor, computer interface.



Instructions

Set the volume of air to its maximum and record the corresponding pressure.
Repeat the process by gently compressing the air in the syringe to obtain a set of readings of volume against corresponding pressure.
Use an appropriate format to show the relationship between pressure and volume of a gas at constant temperature.

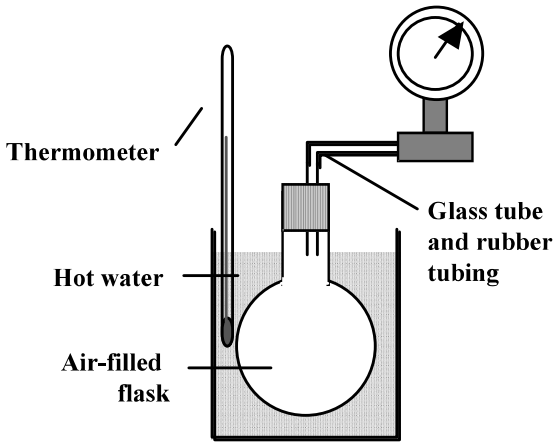


EXPERIMENT 8 (Analogue)

Title: Pressure (Gay-Lussac) Law

Aim: Determine the relationship between temperature and pressure of a fixed mass and volume of gas

Apparatus: air-filled flask, thermometer and glass tube bored through a rubber bung, rubber tubing, bourdon gauge, container of boiling water.



Instructions

Set up the apparatus as shown and carefully heat the water to boiling.

As it slowly heats up, record the temperature and pressure at various (at least five) points.

Use an appropriate format to show the relationship between pressure and temperature of a gas at constant volume.

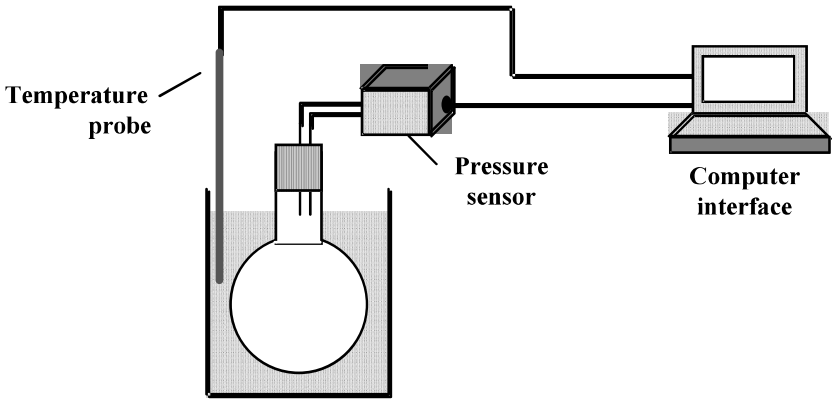
Note: the diagram shows the thermometer in the water bath and not in the air flask. This is the correct way to set this up.

EXPERIMENT 8 (Digital)

Title: Pressure (Gay-Lussac) Law

Aim: Determine the relationship between temperature and pressure of a fixed mass and volume of gas

Apparatus: air-filled flask, temperature probe and glass tube bored through a rubber bung, rubber tubing, pressure sensor, computer interface, container of boiling water.

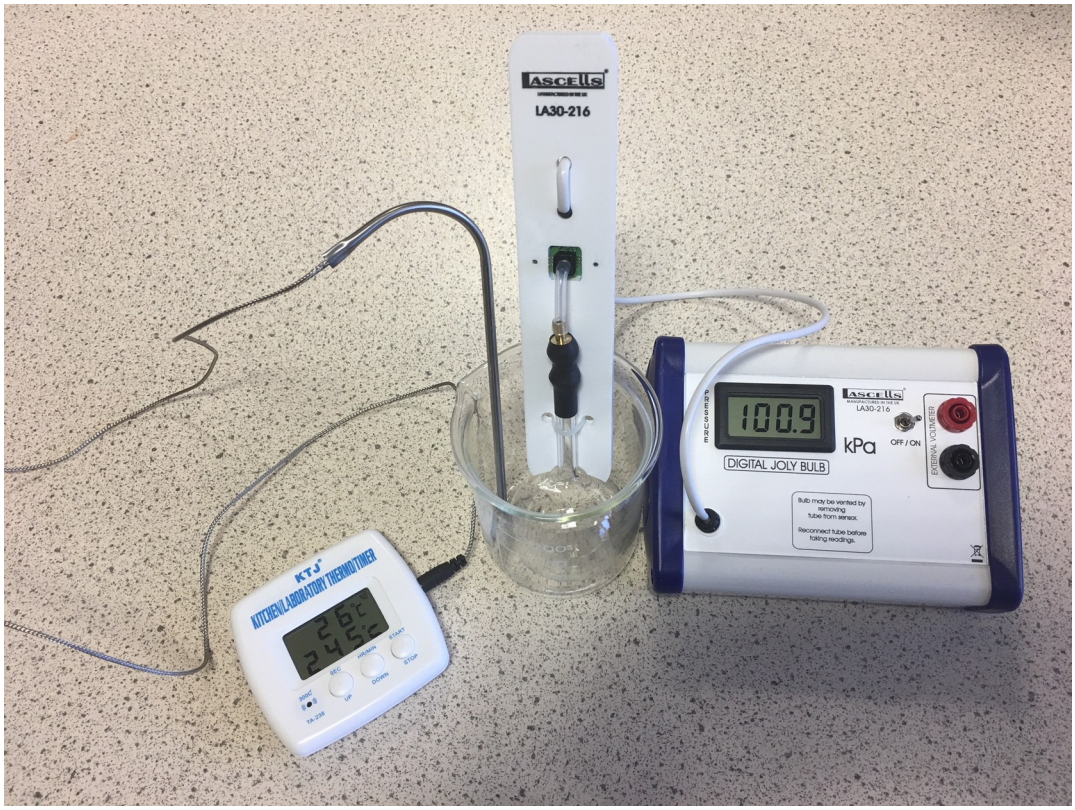


Instructions

Set up the apparatus above, connecting the temperature probe to either a digital thermometer or into the computer interface.

The rest of the method is as previously.

Note: the diagram shows the temperature probe in the water bath and not in the air flask. This is the correct way to set this up.

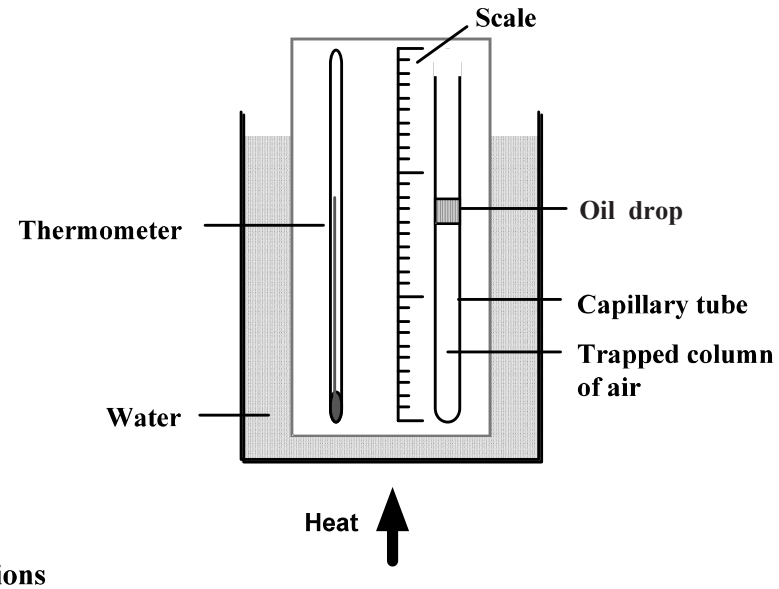


EXPERIMENT 9

Title: Charles' Law

Aim: Determine the relationship between temperature and volume pressure of a fixed mass of gas at a fixed pressure

Apparatus: capillary tube with mercury plug, scale, thermometer, large beaker of water, bunsen burner.



Instructions

Set up the apparatus as shown and carefully heat the water to boiling.
Record the temperature and corresponding length of the trapped air column.
Remove the heat from under the beaker and allow the apparatus to cool.
As the column of air cools, obtain a set of corresponding values of temperature and length of trapped air column.
Use an appropriate format to show the relationship between volume and temperature of a gas at constant pressure.