Physics

National 4/5 Physics -

Outcome 1– a scientific report of an experiment or practical investigation

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This assessment activity requires you to apply skills of scientific inquiry to carry out an experiment/practical investigation that draws on knowledge and understanding of the key areas of a Unit. This booklet provides you with a series of prompts to guide you to produce the required evidence for assessment (Candidate's Guide).

While you are carrying out your experiment/practical investigation, you will be observed to make sure that you are following procedures safely, and that you are taking measurements correctly.
You will:
Apply skills of scientific inquiry and draw on knowledge and understanding of the key areas of the Units to carry out an experiment/practical investigation by:

1.1 Planning an experiment/practical investigation
1.2 Following procedures safely
1.3 Making and recording observations/measurements correctly
1.4 Presenting results in an appropriate format
1.5 Drawing valid conclusions
1.6 Evaluating experimental procedures

Your assessor/teacher will let you know how the assessment will be carried out and any required conditions for doing it. Your assessor/teacher will provide you with the resources you need. You may be able to work in a group to do the practical work, but you will need you to show that you have met the Assessment Standards i.e. involvement and report.

To pass this assessment, you will have to prepare **a scientific report** to show that you can:

- Plan an experiment/practical investigation
- Make and record observations/ measurements correctly
- Present your results in an appropriate format
- Draw valid conclusions
- Evaluate experimental procedures

Candidate Guide

Your **plan** must include:

- an aim – which is a clear statement of what you are trying to do in this experiment/practical investigation
- the dependent and independent variables
- the relevant variable(s) to be kept constant
- what you will be measuring/observing
- a list of equipment/materials you will use
- a labelled diagram of the experimental arrangement, if appropriate
- a description of how you will carry out your experiment/practical investigation (including safety where appropriate).

Checkpoint: Ask your assessor/teacher to check your plan before you start the practical work.

- You should carry out your experiment/practical investigation safely and **record your observations/measurements** in an appropriate way.

Checkpoint: Ask your assessor/teacher to check your results.

- **Present** your findings/results in an appropriate way.

This may be a table, line graph, chart, key, diagram, flow chart, summary or other appropriate format.
Graphs should be plotted on squared graph paper.
Use appropriate SI units and standard abbreviations.

- State your **conclusion(s)** which should include reference to the aim

Evaluate your experimental procedures. Your evaluation should include at least one possible improvement for the experiment with justification

Assessment Activity 1: What you will be assessed on for evidence of Outcome 1

In Assessment Activity 1, you are required to apply skills of scientific inquiry to carry out an experiment/practical investigation that draws on knowledge and understanding of key areas of the Unit. You will be required to show evidence for assessment carrying out the practical and in the form of a scientific report.

Outcomes	**Assessment Standards**	**Making assessment judgements**	**Assessment for candidates (Appendix 1): commentary on making assessment judgements**
1 Apply skills of scientific inquiry and draw on knowledge and understanding of key areas of this Unit to carry out an experiment/practical investigation by:	1.1 Planning an experiment/ practical investigation	The plan should include: a clear statement of the aim a dependent and an independent variable key variables to be kept constant measurements/observations to be made the equipment/materials a clear and detailed description of how the experiment should be carried out, including safety considerations, where appropriate.	The plan for the experiment must be clear enough for another person to follow and at an appropriate level.
	1.2 Following procedures safely	The candidate should be seen to follow procedures correctly, including safety considerations as appropriate.	In the case of assessment by observation, evidence should include assessor comments that show clearly the basis on which assessment judgements have been made. An observation checklist could be used to record that procedures have been followed correctly and safely.

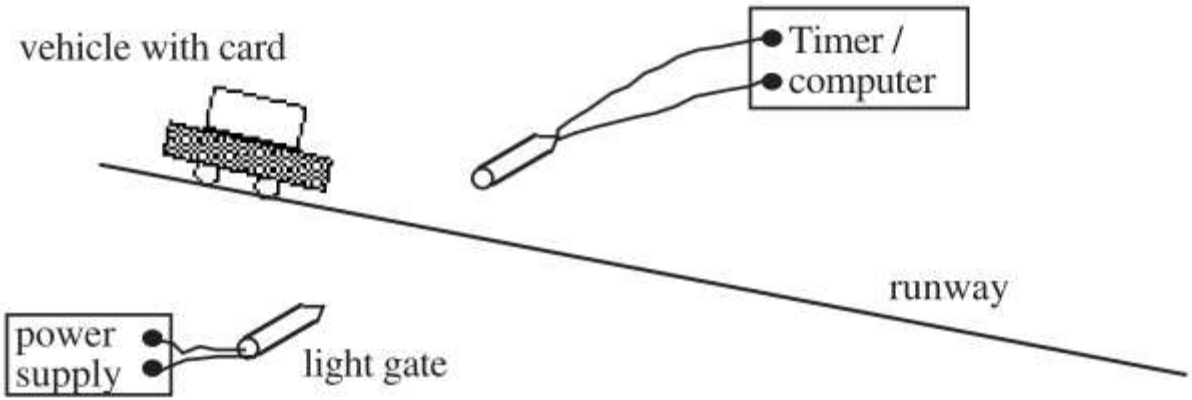
Outcomes	Assessment Standards	Making assessment judgements	Assessment for candidates (Appendix 1): commentary on making assessment judgements
	1.3 Making and recording observations/ measurements correctly	Measurements/observations should be recorded correctly.	The raw data should be collated in a relevant form eg a table Measurements should be repeated and averages calculated, where appropriate
	1.4 Presenting results in an appropriate format	Candidates should present results in an appropriate format using at least one format from: table, line graph, chart, key, diagram, flow chart, summary or other appropriate format.	Candidates should process/analyse the results and present findings in an appropriate format. Results should be presented so that the assessor can check that results have been processed correctly. Candidates should use SI units and standard abbreviations. If used, graphs should be plotted on squared graph paper.
	1.5 Drawing valid conclusions	Conclusions should refer to the aim of the experiment. If results are inconclusive but candidates refer to evidence and the aim of the experiment to say that no conclusion can be drawn then this would be valid and sufficient response.	The response should be appropriate for the experiment.
	1.6 Evaluating experimental procedures	Evaluation should be supported by justification(s) and provide at least one possible improvement for the experiment.	The response should be appropriate for the experiment/practical investigation.

Suggested Experiments/Investigations –

Topic	Key Area	Relevant areas	Activity
Dynamics and Space	Velocity and Displacement	Instantaneous sped	Variation of instantaneous speed with time for an object moving down a slope
Dynamics and Space	Acceleration	Acceleration	Variation of Acceleration with slope
Dynamics and Space	Newton's Laws	F = ma - Newton's Second law	Relationship Between Acceleration and Applied Force: Newton's 2nd law experiment with trolley masses and light gates
Dynamics and Space	Space Exploration	Re-entry / Latent Heat	Cooling Curves - Latent Heat of Fusion
Electricity and Energy	Ohm's law	Relationship between current and potential difference	Current and Potential Difference
Electricity and Energy	Practical Electronics circuit	Investigation of Thermistor	Variation of Resistance of Thermistor with Temperature
Electricity and Energy	Gas laws and Kinetic Model	Relationship between volume and pressure for mass of gas.	Relationship between pressure and volume of a fixed mass of gas at a fixed temperature. Using Boyle's law apparatus
Electricity and Energy	Gas laws and Kinetic Model	Relationship between volume and pressure for mass of gas.	Relationship between pressure and volume of a fixed mass of gas at a fixed temperature. Using syringe and pressure sensor
Waves and Radiation	Light	Refraction	Variation of angle of refraction with angle of incidence

Variation of instantaneous speed with time for an object moving down a slope

Apparatus:
Runway, vehicle with card, light gate, electronic timer or computer, stopclock.



Instructions

•Set up the computer to measure the instantaneous speed of the vehicle as the vehicle passes through the light gate.

• Set the runway at a small angle such that the vehicle will accelerate as it runs down.

• Place the light gate about one third of the way down the runway.

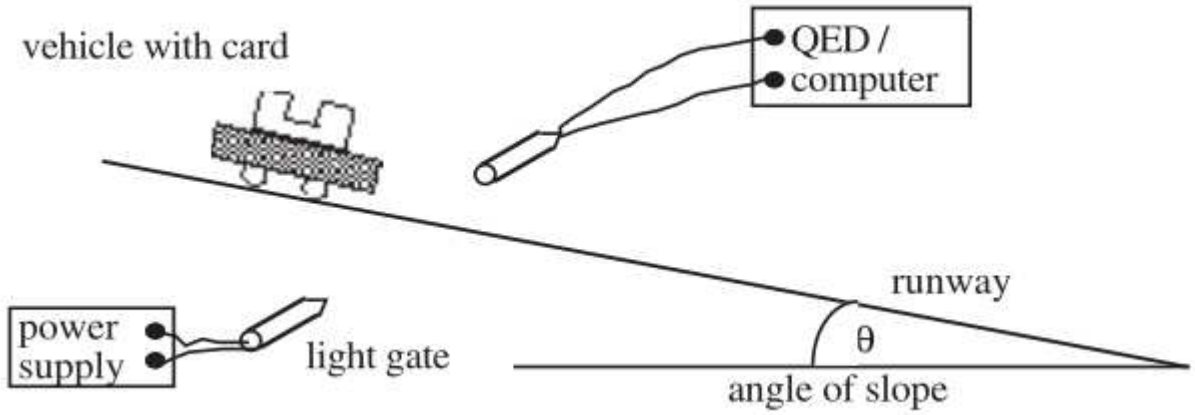
• Release the vehicle from the top of the runway and measure the time taken to reach the light gate and the instantaneous speed as it passes the light gate.

• Move the light gate further down the slope and repeat the measurements for at least four more positions.

• Use an appropriate format to show the variation of speed with time.

Variation of acceleration with changing slope of ramp

Apparatus:
Runway, vehicle with double card, light gate, computer or QED, board protractor.



Instructions

•Organise the QED/computer to measure the acceleration of the vehicle as the vehicle passes through the light gate.

•Set the runway up at an angle.

•Measure the angle of this slope.

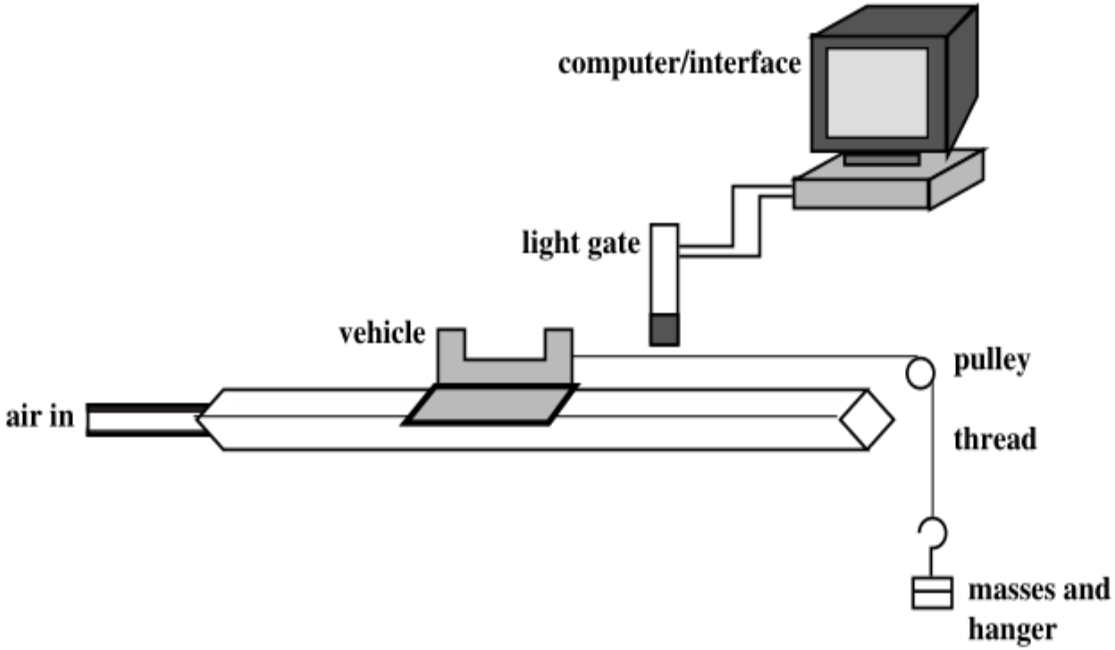
•Place the light gate so that the card cuts the beam as the vehicle passes.

•Release the vehicle and measure the acceleration as it passes through the light gate.

•Change the angle of the slope and repeat the measurements for other angles.

•Use an appropriate format to show the variation of acceleration with angle of slope.

Relationship Between Acceleration and Applied Force



Apparatus:
Linear air track
400 g air track vehicle
10 g masses and 10 g hanger
Light gate
Computer interface to measure acceleration.

Instructions
• Place the 400 g vehicle on the air track and attach 50 g mass to the thread over the pulley.

•Calculate the weight of the mass and hanger - this is the applied force.

•Release the vehicle so the mask passes through the light gate.

•Measure the acceleration using the computer/interface.

• Remove 10 g from the hanger and place on the vehicle (so that the overall mass stays constant).

•Record the new applied force.

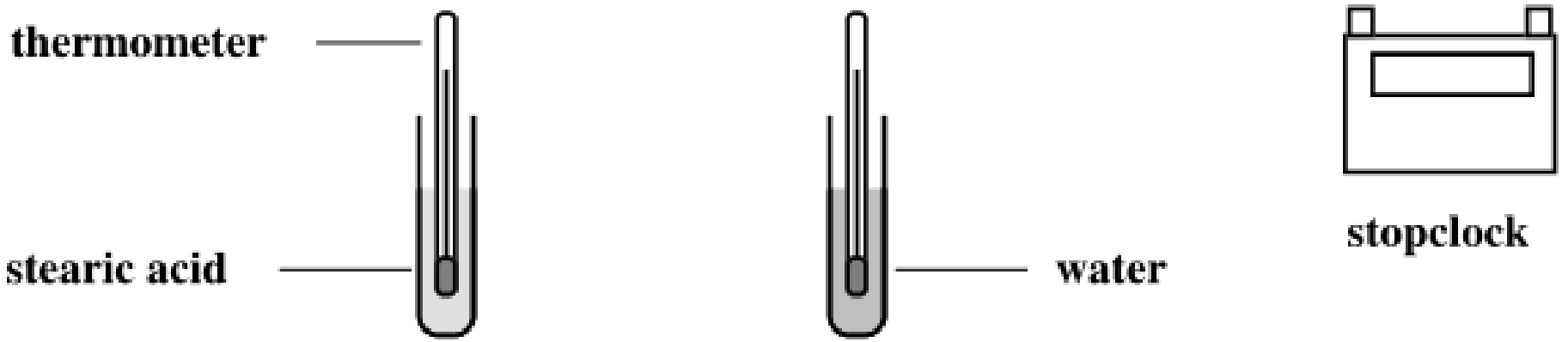
•Release the vehicle and record the acceleration produced.

•Repeat, moving 10 g each time.

• Use an appropriate format to show the variation of the acceleration with the force applied.

Investigation of a cooling curve for a liquid

Apparatus:
Boiling tube containing stearic acid, boiling tube containing water, beaker,
2 thermometers, stopclock, test tube rack and bunsen burner.



Instructions

•Place the boiling tubes of water and stearic acid in a beaker of heated water until the stearic acid is completely melted.

•Remove the boiling tubes from the hot water and place them in a test tube rack.

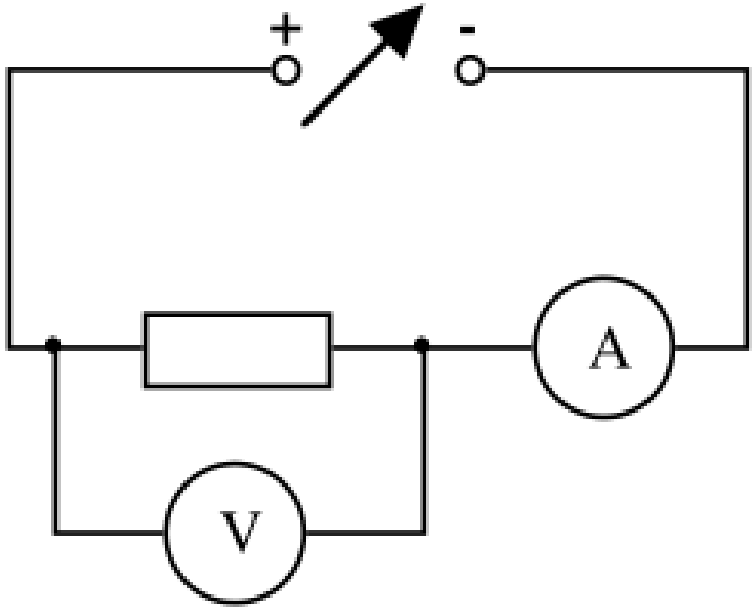
•Note their initial temperatures.

•Record the temperature in each boiling tube every minute for twenty minutes.

•Use an appropriate format to compare the temperature change with time for the two substances.

Current and Potential Difference

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 1 V and measure the current through the resistor and the p.d.
across it.

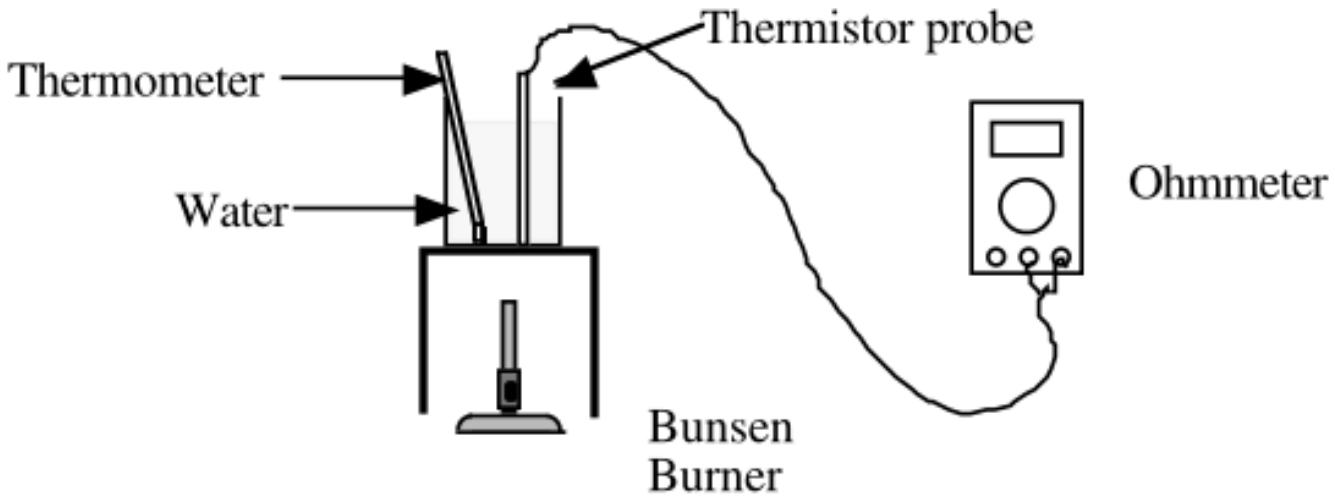
•Using the same resistor, increase the supply voltage to 2 V and repeat the above
measurements.

•Repeat the above, increasing the supply by 1 V each time up to 5 V.

• Use an appropriate format to show the variation of the potential difference with the current.

Variation of Resistance of Thermistor with Temperature

Apparatus:
Bunsen burner, tripod stand, beaker, thermometer, thermistor and ohmmeter.



Instructions

•Set up the apparatus as shown.

•Vary the temperature of the water using a gentle bunsen flame.

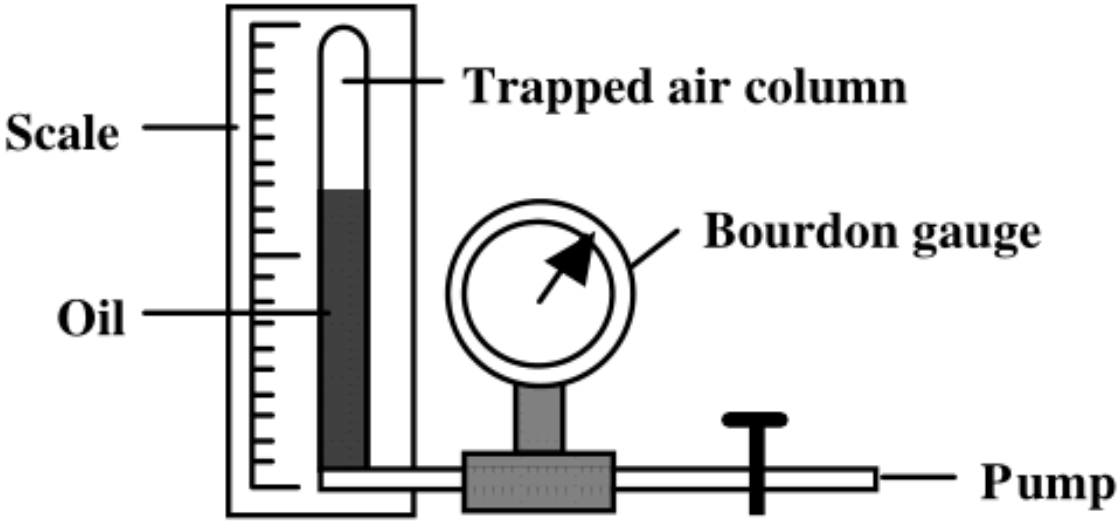
•Note the temperature and the resistance of the thermistor.

•Repeat for intervals of 10 °C.

•Use an appropriate format to show the variation of the resistance of the thermistor with temperature.

Relationship between pressure and volume of a fixed mass of gas at a fixed temperature.

Apparatus: Boyle's Law apparatus, pump.

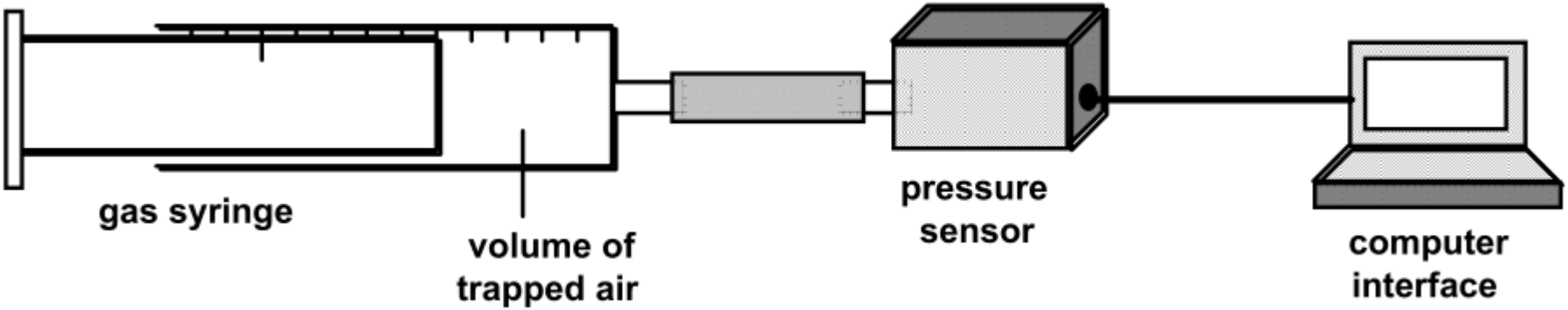


Instructions

- 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 new 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.

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.

Variation of angle of refraction with angle of incidence

Apparatus:
A semicircular perspex block, a protractor, a ray box and power supply.

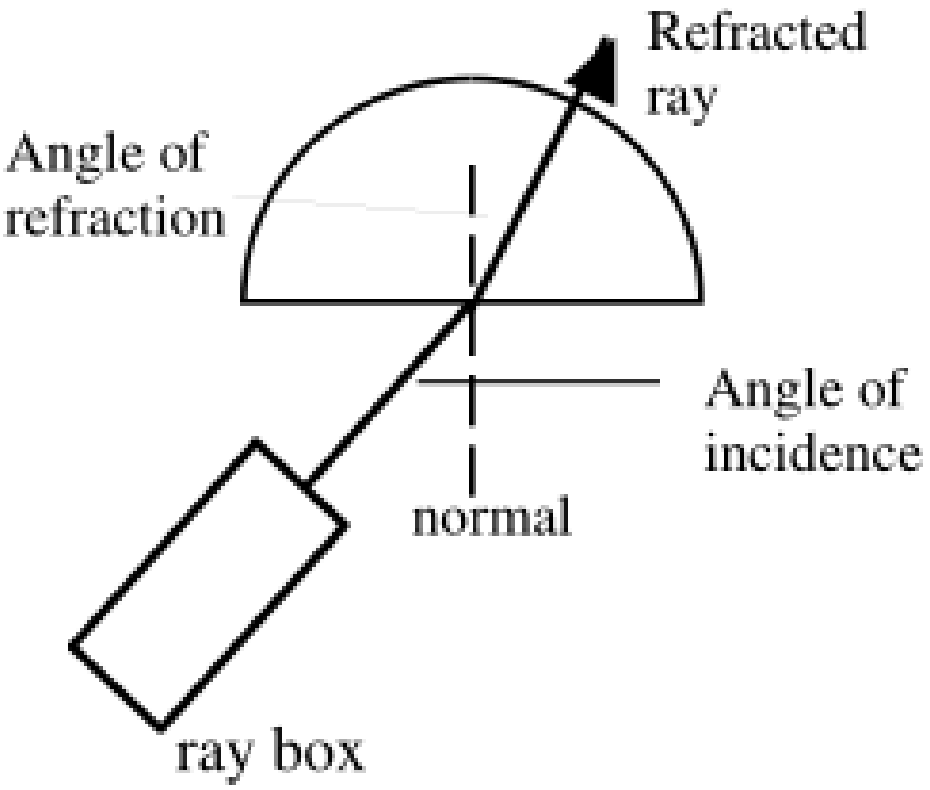
Instructions

•Set up the apparatus as shown in the diagram.

•Draw the ray diagrams for different angles of incidence and measure the corresponding angle of refraction.

•Measure at least 5 different sets of readings.

•Use an appropriate format to display the variation of the angle of refraction with the angle of incidence.



Additional Notes