香港考試及評核局
Hong Kong Examinations and Assessment Authority

Hong Kong Diploma of Secondary Education Examination

Physics and Combined Science (Physics)

School-based Assessment Sample Tasks

(Experiments and Investigative Study)

Teachers may use the sample tasks for non-profit making educational and research purposes with proper acknowledgement.

TABLE OF CONTENT

Practical Skills (%)	
Reporting (%)	
Total	

E1 Relationship between Pressure and Volume of Gas

Name :_____
Class :_____ No.:_____
Date :_____

Objectives: To investigate the relationship between pressure and volume of air in a syringe.

Apparatus: 60 cm^3 plastic syringe
Bourdon gauge
rubber tubing
vaseline

Theory:

Boyle's law states that pressure is inversely proportional to the volume of a gas, provided that the mass and temperature of the gas remain constant. This relationship can be demonstrated by a syringe of air. The syringe is connected to a Bourdon gauge to measure the pressure. The volume of the gas can be estimated by reading the scale on the syringe.

Procedures:

1. Take out the piston of the syringe. Put a little vaseline evenly on top of piston. Fit the piston back to the syringe.
2. Set the volume of air inside the syringe to roughly 25 cm^3.
3. Connect the syringe to the Bourdon gauge with rubber tubing. Put a little vaseline on the surface of connectors before fitting in the rubber tubing.

4. The Bourdon gauge should read roughly 1.0×10^5 Pa (approximately equal to atmospheric pressure). As the pointer of the Bourdon gauge may get stuck due to the friction of the mechanical parts inside, tap the Bourdon gauge slightly every time before you take a reading.

5. Adjust the piston until the Bourdon gauge reading is 1.0×10^5 Pa. Record the volume of the gas inside the syringe.
6. Pull out the piston slowly until the pressure is reduced to 0.9×10^5 Pa. Keep this pressure and hold the piston for 15 seconds. Take the reading of the volume of the gas inside the syringe.
7. Repeat step 6 by further pulling out the piston and reducing the pressure by 0.1×10^5 Pa each time. Remember to keep the pressure and hold the piston by 15 seconds before the volume is read.
8. When the pressure is reduced to 0.7×10^5 Pa, repeat the experiment by returning the piston to 1.0×10^5 Pa in steps of 0.1×10^5 Pa.
9. The volume after the pressure is returned to 1.0×10^5 Pa should be roughly the same as the initial volume. If there is a large difference, check the apparatus and repeat the experiment.
10. Repeat the experiment by pushing in the piston and increasing the pressure to 1.1×10^5 Pa, 1.2×10^5 Pa, 1.3×10^5 Pa and 1.4×10^5 Pa. Then repeat the experiment by returning to 1.0×10^5 Pa. Remember to hold the piston for 15 seconds before taking each reading.

Results:

Pulling out the piston:

Pressure (p) / 10^5 Pa	1.0	0.9	0.8	0.7	0.8	0.9	1.0
Volume (V) / cm^3							

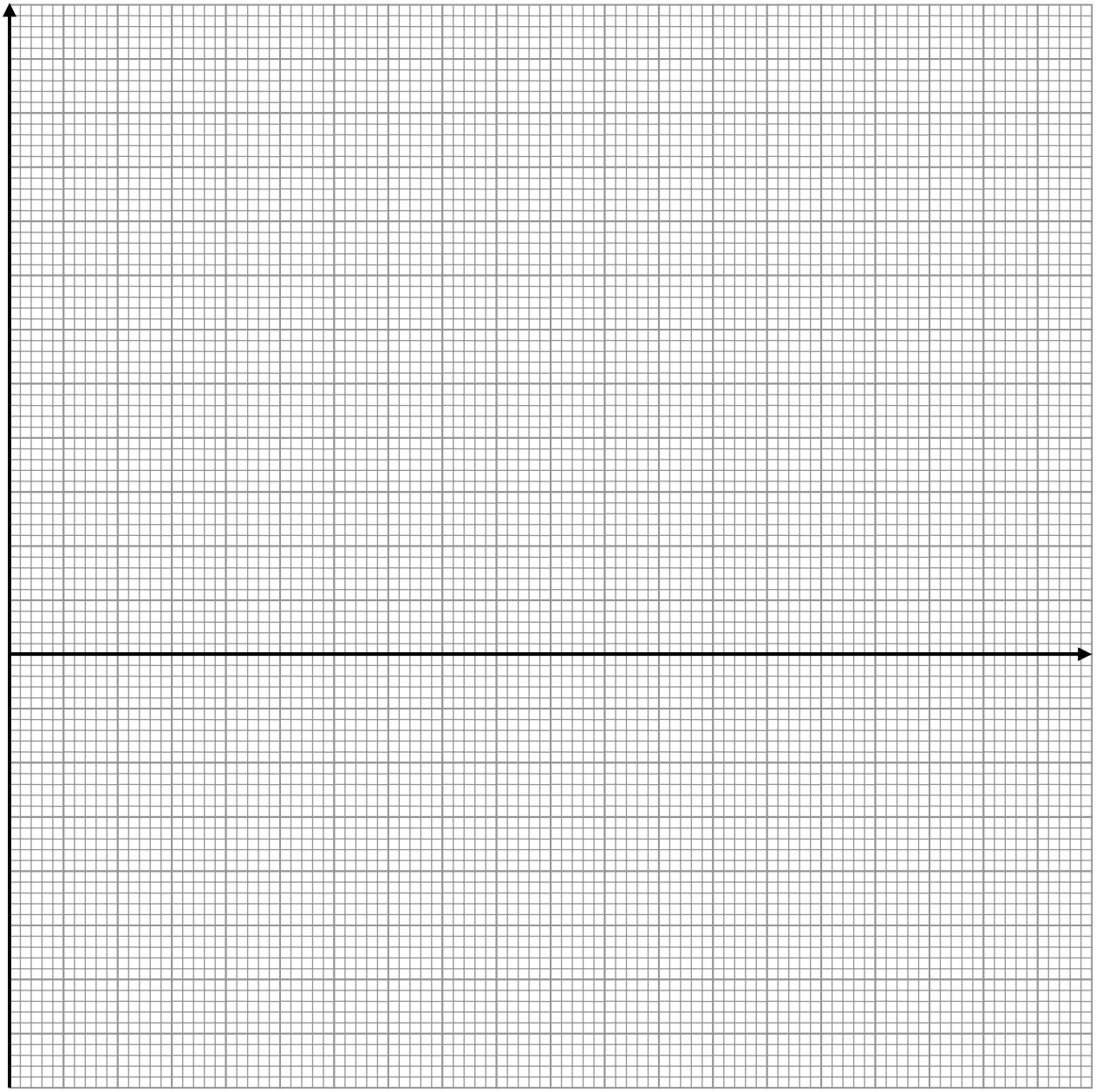
Pressing in the piston:

Pressure (p) / 10^5 Pa	1.0	1.1	1.2	1.3	1.4	1.3	1.2	1.1	1.0
Volume (V) / cm^3									

For a particular pressure, take the mean of volumes when the pressure is increased and decreased. Complete the table below.

Pressure (p) / 10^5 Pa	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4
Mean Volume (V) / cm^3								
$1/p$ /10^{-5} Pa^{-1}								

Plot a graph of volume (V) of the gas against 1/pressure ($1/p$) at room temperature.



Discussion:

1. Do the points in the graph lie on a straight line ? Does the line/curve pass through the origin ? Give a reason for the discrepancy of the result from the Boyle's law.

2. What is the purpose of adding vaseline on the piston of the syringe ?

3. Why is it necessary to hold the piston for 15 seconds before each reading is taken ?

4. Why do we repeat the experiment by returning the piston back to the initial position, so that two volumes are taken for each pressure ?

Further Investigation:

From the graph, find the volume of air inside the rubber tubing and the Bourdon gauge. Derive the formula you used.

Practical Skills (%)	
Reporting (%)	
Total	

E2 Newton's second law of motion

Name :_____

Class :_____ No.:_____

Date :_____

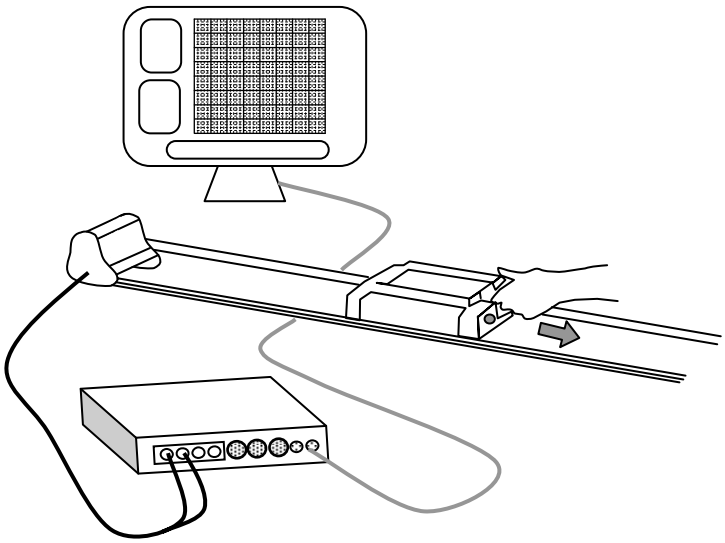
Objective: To investigate the relation of the mass, acceleration and net force acting on an object.

Apparatus: data-logger interface with a motion sensor
elastic threads (unstretched length about 20 cm) × 4
friction-compensated runway
trolley
0.5 kg weights / additional trolleys × 3
electronic balance (optional if the mass of the trolley is known)

Part A—Net force and acceleration

Procedures:

1. Prepare a set-up to record the motion of a trolley on a runway as shown below. While necessary, adjust the runway for friction compensation.



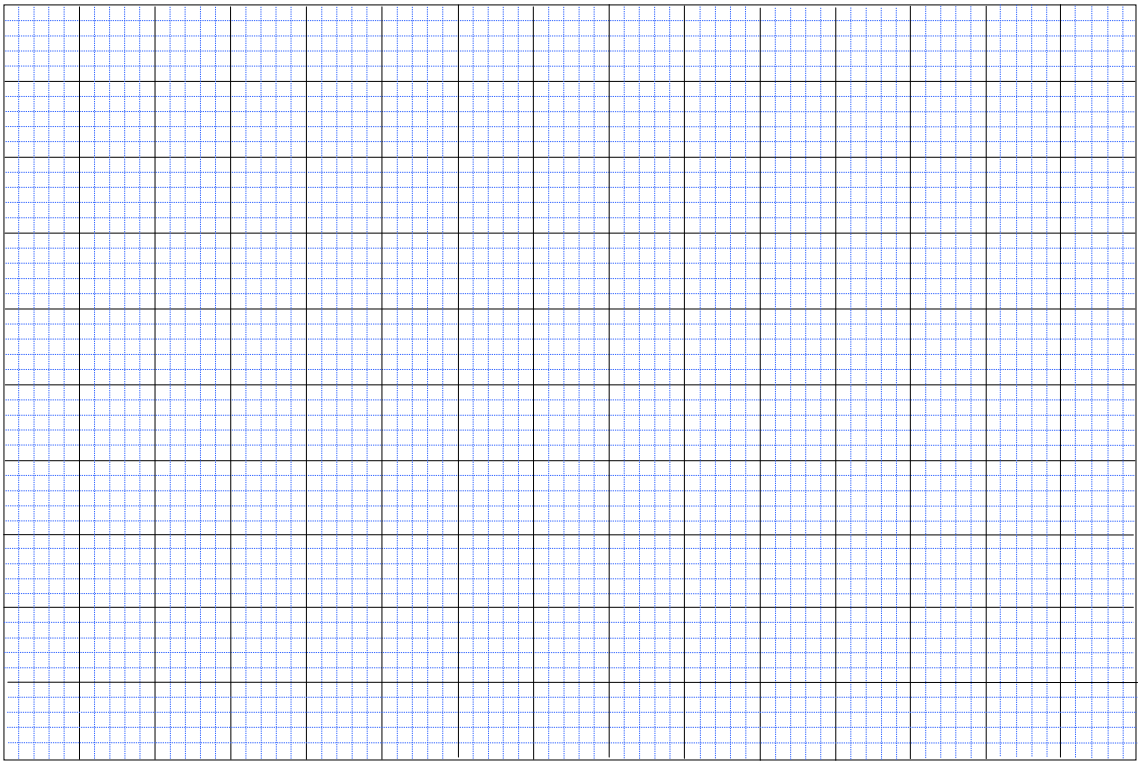
2. Start data-logging. Use 1 elastic thread to pull the trolley along the track. The thread should be stretched by the same amount throughout.
3. From the slope of the velocity-time graph generated by the data-logging program, find the acceleration of the trolley.
4. Take one more confirmatory trial and obtain the mean value of the acceleration of the trolley.
5. Repeat steps 2–4 with 2, 3 and 4 elastic threads respectively. The threads should be stretched by the same amount as before.
6. Plot a graph of the acceleration a of the trolley against the number of elastic threads N used.

Results:

Mass of the trolley m = _____ kg

Number of threads N	Acceleration a / m s^{-2}		
	1st trial	2nd trial	Mean
1			
2			
3			
4			

A graph of a against N:



Discussion:

1. With the aid of a free body diagram, explain the meaning of friction compensation in step 1 of the procedures above. Describe briefly the experimental steps to show that the runway is friction compensated.

2. State the control variable(s), dependent variable(s) and independent variable(s) in this experiment.

3. What physical quantity does the number of threads *N* represent ? From the graph plotted above, what can you say about the relation of the mass, acceleration and net force acting on an object ?

4. While you pull the trolley, the thread should be stretched by the same amount throughout. Explain briefly why it is important in this experiment.

Part B—Mass and acceleration

Procedures:

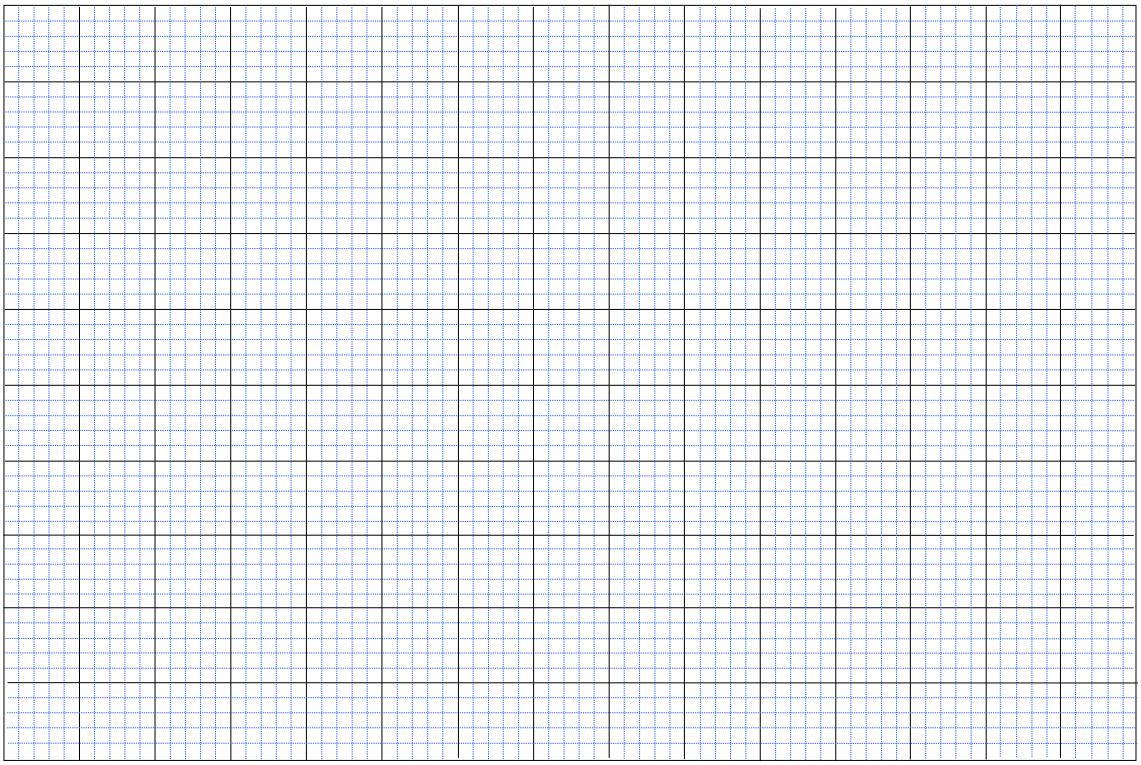
1. Prepare the same set-up as Part A to record the motion of a trolley on a runway. While necessary, adjust the runway for friction compensation.
2. Start data-logging. Use 2 elastic threads to pull the trolley along the track. The thread should be stretched by the same amount throughout.
3. From the slope of the velocity-time graph generated by the data-logging program, find the acceleration of the trolley.
4. Take one more confirmatory trial and obtain the mean value of the acceleration of the trolley.
5. Repeat steps 2–4 with additional weights placed on the trolley. The threads should be stretched by the same amount as before.
6. Plot a graph of the acceleration a of the trolley against $\frac{1}{m}$ where m is the total mass of the trolley.

Results:

Number of threads N = _____

Total mass of the trolley m / kg	$(\frac{1}{m})$ / kg^{-1}	Acceleration a / m s^{-2}		
		1st trial	2nd trial	Mean

A graph of a against $\frac{1}{m}$:



Discussion:

1. State the control variable(s), dependent variable(s) and independent variable(s) in this experiment.

2. From the graph plotted above, what can you say about the relation of the mass, acceleration and net force acting on an object ? Hence, together with the results from Part A, suggest a general relation among them.

3. Discuss **TWO** major sources of errors in this experiment and way(s) for improvement.

4. Now, if the runway were inclined at an angle greater than that required for friction compensation, how would the graphs obtained in Part A and Part B be affected ? Assume that the friction is unchanged throughout.

Practical Skills (%)	
Reporting (%)	
Total	

E3 Centripetal force

Name :_____

Class :_____ No.:_____

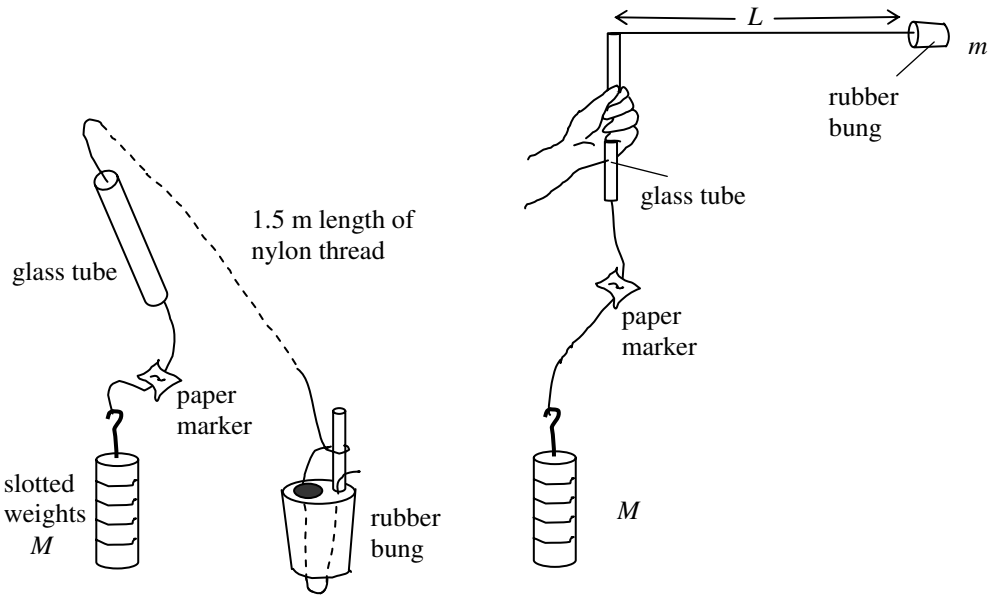
Date :_____

Objective: To measure the centripetal force of whirling a mass round a horizontal circle and compare it with the theoretical value.

Apparatus: rubber bung
glass tube about 15 cm long
slotted weights, with hanger 12 × 0.02 kg
nylon thread 1.5 m
paper marker
adhesive tape
metre rule
stop watch

Procedures:

1. Attach one end of a 1.5 m length of nylon thread to a rubber bung and thread the other end through a glass tube, a paper marker and a number of weights as shown.



2. First adjust the position of the paper marker so that it is at one end of the glass tube, and the length of the thread L from the other end of the glass tube to the rubber bung is, say, 0.8 m. Fix the position of the paper marker using adhesive tape if necessary. First start with M = 0.12 kg (i.e. 120 g).
3. Holding the glass tube vertically, whirl the bung around above your head in a horizontal circle. (Note that the nylon thread need not be horizontal.) Increase the speed of the bung gradually and allow it to move out (i.e. let L increases) until the paper marker is just below the glass tube without touching it.

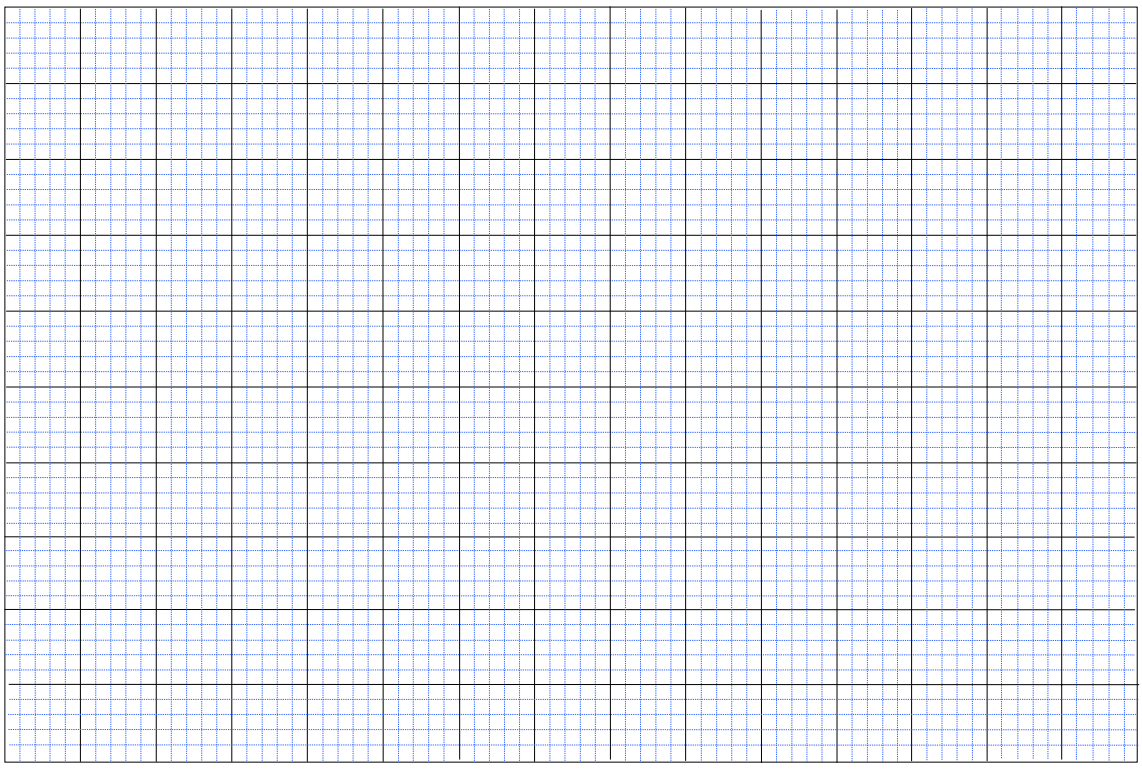
4. Try to keep the angular speed constant so that the paper marker is just below the tube throughout. Ask your partner to time 20 revolutions of the bung using a stop watch. Remember to start the stop watch at 0 and stop it at 20. Take one more confirmatory reading and obtain the mean time for 20 revolutions. Calculate the tension T in the string and the angular velocity ω.
5. Repeat the procedures using different masses M. Remember to check confirmatory reading for each value of M.
6. Measure the mass m of the rubber bung.
7. Plot a suitable graph to find the relation between ω and T.

Results:

Mass of the rubber bung m = _____ kg

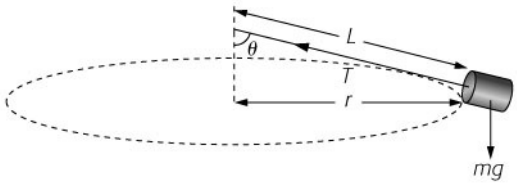
Length of the thread L = _____ m

M / kg	$T = Mg$ / N	Time for 20 revolutions $20t$ / s			Angular speed $\omega = \frac{2\pi}{t}$ / rad s^{-1}
		1st trial	2nd trial	Mean	



Discussion:

1. The string may not be horizontal as the rubber bung moves around.



Show that

(i) the tension T in the string is equal to $m\omega^2 L$;

(ii) the angle θ is independent of the angular velocity ω.

2. From the graph plotted above, what can you say about the relation between ω and T ? Calculate the slope of the graph. What is the physical significance of the slope ? Compare the experimental value and the theoretical value of the slope.

3. In step 3 of the procedures above, the marker should be <u>just below the glass tube without touching it</u>. Explain briefly why it is important in this experiment.

4. Discuss **TWO** major sources of errors in this experiment.

Further Investigation:

1. Design an experiment to find the relation between ω and L.

Practical Skills (%)	
Reporting (%)	
Total	

E4 Focal length of a convex lens

Name :_____

Class :_____ No.:_____

Date :_____

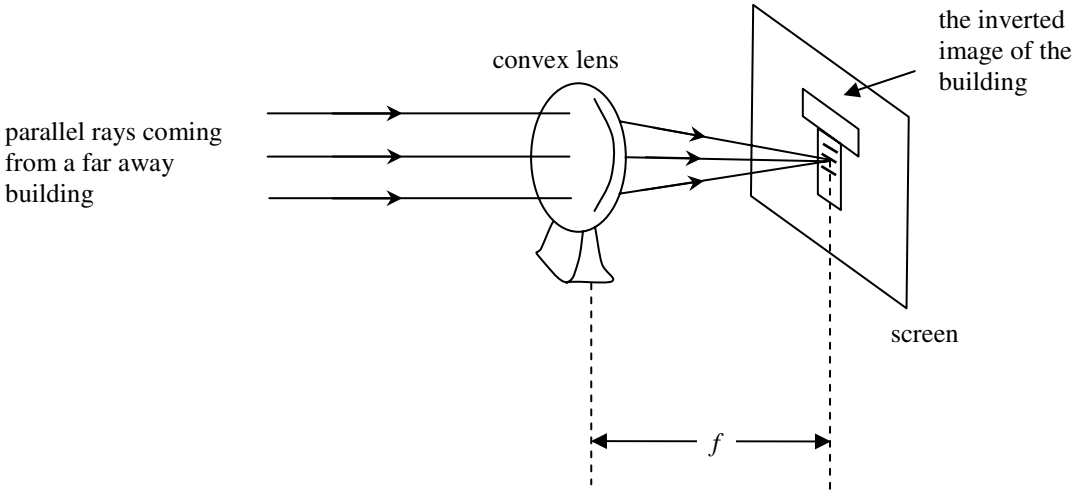
Objective: To measure the focal length of a spherical convex lens.

Apparatus: spherical convex lens with holder
lamp housing
white screen (opague/translucent)
metre rule

Part A—Forming image of a distant object

Procedures:

1. Place a convex lens with a holder near a window. Move the opaque/translucent screen to a position where a sharp image of a distant object is formed as shown below.



2. Measure the distance between the lens and the screen. This is the focal length of the lens.

Results:

The focal length found in Part A, f_1 = _____ cm

Discussion:

1. State the nature of the image formed.

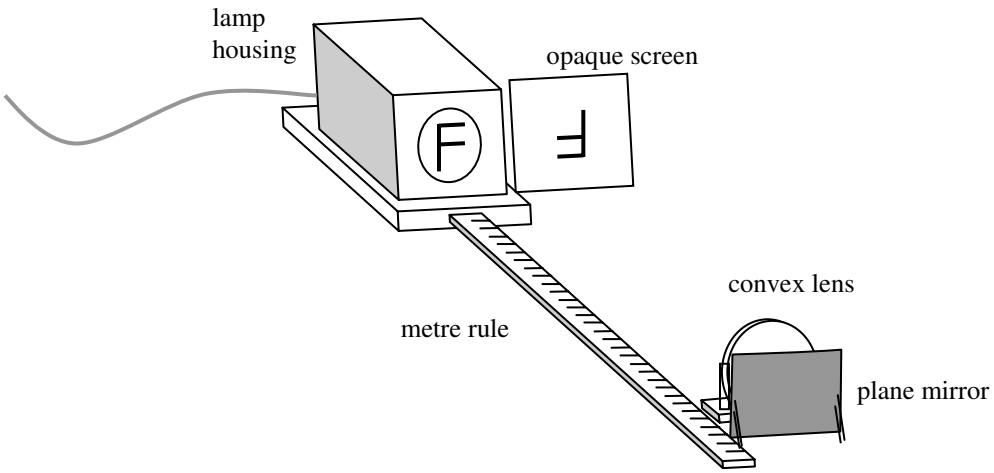
---

2. If the screen is removed, can you see the image of the distant object ?

Part B—Plane mirror method

Procedures:

1. Put an opaque screen side by side with a lamp housing (with a letter F). Attach a plane mirror to a convex lens with holder and place them in front of the lamp housing and the screen as shown below.



2. Move the lens-mirror combination until a sharp image is formed on the opaque screen.
3. Measure the object/image distance, i.e. the distance between the lens and the screen. This is the focal length of the lens.

Results

The focal length found in Part B, f_2 = _____ cm

Discussion

1. State the nature of the image formed.

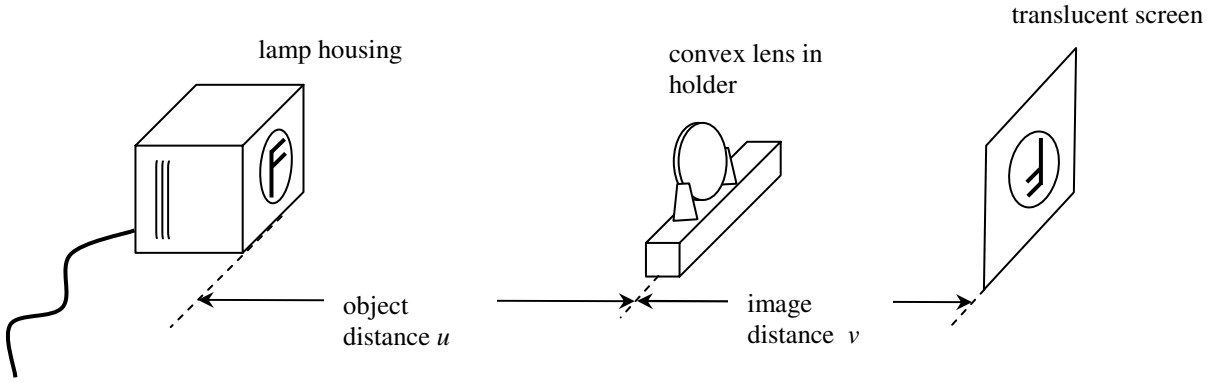
---

2. Will the result be different if the distance between the plane mirror and the lens is changed ?

Part C—Using lens formula

Procedures

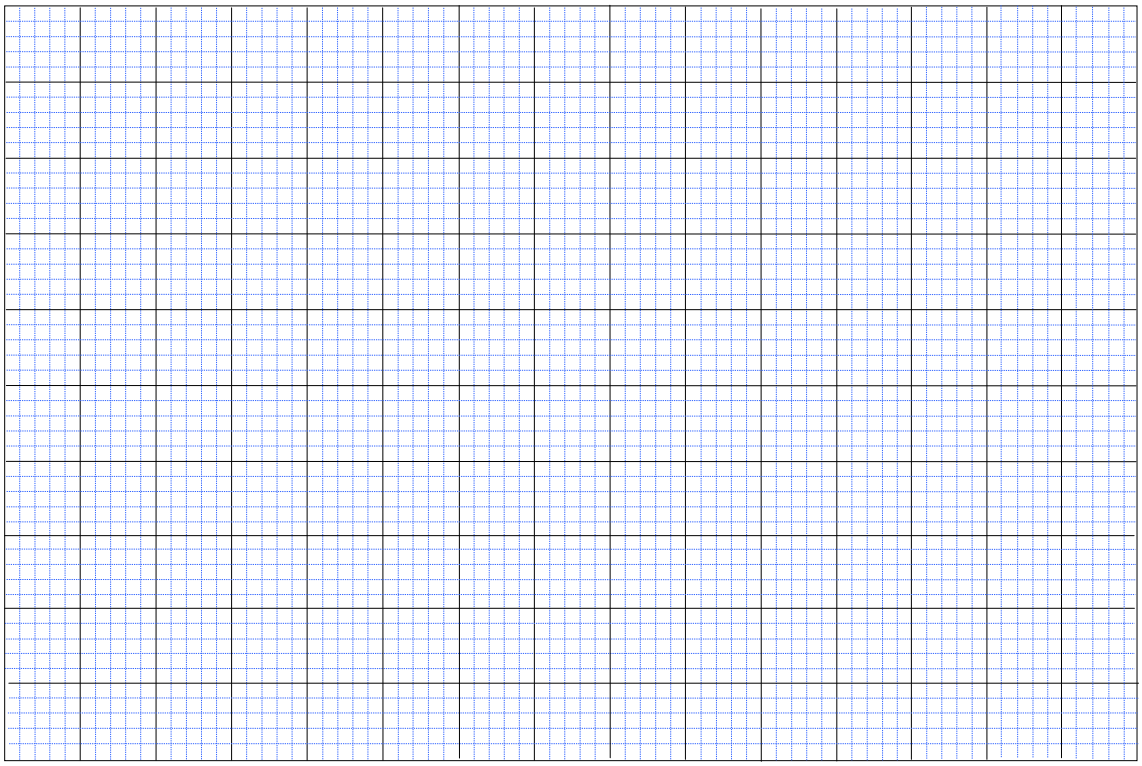
1. Prepare the set-up shown below. Set the distance between an illuminated object and the lens, i.e. the object distance u, to a value close to $2f_1$ (or $2f_2$).



2. Adjust the position of the translucent screen until a sharp image is formed on it and measure the distance between the lens and the screen, i.e. the image distance v.
3. Change the object distance u to some values larger than $2f_1$ and repeat the measurement to obtain 3 more pairs of u and v.
4. Change the object distance u to some values smaller than $2f_1$ and repeat the measurement to obtain 3 more pairs of u and v.
5. Plot a graph of $\frac{1}{v}$ against $\frac{1}{u}$. The focal length can be obtained from the y-intercept of the graph.

Results:

	u / cm	v / cm	$\frac{1}{u}$ / cm^{-1}	$\frac{1}{v}$ / cm^{-1}
$u < 2f_1$				
$u \approx 2f_1$				
$u > 2f_1$				



The focal length found in Part C, f_3 = _____ cm

Discussion:

1. State the nature of the images formed in steps 2, 3 and 4.

2. The focal length of a concave lens cannot be found by this method. Why ?

3. By using the lens formula $\frac{1}{f}=\frac{1}{u}+\frac{1}{v}$, show how the focal length of the lens is obtained from the y- intercept of the $\frac{1}{v}$ against $\frac{1}{u}$ graph.

4. If half of the lens is covered by a cardboard, describe any changes of the image formed.

Further Investigation:

1. Repeat the experiment with other lenses of different thickness. Find out how the thickness of a lens affects its focal length.
2. In Part C, what is the minimum distance between the object and the image ?

Practical Skills (%)	
Reporting (%)	
Total	

E5 Internal Resistance of a Battery

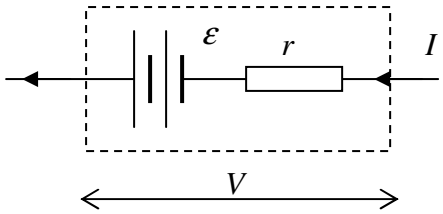
Name :_____
Class :_____ No.:_____
Date :_____

Objective: To determine the internal resistance of a battery.

Apparatus: battery (3 × 1.5 V AA dry cells)
voltmeter (5 V)
ammeter (1 A)
rheostat R
fixed resistor R'
connecting wires
switch

Theory:

A real battery always has internal resistance. Simple theory regards a real battery as an ideal battery of e.m.f. ε in series with the internal resistance r.



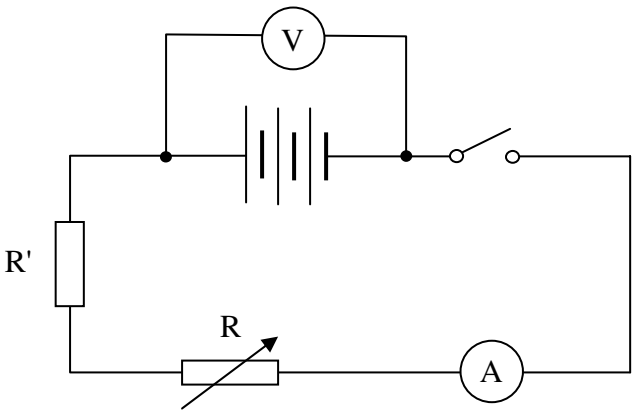
When a current I passes the battery, the potential difference V across the battery is given by

$$V = \varepsilon - Ir$$

If V is plotted against I, the internal resistance and e.m.f. of the battery can be found.

Procedures:

1. Connect the circuit as shown in the diagram below.



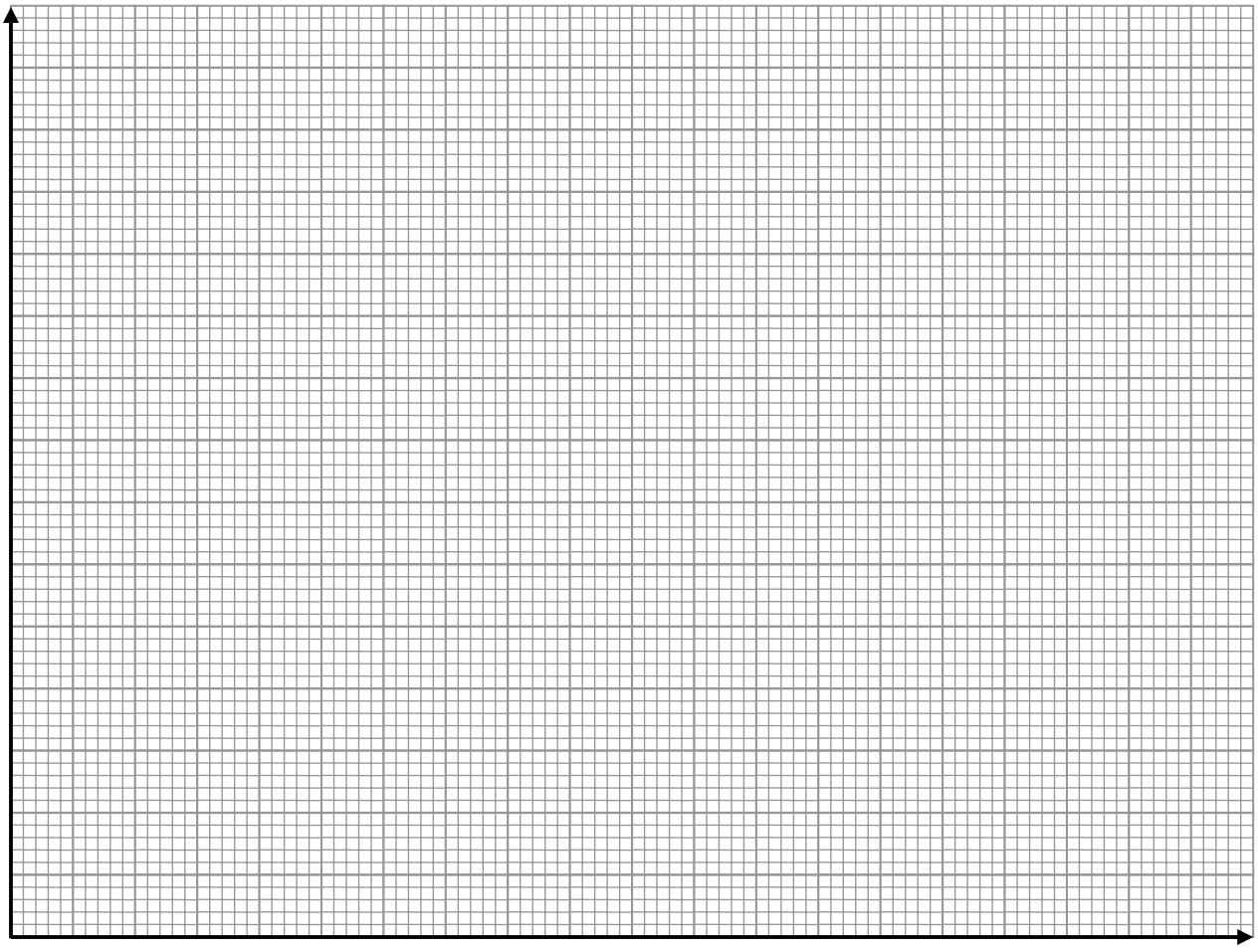
2. Keep the switch turned off. Take the reading of the voltmeter. This is the initial electromotive force (e.m.f.) of the battery.
3. Set the rheostat to zero. Turn on the switch and take the ammeter and voltmeter readings. Turn off the switch once the readings are taken.
4. Increase the resistance of the rheostat. Turn on the switch and adjust the rheostat until the current is roughly 0.1 A below the value in (3). Take the ammeter and voltmeter readings. Remember to turn off the switch once the readings are taken.
5. Repeat step 4 by decreasing the current in steps of 0.1 A. Plot a graph of the voltage *V* against the current *I*.

Results:

Initial electromotive force of the battery = _____ V

Ammeter reading *I*/A						
Voltmeter reading *V*/V						

Plot a graph of *V* against *I*.



From the graph above, how can you find the internal resistance and e.m.f. of the battery ? Derive the formulae you used.

_____

_____

_____

_____

_____

_____

Conclusion:

The internal resistance of the battery is _____ Ω.

The e.m.f. is _____ V.

Discussion:

1. Why is it necessary to turn off the switch after each reading is taken ?

   _____

   _____

   _____

   _____

   _____

2. Do you think that the resistance of the connecting wire is a significant error in this experiment ? Explain briefly.

   _____

   _____

   _____

   _____

   _____

   _____

3. The battery contains three identical dry cells in series. What are the e.m.f. and internal resistance of each dry cell ? Explain briefly.

_____

_____

_____

_____

_____

_____

Further Investigation:

Set the resistance of the rheostat to zero. Turn on the switch for roughly 10 minutes. Repeat steps 3 to 5 and plot another V - I graph. What happen to the internal resistance and e.m.f. after the battery has been discharged for 5 minutes ? Suggest what happens inside the dry cells while they are discharging ?

Investigative Study –To study the factors affecting the rate of cooling of hot water

Task outline:

In this investigation, you are going to find the factors affecting the rate of temperature drop of hot water and design experiments to show their relationships. You should collaborate with your group-mates to complete the task. You should apply your knowledge and skills in Physics to solve the problems and draw conclusions based on the results obtained.

The investigation is divided into five stages.

1. Searching for and defining questions for investigation
2. Developing an investigation plan
3. Conducting the investigation
4. Organising and analysing data for a justified conclusion
5. Presenting the investigation findings with a written report, posters and other means

Apparatus:

The following apparatus and materials will be provided:

- Data logger
- Temperature sensor
- Vacuum flask
- Stirrer
- Thermometer
- Cork plate
- Electric kettle

Students are recommended to propose other apparatus and materials that may be useful.

Discussion:

1. Propose the factors affecting the rate of cooling of hot water. Identify the independent variables, dependent variables and control variables in your experiment.
2. Carry out a book and web search about the law of cooling.
3. Write down an equation relating the power loss and the rate of temperature drop of the hot water.
4. Design a series of experiments to verify the equation proposed in (3).
5. Carry out a risk assessment to identify the safety precaution(s) needed to be taken.

Assessment:

Your work will be accessed in the following areas.

Design of the experiment (marks to be given in the report)

Design an experiment to find out how the factor(s) affect the rate of temperature drop of hot water.
This part should be submitted before the experiment. Comments will be given and your revised plan should be included in the report.

Implementation

1. Implementation of action plan with understanding
2. Proper use of apparatus
3. Proper experimental skills
4. Group work and time management
5. Ability to deal with problems encountered independently.

Questions may be asked during the experiment to verify understanding.

Report

1. Theory
2. Experiment Design and Procedure
3. Apparatus

} is required to submit one set only

4. Data presentation and graph plotting
5. Analysis and conclusion drawn according to experimental results
6. Record of reference materials

} **Individual** work. To be attached to the end of group work.

Record format for reference materials if any

Book / Website : _____ Author : _____ Publisher / Organisation : _____ Year : _____ Reading / Browsing Date : _____ Time spent on studying the information : _____
Relevant information:

Work Schedule:

6 Nov 2010	Submission of Experiment Design
13 Nov 2010	Trial/Preliminary experiment
20 Nov 2010	Experiment
27 Nov 2010	Submission of Report

Investigative Study - To study the factors affecting friction

Task outline:

In this investigation, you are going to find the factors affecting friction and design experiments to show their relationships. You should collaborate with your group-mates to complete the task. You should apply your knowledge and skills in Physics to solve the problems and draw conclusions based on the results obtained.

The investigation is divided into five stages.

1. Searching for and defining questions for investigation
2. Developing an investigation plan
3. Conducting the investigation
4. Organising and analysing data for a justified conclusion
5. Presenting the investigation findings with a written report, posters and other means

Apparatus:

The following apparatus and materials will be provided:

- Wooden block
- Drawing board
- Spring balance
- Weights and nuts
- Electronic balance
- Spirit level
- Fine brush

Students are recommended to propose other apparatus and materials that may be useful.

Discussion:

1. Propose the factors that can affect friction. Are these factors changeable in the experiment ? Identify the independent variables, dependent variables and control variables in your experiment.
2. Carry out a book and web search. Collect more information about friction.
3. Design a series of experiments in which you can check your hypotheses.
4. Carefully examine the feasibility and validity of your experiments.
5. Carry out a risk assessment to identify the safety precaution(s) needed to be taken.

Assessment:

Your work will be accessed in the following areas.

Design of the experiment (marks to be given in the report)

1. Hypothesis and experiment design
2. Dependent, independent and control variables

This part should be submitted before the experiment. Comments will be given and your revised plan should be included in the report.

Implementation

1. Implementation of action plan with understanding
2. Proper use of apparatus
3. Proper experimental skills
4. Group work and time management
5. Ability to deal with problems encountered independently.

Questions may be asked during the experiment to verify understanding.

Report

1. Theory
2. Experiment Design and Procedure
3. Apparatus

} Draft should be submitted before the experiment. Each **group** is required to submit one set only

4. Data presentation and graph plotting
5. Analysis and conclusion drawn according to experimental results
6. Record of reference materials

} attached to the end of group work.

Record format for reference materials

Book / Website : _____ Author : _____ Publisher / Organisation : _____ Year : _____ Reading / Browsing Date : _____ Time spent on studying the information : _____
Relevant information:

Work Schedule:

13 Sep 2010	Submission of Experiment Design
21 Sep 2010	Trial/Preliminary experiment
28 Sep 2010	Experiment
4 Oct 2010	Submission of Report

Investigative Study - To study the factors affecting terminal velocity

Task outline:

In this investigation, you are required to *find the factors affecting the terminal velocity of a falling sphere in water* and design experiments to *show their relationships*. You should collaborate with your group-mates to complete the task. You should apply your knowledge and skills in Physics to solve the problems and draw conclusions based on the results obtained.

The investigation is divided into five stages.

1. Searching for and defining questions for investigation
2. Developing an investigation plan
3. Conducting the investigation
4. Organising and analysing data for a justified conclusion
5. Presenting the investigation findings with a written report, posters and other means

Apparatus:

The following apparatus and materials will be provided:

- A plastic hollow tube of 5 cm diameter and 2 m long
- Hollow sphere(s) of 1.5 cm diameter
- Small metal spheres
- Stop watch
- Metre rule

Students are recommended to propose other apparatus and materials that may be useful.

Discussion:

1. Propose the factors that can affect terminal velocity. Are these factors changeable in the experiment? Identify the independent variables, dependent variables and control variables in your experiment.
2. Carry out a book and web search. Collect more information about terminal velocity.
3. Design a series of experiments in which you can check your hypotheses.
4. Carefully examine the feasibility and validity of your experiments.
5. Carry out a risk assessment to identify the safety precaution(s) needed to be taken.

Assessment:

Your work will be assessed in the following areas.

Design of the experiment (marks to be given in the report)

1. Hypothesis and experiment design
2. Dependent, independent and control variables

This part should be submitted before the experiment. Comments will be given and your revised plan should be included in the report.

Implementation

1. Implementation of action plan with understanding
2. Proper use of apparatus
3. Proper experimental skills
4. Group work and time management
5. Ability to deal with problems encountered independently.

Questions may be asked during the experiment to verify understanding.

Report

1. Theory
2. Experiment Design and Procedure
3. Apparatus

} **group** is required to submit one set only

4. Data presentation and graph plotting
5. Analysis and conclusion drawn according to experimental results
6. Record of reference materials

} **Individual** work. To be attached to the end of group work.

Record format for reference materials if any

Book / Website : _____
Author : _____ Publisher / Organisation : _____ Year : _____
Reading / Browsing Date : _____ Time spent on studying the information : _____
Relevant information:

Work Schedule:

13 Sep 2010	Submission of Experiment Design
21 Sep 2010	Trial/Preliminary experiment
28 Sep 2010	Experiment
4 Oct 2010	Submission of Report

Investigative Study - To study the factors affecting the range of a projectile

Task outline:

Prior knowledge of projectile motion is required.

In this investigation, you are going to make an air table or other apparatus suitable for studying projectile motion and design experiments to show that the range of projection of an object is proportional to v^2 and $\sin(2\theta)$ of the projection . You should collaborate with your group-mates to complete the task. You should apply your knowledge and skills in Physics to solve the problems and draw conclusions based on the results obtained.

The investigation is divided into five stages.

1. Searching for and defining questions for investigation
2. Developing an investigation plan
3. Conducting the investigation
4. Organising and analysing data for a justified conclusion
5. Presenting the investigation findings with a written report, posters and other means

Apparatus:

The following apparatus and materials will be provided:

- Air blower
- Disc moving on the air table
- Digital video camera
- Metre rule

Students are recommended to propose other apparatus and materials that may be useful.

Discussion:

1. Propose the factors that can affect the range of a projectile. Are these factors changeable in the experiment ? Identify the independent variables, dependent variables and control variables in your experiment.
2. Carry out a book and web search. Collect more information about projectile motion.
3. Design a series of experiments in which you can check your hypotheses.
4. Carefully examine the feasibility and validity of your experiments.
5. Carry out a risk assessment to identify the safety precaution(s) needed to be taken.

Assessment:

Your work will be assessed in the following areas.

Design of the experiment (marks to be given in the report)

1. Make an air table or other apparatus for studying projectile motion
2. Decrease the acceleration of the disc so that slow motion can be demonstrated
3. Make the emitter for the projectile

This part should be submitted before the experiment. Comments will be given and your revised plan should be included in the report.

Implementation

1. Implementation of action plan with understanding
2. Proper use of apparatus
3. Proper experimental skills
4. Group work and time management
5. Ability to deal with problems encountered independently.

Questions may be asked during the experiment to verify understanding.

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Work Schedule:

6 Nov 2010	Submission of Experiment Design
13 Nov 2010	Trial/Preliminary experiment
20 Nov 2010	Experiment
27 Nov 2010	Submission of Report

Investigative Study – To study the factors affecting the strength of an electromagnet

Task outline:

In this investigation, you are going to find the factors affecting the magnetic force produced by an electromagnet and design experiments to show their relationships. You should collaborate with your group-mates to complete the task. You should apply your knowledge and skills in Physics to solve the problems and draw conclusions based on the results obtained.

The investigation is divided into five stages.

1. Searching for and defining questions for investigation
2. Developing an investigation plan
3. Conducting the investigation
4. Organising and analysing data for a justified conclusion
5. Presenting the investigation findings with a written report, posters and other means

Apparatus:

- Soft iron C-core
- Iron plate
- Wrapping wire
- Low voltage power supply
- Ammeter
- Rheostat
- Switch
- G-clamps and wooden blocks
- Stand
- Pulley and strings
- Weights
- Connecting wires
- Polystyrene board

Students are recommended to propose other apparatus and materials that may be useful.

Discussion:

1. Propose the factors that can affect the magnetic force of an electromagnet. Are these factors changeable in the experiment? Identify the independent variables, dependent variables and control variables in your experiment.
2. Carry out a book and web search. Collect more information about electromagnets.
3. Design a series of experiments in which you can check your hypotheses.
4. Carefully examine the feasibility and validity of your experiments.
5. Carry out a risk assessment to identify the safety precaution(s) needed to be taken.

Assessment:

Your work will be assessed in the following areas.

Design of the experiment (marks to be given in the report)

1. Hypothesis and experiment design
2. Dependent, independent and control variables

This part should be submitted before the experiment. Comments will be given and your revised plan should be included in the report.

Implementation

1. Implementation of action plan with understanding
2. Proper use of apparatus
3. Proper experimental skills
4. Group work and time management
5. Ability to deal with problems encountered independently.

Questions may be asked during the experiment to verify understanding.

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