Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2023

Physics

Unit 3: Practical Skills

Booklet A

Foundation Tier

GPY31

[GPY31]

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is **30**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Follow all health and safety instructions.
You may use a ruler and calculator if required.
The apparatus and materials required to complete the task(s) are provided.

FOR TEACHER USE ONLY

In Experiment 2, it is assumed that the candidate was given help to complete the circuit. If this is **not** the case please tick the box below.

No help was given ☐

Examiner's use only	Marks
Experiment 1	
Experiment 2	
Total Marks	

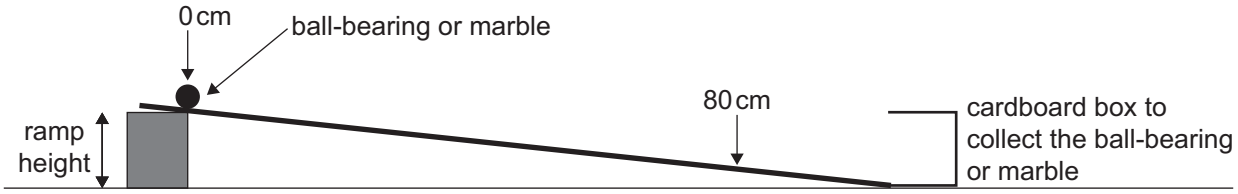
Experiment 1 Motion down a ramp

Introduction
In this experiment you will investigate how the motion of a ball-bearing or marble down a ramp is affected by the ramp height.

Aim
The aim of the experiment is to measure the time it takes a ball-bearing or marble to travel from rest, a measured distance down the ramp. You will repeat this process for a number of different ramp heights from 1 cm to 5 cm.

You will calculate the **average speed** of the ball-bearing or marble as it moves a distance of 80 cm down the ramp.

Apparatus



The apparatus shown in the diagram above has been set up for you.
The ramp has two lines marked on it which are **80 cm apart**.
A wooden block has been placed under the ramp.

During (a)(i) to (iii) you may work on your own or as part of a group of two or three.

Examiner Only	
Marks	Remark

Procedure

(a) (i) A wooden block marked 1 cm has been placed under the ramp, as shown in the diagram.
Release the ball-bearing or marble from rest at the position on the ramp marked 0 cm, and record the time it takes the ball-bearing or marble to reach the 80 cm mark.
Record this time to **one decimal place** in column 1 of Table 1.

Repeat this process twice more so that you have three values of the time.
Record all these values to **one decimal place** in columns 2 and 3 of Table 1.
Add appropriate headings with units to columns 1, 2 and 3 of Table 1. [2]

(ii) Remove the block marked 1 cm and replace it with the one marked 2 cm.
Release the ball-bearing or marble from rest at the position on the ramp marked 0 cm, and record the time it takes the ball-bearing or marble to reach the 80 cm mark.
Record this time to **one decimal place** in Table 1.
Repeat this process twice more so that you have three values of the time.
Record all these values to **one decimal place** in Table 1. [1]

(iii) Repeat this process for ramp heights of 3 cm, 4 cm and 5 cm.
Record your values in Table 1 **to one decimal place**. [2]

Table 1

	Column 1	Column 2	Column 3
Ramp height/cm			
1			
2			
3			
4			
5			

Insert heading

When you have taken all your measurements or when your teacher tells you that 30 minutes are up you must stop using the apparatus.

To complete the remainder of this assessment you must work alone.
Your teacher will direct you to a place in the room to do this.

For the remainder of Experiment 1 you must work alone.

Examiner Only	
Marks	Remark

Analysis of your data

The analysis of your data will involve calculating the average time it takes for the ball-bearing or marble to travel 80 cm down the ramp.

You will then use this average time to calculate the average speed of the ball-bearing or marble as it travels 80 cm down the ramp.

(b) (i) Using your values in Table 1, calculate the average time for the ball-bearing or marble to travel down the ramp for each ramp height.
You may use the space below for calculations.
Record your values to **one decimal place** in column 4 of Table 2. [2]

Space for calculation of average times.

(ii) Using your average time values, calculate the average speed of the ball-bearing or marble for each ramp height. Give your values in cm/s.
Write the equation you plan to use in the box below. [1]

Record your calculated average speed in column 5 of Table 2 to **one decimal place**.
Remember the distance the ball-bearing or marble travels down the ramp is 80 cm.
You may use the space on the opposite page for calculations. [1]

Space for calculations.

Table 2

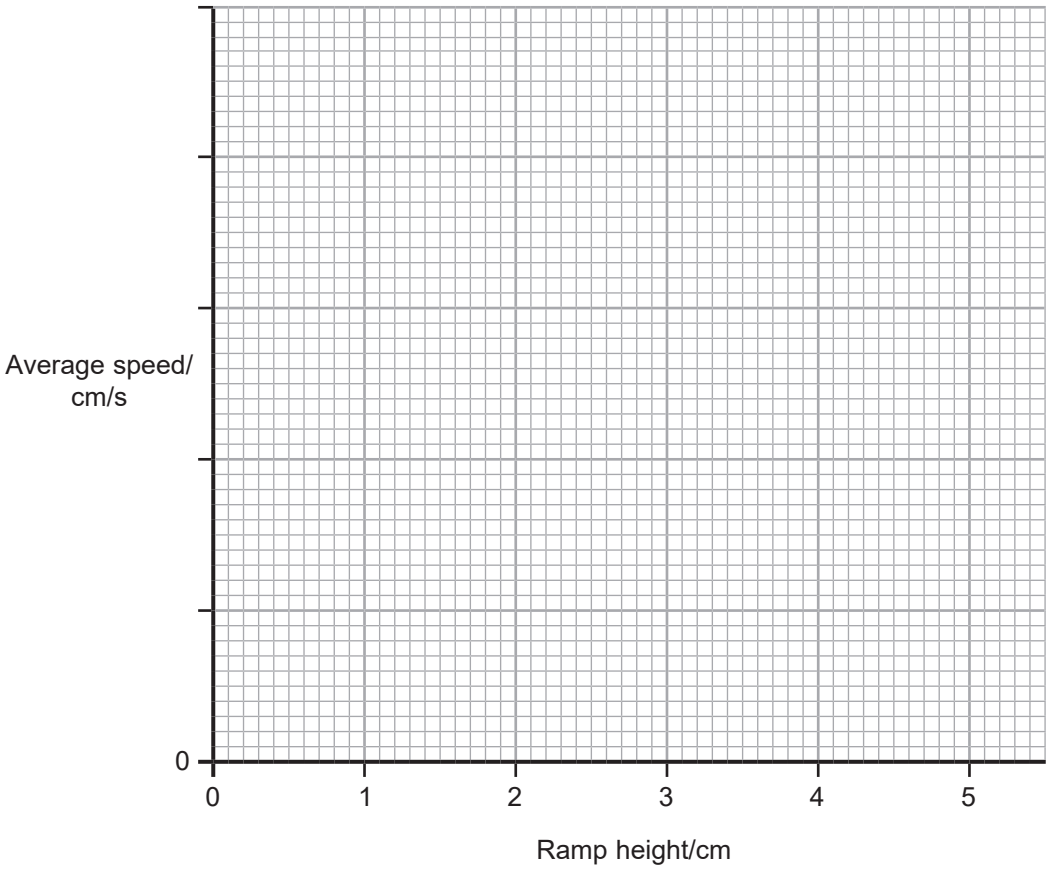
	Column 4	Column 5
Ramp height/cm	Average time/s	Average speed/ cm/s
1		
2		
3		
4		
5		

Interpretation of your data

Examiner Only	
Marks	Remark

(c) (i) Use the grid below to plot a graph of the average speed of the ball-bearing or marble against the height of the ramp.
Use ◉ or ✕ to indicate your plotted values. [3]

(ii) Draw the best fit **curve** through your points. [1]



(iii) Is the average speed of the ball-bearing or marble proportional to the ramp height?

Circle your answer. **YES** **NO**

Explain your answer.

_____

_____ [2]

Experiment 2 Voltage – Current (V – I) Graph

Introduction

The current passing through a length of wire depends on the voltage applied across the wire.

Aim

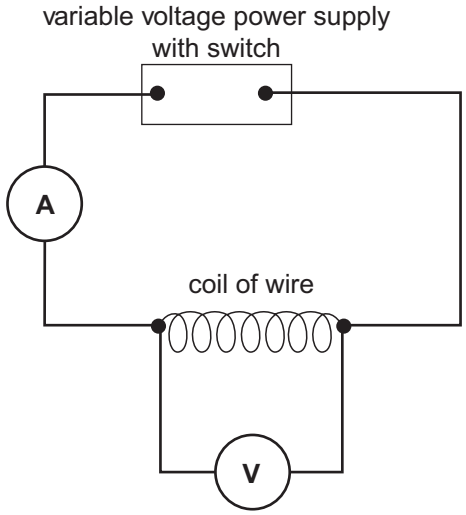
The aim of the experiment is to obtain voltage and current measurements for a coil of wire at **constant temperature**.
You will use the voltage and current measurements to plot a V – I graph.

Procedure

Examiner Only	
Marks	Remark

During (a)(i) to (iii) you may work on your own or as part of a group of two or three.

(a) (i) Complete the circuit according to the circuit diagram below by adding the ammeter.
Before proceeding have your teacher check your circuit. [1]



Caution: Do not touch the coil of wire, it could be very hot

(ii) Use this experiment to obtain **voltage** and **current** measurements for the coil of wire at constant temperature.
Add column headings with units to column 1 and column 2 to the table opposite. [1]

(iii) Close the switch.
Adjust the output of the power supply to a voltage of approximately 1.00 V.
Measure the voltage and current and record your measurements in the table opposite.
Record your values of voltage and current to **2 decimal places**.
Open the switch after you record each measurement of voltage and current, to allow the coil of wire to cool.

Increase the voltage in steps of approximately 1.00 V until you have a total of 5 sets of voltage and current measurements.
Do not exceed 6.00 V.
Switch off the power supply when you have recorded all your measurements. [3]

Results

Column 1	Column 2

Insert column headings with units

When you have taken all your measurements or when your teacher tells you that 30 minutes are up, you must stop using the apparatus.

To complete the remainder of this assessment you must work alone.
Your teacher will direct you to a place in the room to do this.

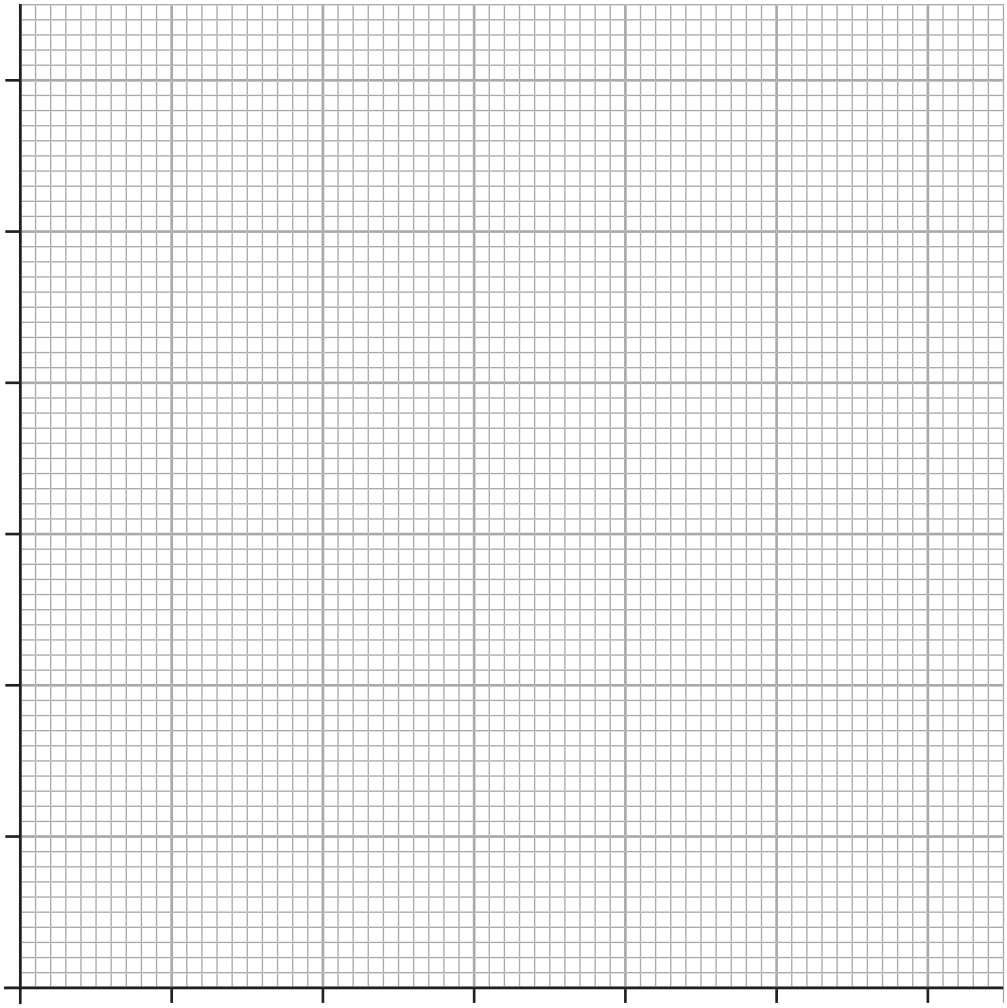
For the remainder of Experiment 2 you must work alone.

Examiner Only	
Marks	Remark

Analysis

(b) (i) On the grid below, use your measurements to plot a graph of voltage – current (V – I) for the coil.
Use the y-axis for the voltage and the x-axis for the current.
Make sure you label the x-axis and y-axis with the quantities and their units.
Use ⊙ or X to show your plotted values. [4]

(ii) Draw a **best fit straight line** through your points. [1]



(c) (i) In this experiment the relationship between the voltage V and the current I is given by the equation below. In this equation K is a constant.

$$V = KI$$

Does your graph agree with this equation? Circle your answer.

YES **NO**

Explain your answer.

_____

_____

_____ [1]

(ii) How would you use the graph to find the value of K?

_____ [1]

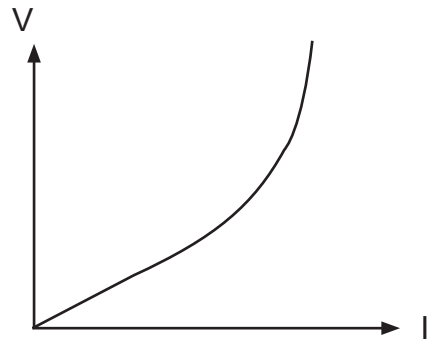
(iii) Calculate the value of K and state its units.
Show clearly how you get your answer.

K = _____

Units of K = _____ [2]

Examiner Only	
Marks	Remark

Another group of students carried out the same experiment as the one you have just completed. When the results were plotted, the graph shown below was obtained.



(iv) What precaution did these students **not** take when carrying out the experiment?

_____

_____

_____ [1]

THIS IS THE END OF THE QUESTION PAPER

Examiner Only	
Marks	Remark

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Physics

Unit 3A: Practical Skills

Booklet A

Foundation Tier

[GPY31]

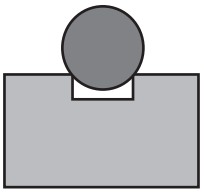
APPARATUS AND MATERIALS LIST AND CONFIDENTIAL INSTRUCTIONS

To be accessed by Head of Department only

It is the responsibility of the centre to ensure that appropriate risk assessments are carried out for all practical skills assessments.

Experiment 1 Equipment and Confidential Instructions

Apparatus and Materials List



Rigid ramp at least 1.0 m long with a groove that the ball-bearing or marble will roll down, e.g. a wooden lath with a groove cut into it would be suitable.

One ball-bearing of a size that will allow it to run smoothly down the ramp.

Stop clock or stopwatch that reads to one decimal place.

5 wooden blocks of heights 1 cm, 2 cm, 3 cm 4 cm and 5 cm.

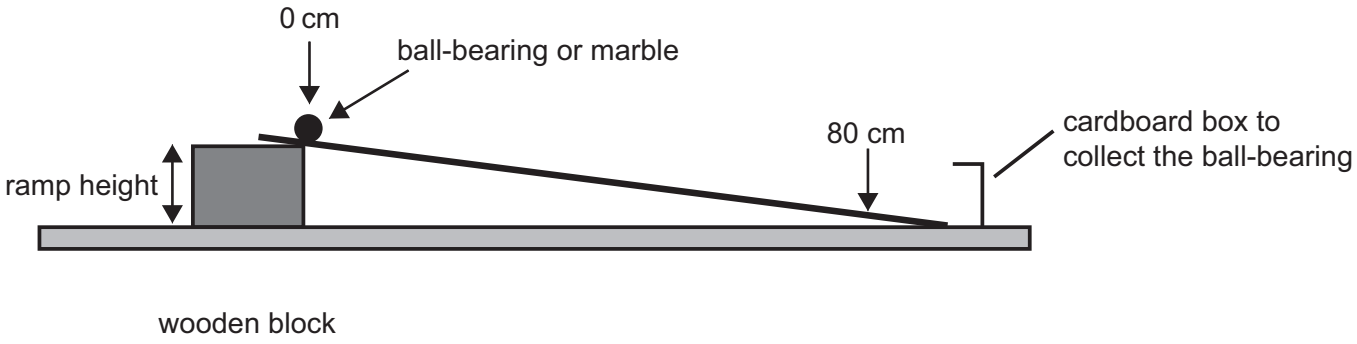
The heights should be marked on the blocks.

Safety glasses if considered appropriate.

Cardboard box to collect the ball-bearing or marble

Instructions to the teacher

The apparatus shown below should be set up prior to the student using it.
The wooden block of height 1 cm to be placed under the ramp as shown.
The other blocks to be left near the apparatus.



Lines 80 cm apart should be added to the ramp, label them 0 cm and 80 cm.

Supervision of the Practical Skills Assessment

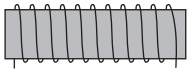
Up to 30 minutes collecting results, with the students working individually or collectively in a group of maximum size three.

Then 30 minutes with all students working individually under full examination conditions with a high level of control to complete the booklet.

Experiment 2 Voltage – Current (V – I) Graph

Apparatus and Materials List

Switch
A variable power supply set so that voltages greater than 6 V are not possible.
If you plan to use a stepped power supply ensure candidates can obtain 5 values of voltage.
Ammeter (digital capable of measuring 0 – 2 A and reading to two decimal places).
Voltmeter (digital capable of measuring 0 – 6 V and reading to two decimal places).
100 cm of 28 SWG Nichrome wire (approx. 10 Ω) wound into a coil
on a wooden dowel or similar. Use tape to ensure coil does not become loose.

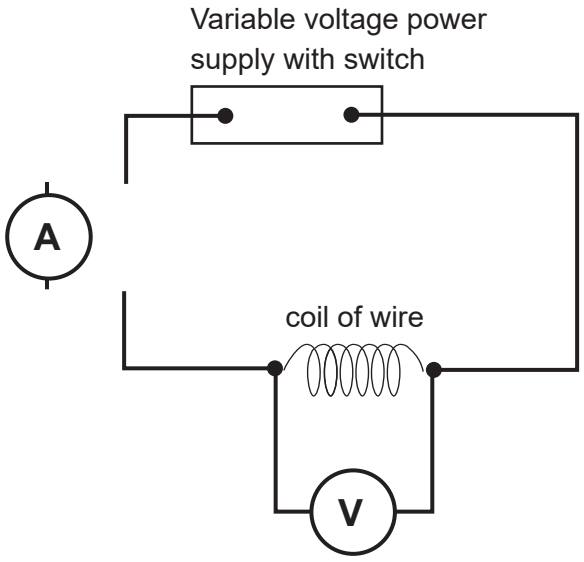


Stackable connecting leads.
Crocodile clips if required.
Safety glasses, if considered appropriate.

Instructions to the teacher

The partial circuit shown below should be set up by the teacher.
A gap to be left for the ammeter.
Ensure the voltage of the power supply does not exceed 6 V.
At change over switch off and remove the ammeter.

Place a warning notice beside the circuit stating
Caution: Do not touch the coil of wire it could be very hot.



Supervision of the Practical Skills Assessment

Up to 30 minutes collecting results, with the students working individually or collectively in a group of maximum size three.

Then 30 minutes with all students working individually under full examination conditions with a high level of control to complete the booklet.