Mission Heights
JUNIOR COLLEGE

Planning

Consider the key variables involved in this experiment.

Write down:

- the independent variable (the variable that is to be changed)
- the dependent variable (the variable that is to be measured)
- how you will control any other variables (significant or relevant variables that will need to be kept the same to make your results more reliable)
- decide and record any techniques you will use to make your results more accurate and/or reliable

Gathering information:

Set up the equipment provided by your teacher and carry out the experiment.

Record:

- ❏ your data, with units
- ❏ any modifications you make to your planning
- ❏ any issues or difficulties you encounter while gathering the data and how you try to deal with them. These difficulties should not relate to mistakes you may make when setting up or using the equipment. If you make such mistakes, just fix them and carry on.

Analysing data

Prepare your data as necessary to draw an appropriate graph, with appropriate axes and plot the data using the computer. Make sure your axes are labelled with the variable name and the units.

Draw a line of best fit on your graph and calculate its gradient.

Using information from the graph, state the equation of the relationship between the independent and dependent variables.

Producing a report

Compile the information you have recorded into a report and use this as a checklist before handing in your assessment

Tick as you complete each of the following:

- ❏ the **aim** of the investigation
- ❏ the **variables** (independent, dependent and controlled)
- ❏ how I will ensure the **results** are **accurate and reliable**
- ❏ the **method** you used to gather the data
- ❏ any **changes** made to the method during the trialling phase
- ❏ the **results you obtain in a table** and any processing that you might have done
- ❏ the **graph** you drew on the computer and any working used to calculate the gradient
- ❏ a **conclusion** based on your data. Your conclusion could include:
  - ❏ an explanation of the equation that you found,
  - ❏ an example of the equation being used,
  - ❏ the relationship that the graph line has established
- ❏ a **discussion** that validates your conclusion. Your discussion **must include at least 2** from the following list **in detail**.
  - ❏ accuracy improvements – what you did to make your measurements as accurate as possible
  - ❏ how you made your experiment more reliable
  - ❏ reasons(s) for your choice of the range of values for the independent variable (for example, why the range for the independent variable had an upper and lower limit)
  - ❏ for each controlled variable, a reason why control was necessary

- ❏ a description of any difficulties you had when making measurements and what you did to try to overcome these difficulties
- ❏ a description of any unexpected issue that arose when processing the data and how you dealt with the issue
- ❏ a link between your findings and relevant principles of physics

Aim of the investigation:

The aim of this investigation is to find the relationship between the release height of the marble and its stopping distance (Cm)

Independent variable:

What variable are you changing?

The independent variable in this investigation is the release height of the car.

How will you change the variable?

The independent variable will be changed by releasing the car from the ramp at different heights above the ground.

Give a suitable range of values for this variable.

A suitable range of values for this variable is 2blocks, 3 blocks, 4blocks and 5 blocks

Dependent variable:

Which variable are you measuring?

The dependent variable will be measured using a measuring tape from the end of the ramp/ruler to the back of the marble in its final resting position.

How are you measuring the variable?

The readings will be taken from directly above the marble (e.g. at 90 degrees to the measuring tape). The distance will be measured in cm.

Controls: List the other variables you will keep the same to make your results more accurate and to make this a fair test.

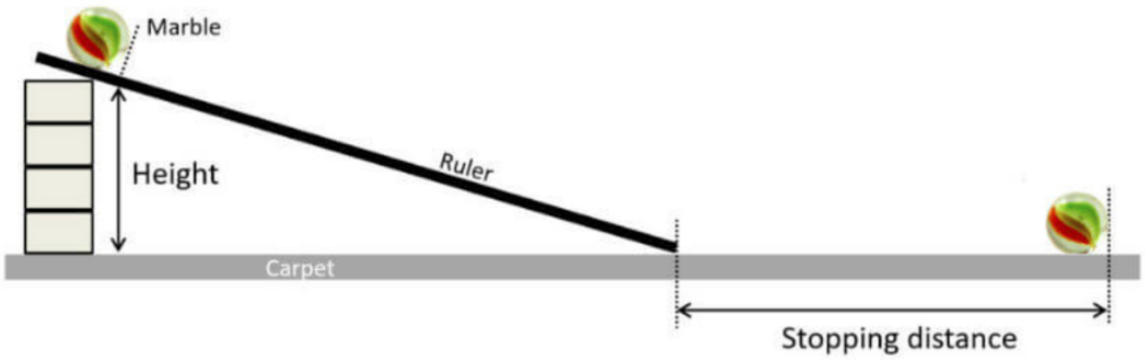
Control variables	Describe how this will be controlled or kept the same
Same car	The same car will be used throughout the experiment as different cars may vary in mass or surface imperfections.
Same surface	Use the same floor in every trial to ensure that any differences observed are not due to changes in friction.
Same Equipment	Use the same ruler, measuring tape etc to avoid any errors in measurement.

Same method of release	Release the car with no force. As difference in release force can alter the measurements.

How will you ensure that your results are accurate and/or reliable?

(How are you going to mitigate the 4 sources of error??)

Method: Use the space below to write a detailed step-by-step method for your investigation. This must be detailed enough that it could be followed by another student.



1. Set up the equipment as shown in the diagram.

2. Place the toy car at a desired release height of 2 blocks.

3. Release the car down the ramp.

4. Allow the car to come to a complete stop.

5. Measure from the end of the ramp/ruler to the front of the car.

6. Repeat this process three more times and record the data each time.

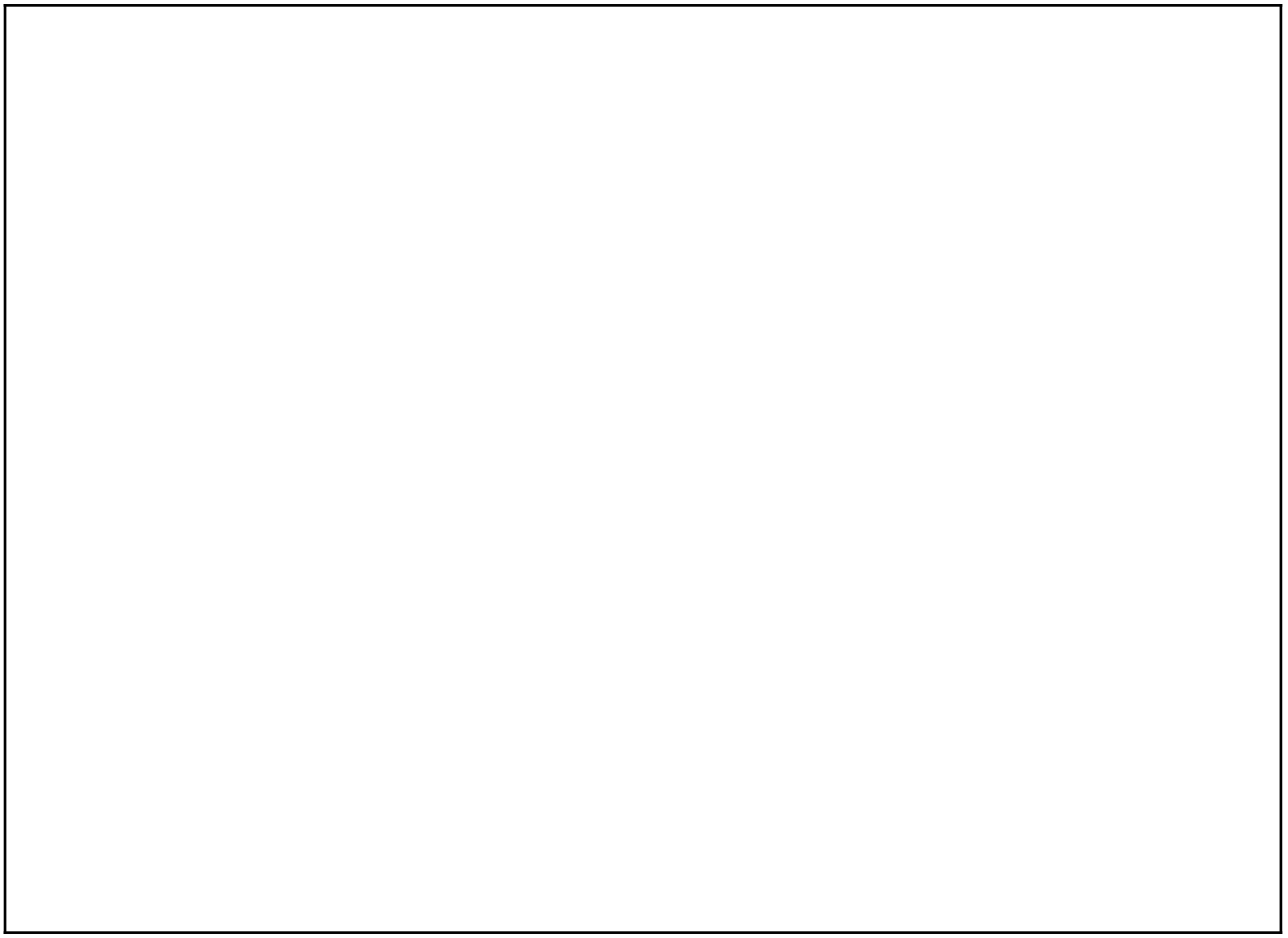
7. Repeat steps 2–6 with the following release heights: 3 blocks, 4blocks and 5 blocks.

Note any changes in this space that you made to your method as you trialled it and record why these changes were necessary.

Results:
Use the space below to record your data in an appropriate **table** with **headings** and **units** and then process it appropriately. This will usually involve some calculations (e.g. averages)

Table title:

No : of blocks	Distance travelled by car (Cm)					
	Trial 1	Trial 2	Trial 4	Trial 4	Trial 5	Average time
2						
3						
4						
5						



Session 3: COMPUTER WORK

USE THIS PAGE FOR PLANNING

- If you use additional paper for planning, please write your name on it and hand in with this booklet
- All computer work must be on Google Docs
- A PDF of you computer work MUST be uploaded onto MHOL by the end of session AND PRINTED

Graph:
Using the **computer,** create a graph using your collected data. Ensure it has a title and that your x and y axis are appropriately labelled and include units. Compute and add the line of best fit to your graph and the equation. Please **print** out your graph, put your name on it and hand it in with this booklet.

Analysis: (Plan only and complete this on the computer)
State the equation of the line of best fit and the relationship between your independent and dependent variables.

The aim of this experiment is to find if there is a relationship between the release height of the marble and the stopping distance. From the above graph you can see that there is a positive linear relationship between the independent variable which is the release height of the car and the dependent variable which is the stopping distance. This means that as the release height of the car increases so does the distance at which the car stops.
The equation for the graph is (Insert your equation) . This means that Y which is the

As all the points are on a straight line it shows a strong relationship between the release height and the stopping distance of the marble.

Discussion: (Validating your conclusion. Plan only and complete this on the computer)
Write a justification of your conclusion in terms of the processed data and the purpose of investigation. How did you ensure your experiment was valid?

When the marble was placed on the ruler it possessed gravitational potential energy (GPE). When it was released this GPE was transformed into kinetic energy (KE) as it started to roll down the ramp. When the marble reached the end of the ramp all of the GPE had been transformed into KE. As the marble rolled along the carpet the KE was transformed into heat and sound energy due to friction with the carpet and the air. Eventually, all of the KE has been lost and the marble stopped moving. As the release height increased the amount of GPE also increased causing the marble to have greater KE at the bottom of the ramp and a larger stopping distance.

Since the data is all consistent with no outliers, it shows that all the variables were tightly controlled. However the following are the factors that could have affected the experiment

- • By repeating the experiment at least three times and averaging the results.
- • By making measurements using the ruler at eye level to reduce parallax error.
- • By defining the start and end points for measurements so that they remain consistent in each reading.
- • By aligning the zero of the ruler to the starting point for the measurement to reduce zero errors.
- • By ensuring that the marble has completely stopped moving before taking the measurement for its stopping distance.