

Science Investigation Planning Sheet

Aim (what you are trying to find out):

Independent Variable (the variable that you change or select the values for):

Dependent Variable (the variable that is measured for each change of the independent variable):

Control Variables (variables that could affect the outcome of the experiment and need to be kept constant):

Method

This should include the equipment you are going to use, a step-by-step guide for carrying out the experiment and how you will make sure your results are valid.

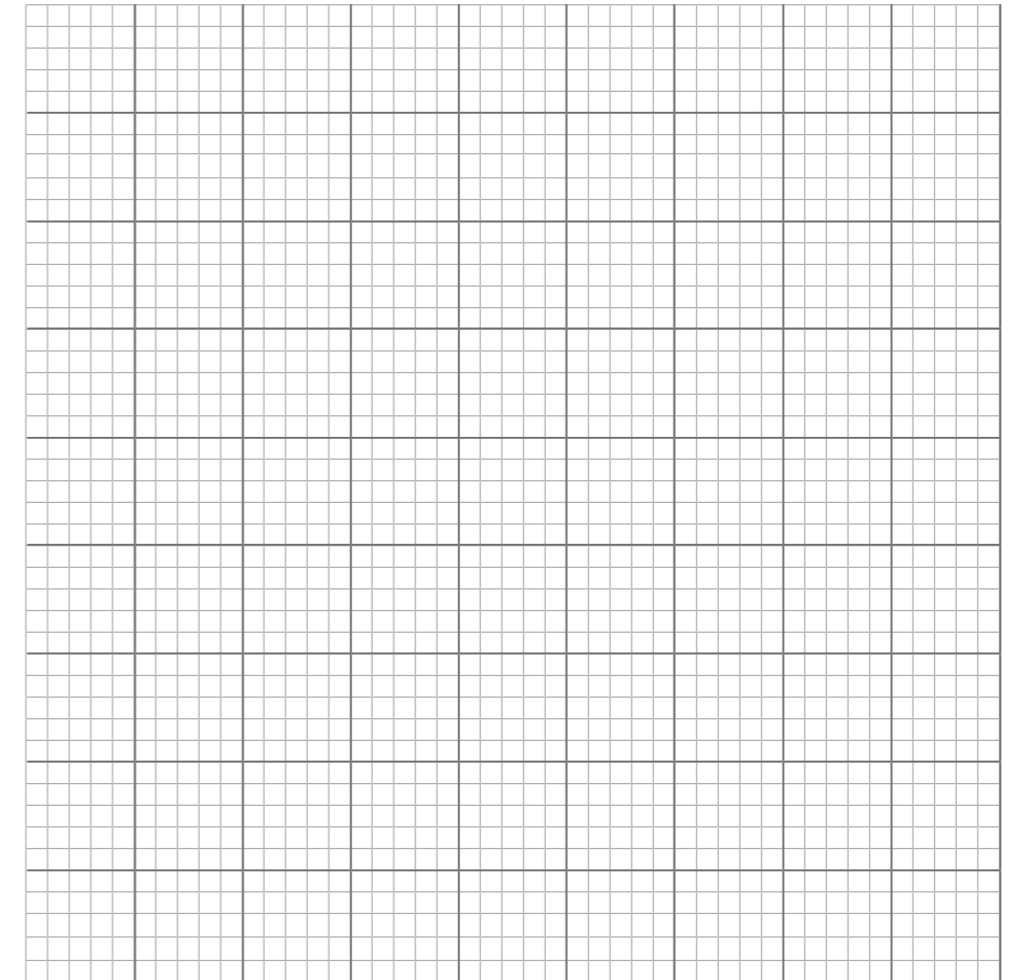
Hazard	Risk	Prevention

Results Table

Draw a table to record your results in the space below.

Displaying Your Results

Draw a graph of your results in the space below.



Conclusion

Explain what you found out in your investigation, including some data to support your explanation.

Evaluation

Consider the quality of your method and how successful you were at collecting valid results.

Science Investigation Planning Sheet

Aim (what you are trying to find out):

Variables

Independent Variable (the variable that you change or select the values for):

Dependent Variable (the variable that is measured for each change of the independent variable):

Control Variables (variables that could affect the outcome of the experiment and need to be kept constant):

Risk Assessment

Hazard	Risk	Prevention

Method

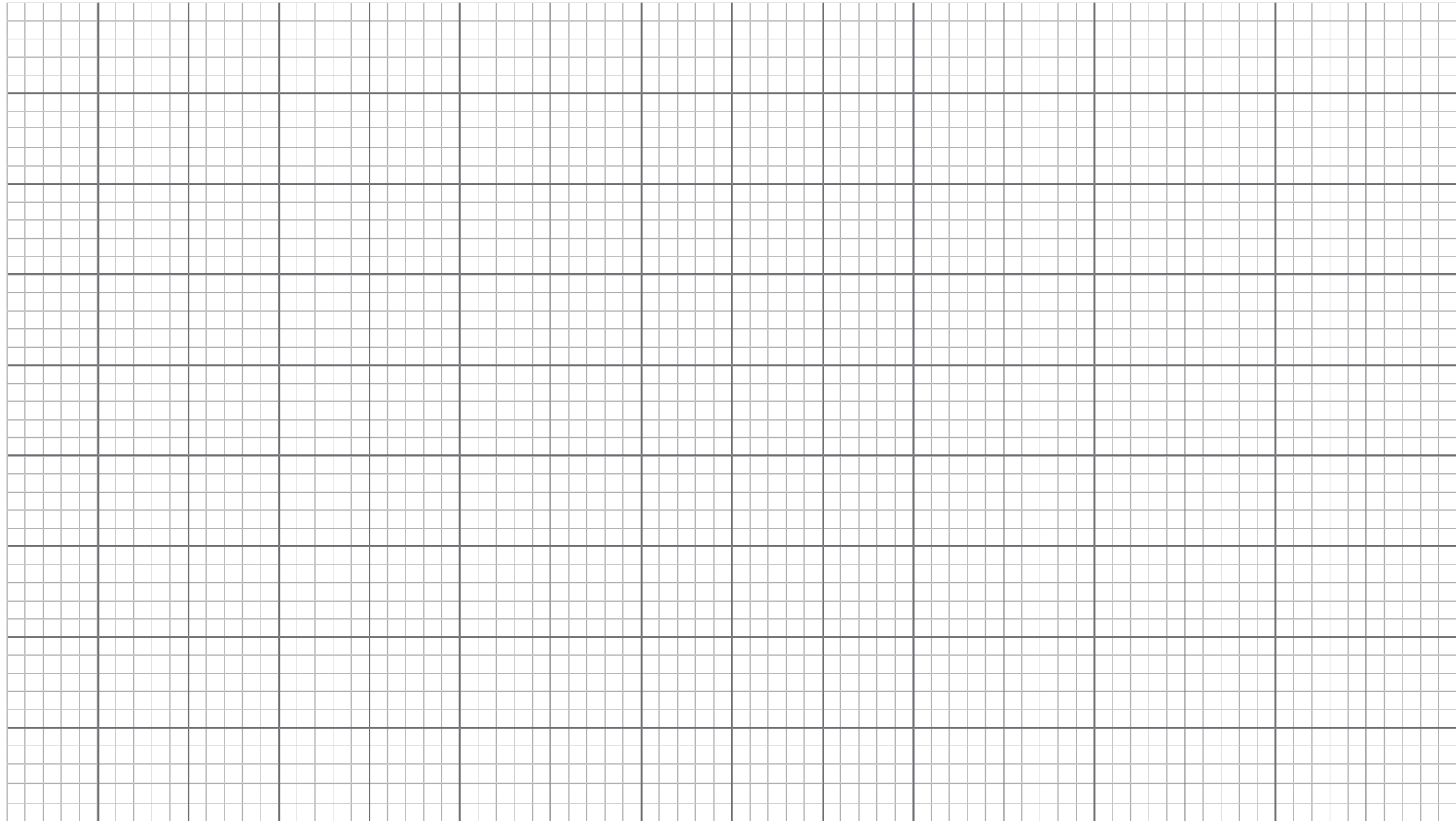
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Marshmallow Investigation



Learning Objective

To investigate the effect of marshmallows on the temperature of hot chocolate over time.

Success Criteria

- **To identify the key variables in an investigation.**
- **To carry out an experiment safely.**
- **To draw a graph representing investigation results.**

What is Physics?

Today we are going to investigate an area of physics.

Which topics below are physics topics? (Hint: there are six.)

electricity

chemical reactions

forces

cells

static

energy

ecology

health

space

diseases

evolution

acids and alkalis

waves

Physics Investigation

Our investigation today is related to energy.

Most objects have energy stores.

The larger an object's energy store, the higher its temperature.

What piece of equipment would you use to measure the temperature of a liquid?

a thermometer

What are the units of temperature?

°C



Hot Chocolate

What will happen to this cup of hot chocolate over time?

It will cool down.

Why does the hot chocolate cool down?

Energy is transferred from the hot chocolate to the surroundings.

As the energy store of the hot chocolate decreases it will become cooler.

Eventually the hot chocolate will be the same temperature as the surroundings.



Marshmallows

Does adding marshmallows keep hot chocolate warmer for longer?

How could you investigate this question?

- **What equipment would you need?**
- **What would your method be?**
- **How would you ensure a fair test?**



Variables

A variable is something which can change in an investigation.

The independent variable is the variable that you change or select the values for.

What is the independent variable in your investigation?

with or without marshmallows



Variables

A variable is something which can change in an investigation.

The dependent variable is the variable that is measured for each change of the independent variable.

What is the dependent variable in your investigation?

the temperature change of the hot chocolate



Variables

A variable is something which can change in an investigation.

A control variable is one that may, in addition to the independent variable, affect the outcome of the investigation and therefore must be kept constant.

When planning the investigation, you need to identify the other variables that might affect the dependent variable and plan how to control them.

Read the next slide and identify the variables.



Method

1. Collect a **small cup/250ml beaker**.
2. Add **1 spoonful of hot chocolate powder**.
3. Add **150ml of boiled water**.
4. Add the marshmallows, place the thermometer into the beaker and start the timer.
5. Wait for **1 minute** (to allow the marshmallows to melt), then measure the temperature.
6. Measure the temperature again after **5 minutes**.
7. Repeat the above steps without the marshmallows.

Identify the control variables in the method above.
(Hint: There are four.)

size of beaker, amount of hot chocolate, volume of water, time when temperature is measured

Why is it important to control each of these variables?

Prediction

What effect, if any, do you think the marshmallows will have on the temperature of the hot chocolate over time?

Why do you think this will happen?



Safety

What safety precautions do you need to take during your investigation?

Wear eye protection.



Do not eat or drink in the laboratory.



Carry out the practical while standing up.

Do not place hot liquids at the edge of the bench.

Remember: tell the teacher immediately if a spill, breakage or injury occurs.

Results Table

Follow the instructions for the investigation and record your results in a table.

	Temperature after 1 Minute (°C)	Temperature after 5 Minutes (°C)	Decrease in Temperature (°C)
With Marshmallows			
Without Marshmallows			

Remember: tell the teacher immediately if a spill, breakage or injury occurs.



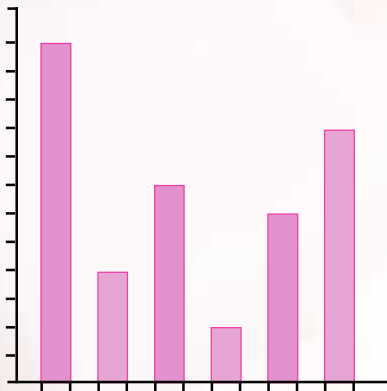
Example Results

	Temperature after 1 Minute (°C)	Temperature after 5 Minutes (°C)	Decrease in Temperature (°C)
With Marshmallows	81	75	6
Without Marshmallows	83	73	10

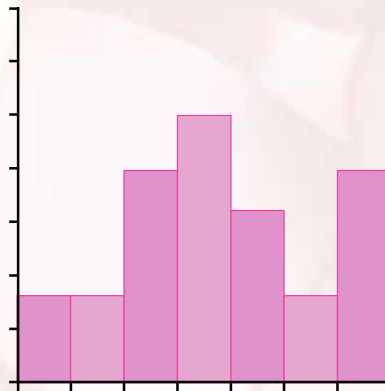
Displaying Your Results

There are different types of graph.

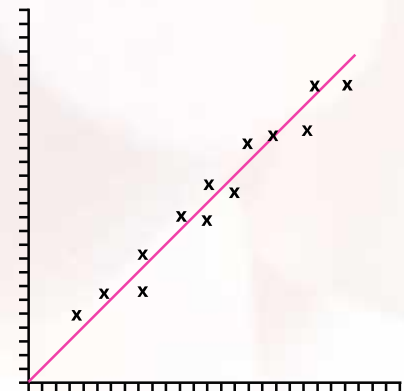
Which one should we use to display our results?



When one of our variables is discrete or categoric (not measured on a continuous scale), we draw a bar chart.



When continuous data (which can have any numerical value) is grouped into categories, we draw a histogram.



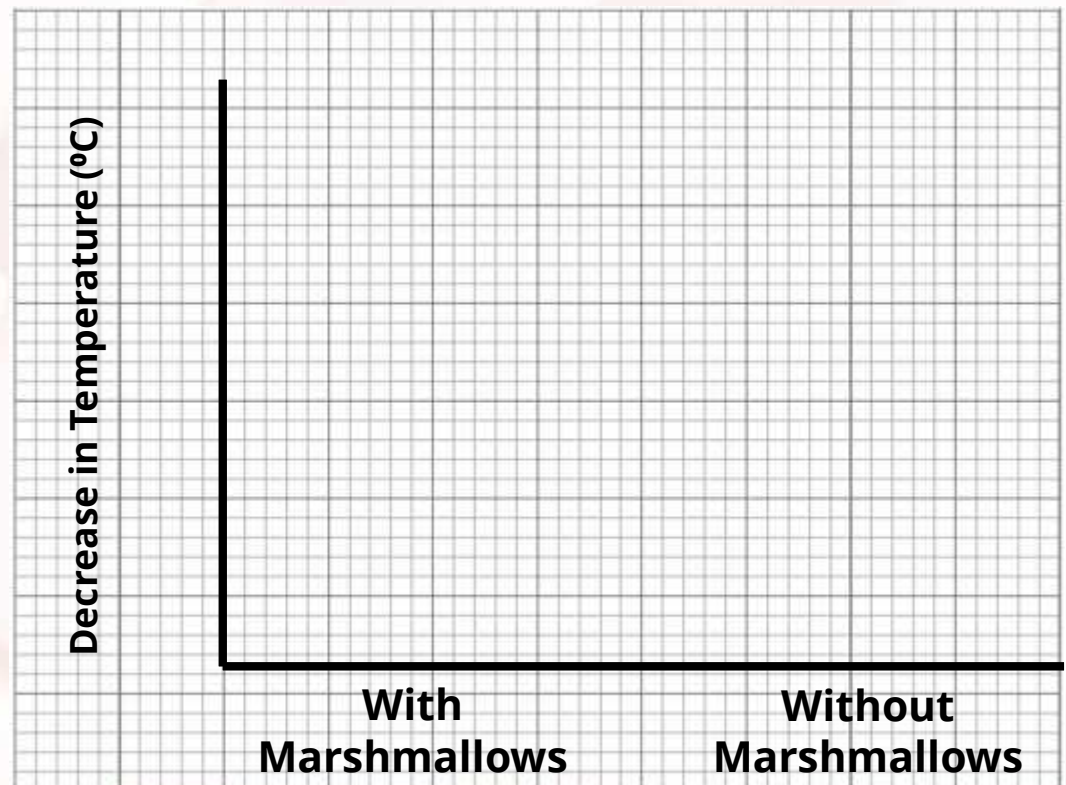
When both variables are continuous (can have any numerical value), we draw a scatter graph.

Drawing a Bar Chart

Draw an x-axis and a y-axis for your graph.

The independent variable is labelled on the x-axis.

The dependent variable is labelled on the y-axis.



	Temperature after 1 Minute (°C)	Temperature after 5 Minutes (°C)	Decrease in Temperature (°C)
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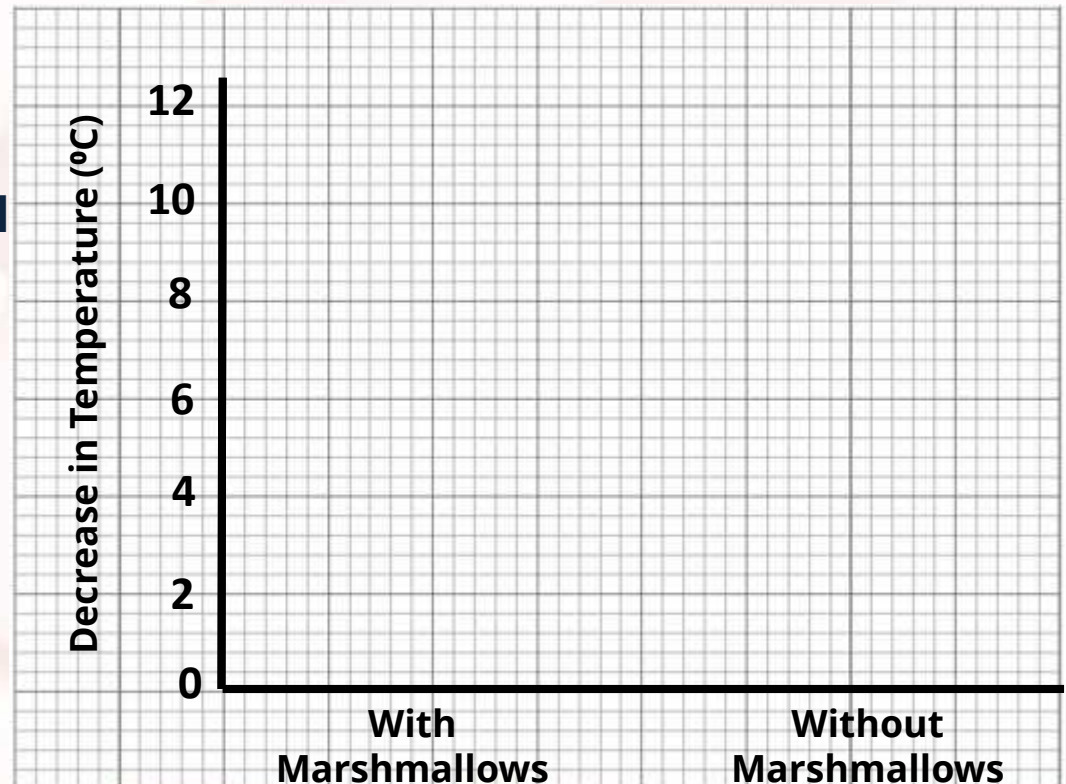
Drawing a Bar Chart

Add a suitable scale to the y-axis.

You must be able to display all of your data on your graph.

In the example results below the largest decrease in temperature is 10.

The y-axis must show this.

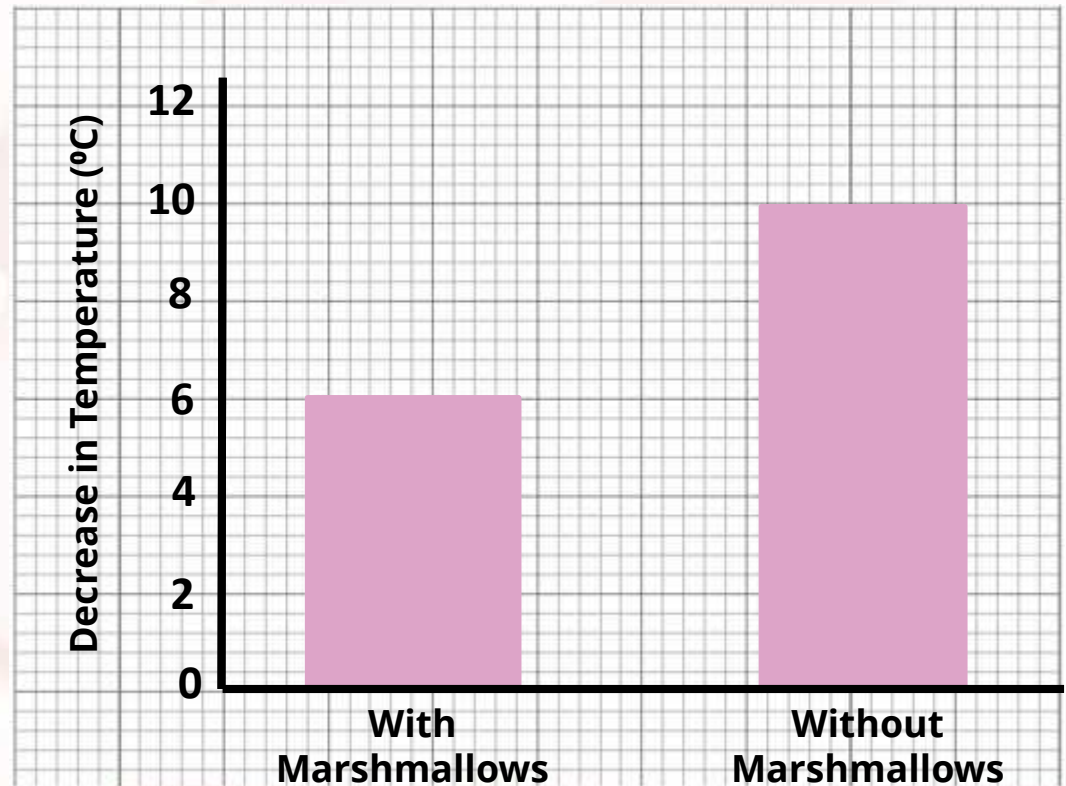


	Temperature after 1 Minute (°C)	Temperature after 5 Minutes (°C)	Decrease in Temperature (°C)
With Marshmallows	81	75	6
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Drawing a Bar Chart

Add a bar to show the decrease in temperature of the hot chocolate with and without marshmallows.

There should be a gap between the bars.



	Temperature after 1 Minute (°C)	Temperature after 5 Minutes (°C)	Decrease in Temperature (°C)
With Marshmallows	81	75	6
Without Marshmallows	83	73	10

Conclusion

A conclusion is an explanation of what you found out in your investigation.

What was the effect of adding marshmallows on the temperature of the hot chocolate over time?

The temperature of the hot chocolate with marshmallows decreased less over time compared to the temperature of the hot chocolate without marshmallows. The hot chocolate with marshmallows stayed warmer for longer.

How do you know this? (Use the data you collected to support the pattern you have identified.)

After five minutes the temperature of the hot chocolate with marshmallows had decreased by 6°C whereas the temperature of the hot chocolate without marshmallows had decreased by 10°C .

Why does this happen?

When the marshmallows melted on the surface of the hot chocolate they created an insulating layer which reduced the transfer of energy

Class Conclusion

Does adding marshmallows keep hot chocolate warmer for longer?

Yes

or

No

Did every group reach the same conclusion?



Plenary

The independent variable in our investigation was....
with or without marshmallows

Plenary

The dependent variable in our investigation was....
the change in temperature over time

Plenary

The control variables in our investigation were....

the size of the beaker

the amount of hot chocolate

the volume of water

the time after which we measured the temperature

Plenary

Which variable goes on the x-axis of a graph?
the independent variable

Plenary

Which type of graph should we use to display discrete or categorical variables?

a bar chart





Marshmallow Investigation Teaching Ideas

Learning Objective:

To investigate the effect of marshmallows on the temperature of hot chocolate over time.

Success Criteria:

- To identify the key variables in an investigation.
- To carry out an experiment safely.
- To draw a graph representing investigation results.

Context

This lesson is part of the Introduction to Science unit of work for year 7. This lesson introduces students to investigative skills, including identifying variables, recording measurements, representing data in a graph and drawing conclusions from data. These skills are developed while investigating the effect of marshmallows on the rate of cooling of hot chocolate.

Although the focus of this lesson is investigative skills the context involves some discussion relating to energy. This can be a challenging topic for key stage three students due to its abstract nature. You may find our [Teaching Guide: Energy](#) helpful.

Resources

per group:

250ml beaker, spoon, thermometer, timer, instant hot chocolate powder, marshmallows, hot water (a kettle), mini whiteboards and pens (optional)

Starter

Physics Investigation

From the twelve topics listed on the [PowerPoint](#), can students identify the six physics topics? Students could discuss their ideas in pairs or write their ideas into their books or onto mini whiteboards.

Explain to students that the investigation they will carry out in this lesson relates to energy and that hot objects have a large energy store and that the average kinetic energy of the particles in a substance is known as temperature. Ask students to identify a piece of equipment which can be used to measure temperature.

Main Activities

Hot Chocolate

Ask students "What will happen to a cup of hot chocolate over time?" and ask them to explain their ideas.

Explain that hot objects like hot chocolate transfer energy to their surroundings. As the energy store of the hot chocolate decreases, its temperature will also decrease.

Marshmallows

Give students 2-3 minutes to discuss how they could investigate this question. Prompts are provided on the [PowerPoint](#). Students could share their ideas with the rest of the class.

Variables

Use the [PowerPoint](#) to introduce students to each type of variable in turn and identify the variables in this investigation. The [Marshmallow Investigation Planning Sheets](#) includes space for students to record the variables, a prediction, results, graph and conclusions for this investigation. A [Blank Science Investigation Planning Sheet](#) has also been included in this pack should you wish to focus on an alternative investigative skill.

Method

Ask the students to read through the method on the [PowerPoint](#) and identify the control variables. They can do this activity in pairs or small groups. They should write their answers on mini whiteboards and then discuss as a class. Have any students identified control variables that are not included in the method? Once the class has agreed on a set of control variables, they can add these to their planning sheets.

Extension

Can students explain why each variable they have identified needs to be kept the same?

Prediction

Students should record their prediction with a reason, on their planning sheets.

Safety

Students should discuss and decide upon safety instructions for this investigation. They should then record these on their planning sheets.

Practical

Students then carry out the practical, safely, wearing eye protection and while standing up. They should complete the results table as they go. There is an example set of data included in the [PowerPoint](#).

Displaying Your Results

The [PowerPoint](#) takes students step by step through drawing a bar chart to display their results.

Conclusion

Students should consider their results and form a conclusion based upon them. You could ask the class to compare their results and conclusions. Did all groups come to the same conclusion? If not, why might this be the case?

Plenary

Use mini whiteboards to review students' knowledge of the key variables and graph drawing skills from this investigation.

Disclaimer

We hope you find the information on our website and resource useful. The description of any physical activity contained within this resource is intended as a general guide only. It may not fit your specific situation. You should not rely on the resource to be right for your situation. It is your responsibility to decide whether to carry out the activity at all and, if you do, to ensure that the activity is safe for those participating. You are responsible for carrying out proper risk assessments on the activities and for providing appropriate supervision. We are not responsible for the health and safety of your group or environment so, insofar as it is possible under the law, we cannot accept liability for any loss suffered by anyone undertaking any activity or activities referred to or described in this resource. It is also your responsibility to ensure that those participating in the activity are fit enough to do so and that you or the organisation you are organising it for has the relevant insurance to carry out the physical activity. If you are unsure in any way, we recommend that you take guidance from a suitably qualified professional.

Marshmallow Investigation **Planning Sheet**

Aim

To investigate the effect of marshmallows on the temperature of hot chocolate over time.

Independent Variable

The **independent variable** is the variable that you change or select the values for.

What is the independent variable in your investigation?

Dependent Variable

The **dependent variable** is the variable that is measured for each change of the independent variable.

What is the dependent variable in your investigation?

Marshmallow Investigation **Planning Sheet**

Control Variables

A **control variable** is one that may, in addition to the **independent variable**, affect the outcome of the investigation and therefore must be kept constant.

What variables will you need to control in your investigation?

Prediction

What effect, if any, do you think the marshmallows will have on the temperature of the hot chocolate over time?

Why do you think this will happen?

Method

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5. Wait for 1 minute (to allow the marshmallows to melt), then measure the temperature.
6. Measure the temperature after 5 minutes.
7. Repeat the above steps, but without the marshmallows

Safety

What safety precautions do you need to take during your investigation?

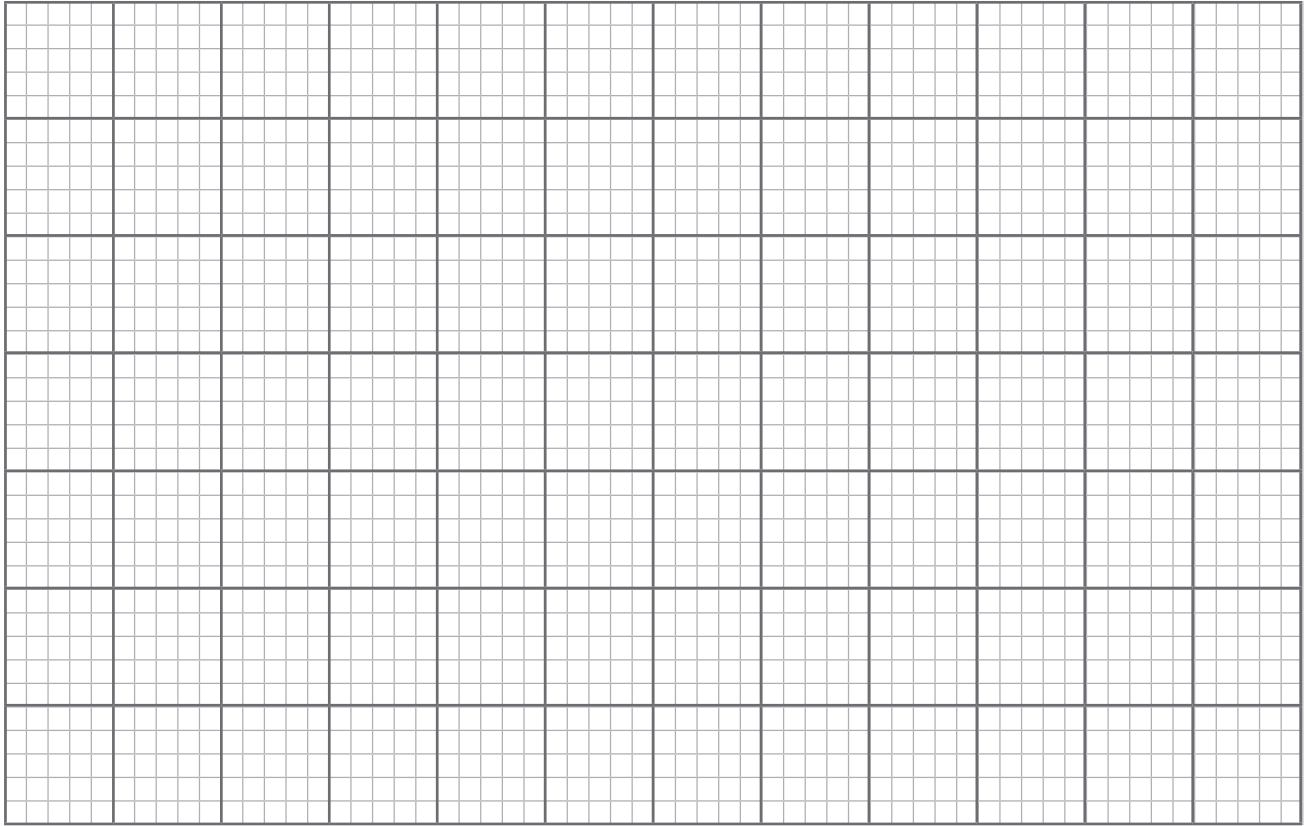
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Displaying Your Results

Draw a graph in the space below.



Conclusion

A **conclusion** is an explanation of what you found out in your investigation.

What was the effect of adding marshmallows on the temperature of the hot chocolate over time?

How do you know this?

(Use the data you collected to support the pattern you have identified.)

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What was the effect of adding marshmallows on the temperature of the hot chocolate over time?

How do you know this?

(Use the data you collected to support the pattern you have identified.)

Why does this happen?

(Give the science behind your results.)
