

Experiment: Which Surface Creates the Most Friction?

Big Science Question

When a toy car moves across different surfaces, it does not always travel the same distance.

Some surfaces are smooth.

Some surfaces are rough.

Some surfaces are soft.

Some surfaces are uneven.

In this investigation, you will test different surfaces to find out:

Which surface creates the most friction?

Learning Goals

By the end of this investigation, you should be able to:

- explain what friction is
 - write a clear hypothesis
 - conduct a fair test
 - measure distance accurately
 - collect evidence
 - record results in a table
 - create a graph
 - write a conclusion using evidence
 - write a scientific report
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Safety First

This experiment is safe, but scientists still work carefully.

Safety Rules

- Set up the ramp on a stable surface.
- Do not place the ramp where someone may trip over it.
- Do not throw or push the toy car.
- Keep your hands clear when the car is rolling.
- Use a ruler or measuring tape carefully.
- Be careful when testing outdoor surfaces.
- Wash your hands after testing soil or grass.
- Pack away all materials after the experiment.
- Ask an adult before beginning.

Investigation Question

Which surface creates the most friction?

Materials

You will need:

- toy car
 - ramp, such as cardboard, a chopping board or a flat book
 - stack of books to raise the ramp
 - ruler or measuring tape
 - masking tape or sticky note to mark the starting point
 - pencil
 - evidence collection sheet
 - different surfaces:
 - tiles
 - carpet
 - towel
 - cardboard
 - soil
 - grass
 - concrete
-

Important Science Idea

What Is Friction?

Friction is a force that slows down moving objects when two surfaces rub against each other.

For example:

- A toy car rolls further on a smooth floor because there is less friction.
- A toy car travels a shorter distance on carpet because there is more friction.
- Your shoes grip the ground because of friction.
- Brakes on a bike or car work because of friction.

Friction is invisible, but we can see its effects.

If friction is high, the car slows down quickly.

If friction is low, the car travels further.

Important Science Idea

Rough and Smooth Surfaces

A **surface** is the outside or top layer of something.

Surfaces can be:

- smooth
- rough
- bumpy
- soft
- hard
- slippery
- uneven

Rough, soft or uneven surfaces usually create more friction because they grip the object more.

Smooth and hard surfaces usually create less friction because the object can move more easily.

Variables

A **variable** is something that can change in an experiment.

In a fair test, we change only **one** thing and keep everything else the same.

Independent Variable

The **independent variable** is the thing you change.

In this experiment, the independent variable is:

The type of surface.

The surfaces tested are:

- tiles
 - carpet
 - towel
 - cardboard
 - soil
 - grass
 - concrete
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Dependent Variable

The **dependent variable** is the thing you measure or observe.

In this experiment, the dependent variable is:

The distance the toy car travels.

Controlled Variables

The **controlled variables** are the things you keep the same.

In this experiment, you should keep these things the same:

- the same toy car
 - the same ramp
 - the same ramp height
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- the same starting point
- the same release method
- the same measuring tool
- the same number of trials for each surface

Fair Test Reminder

A **fair test** means the experiment is fair because only one thing changes.

For this investigation, the only thing that should change is the **surface**.

Everything else should stay the same.

Example

If you roll the car on carpet from a tall ramp but roll it on tiles from a shorter ramp, the test is not fair.

If every surface uses the same ramp height, same car and same starting point, the test is fair.

Hypothesis

A **hypothesis** is a scientific prediction. It tells what you think will happen and why.

A strong hypothesis uses this structure:

If I roll a toy car across different surfaces, then _____ will create the most friction because _____.

My Hypothesis

If I roll a toy car across different surfaces, then

_____ will create the most friction because _____.

Procedure

A **procedure** gives clear steps to follow.

Scientists write procedures so other people can repeat the experiment.

Method

1. Place a stack of books on the floor or table.
 2. Rest one end of the ramp on the books.
 3. Place the first surface at the bottom of the ramp.
 4. Mark the starting point at the top of the ramp.
 5. Place the toy car at the starting point.
 6. Let the toy car roll down the ramp without pushing it.
 7. Measure how far the car travels from the bottom of the ramp.
 8. Record the distance in centimetres.
 9. Repeat the test **three times** on the same surface.
 10. Repeat the same steps for each surface.
 11. Compare the results.
 12. Decide which surface created the most friction.
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Important Measuring Rule

Always measure from the **same point**.

Measure from the bottom of the ramp to where the front of the car stops.

If the car turns sideways, measure to where it stopped.

Evidence Collection Sheet

Scientists collect **evidence** to support their conclusions.

Evidence can include:

- measurements
- observations
- tables
- graphs
- photographs
- repeated trials
- averages

Evidence Collection Table

Surface	Trial 1 Distance	Trial 2 Distance	Trial 3 Distance	Average Distance	Observation
Tiles					
Carpet					
Towel					
Cardboard					
Soil					
Grass					
Concrete					

How to Find the Average

An **average** gives a fairer result because it uses more than one trial.

To find the average:

1. Add the three distances together.
2. Divide the total by 3.

Example

Trial 1: 90 cm

Trial 2: 87 cm

Trial 3: 93 cm

$$90 + 87 + 93 = 270$$

$$270 \div 3 = 90$$

The average distance is **90 cm**.

Observation Notes

Use this space to record extra details.

Tiles

Carpet

Towel

Cardboard

Soil

Grass

Concrete

Optional Evidence

Drawing or Photo Space

Draw or paste a photo of your experiment setup.

Results Summary

After completing the experiment, answer these questions.

1. Which surface allowed the car to travel the furthest?

2. Which surface made the car travel the shortest distance?

3. Which surface created the most friction?

4. What evidence supports your answer?

5. Was your hypothesis correct or incorrect?

Results Ranking

Rank the surfaces from **most friction** to **least friction**.

Remember:

The surface with the **shortest distance** created the **most friction**.

The surface with the **longest distance** created the **least friction**.

Rank	Surface
1. Most friction	
2	
3	
4	
5	
6	
7. Least friction	

Bar Graph Template

Create a bar graph to show the average distance travelled on each surface.

Title

Distance Travelled by Toy Car on Different Surfaces

Surface	Average Distance in cm
Tiles	
Carpet	
Towel	
Cardboard	
Soil	
Grass	
Concrete	

Scientific Report Scaffold

Use this scaffold to write your scientific report.

Title

Which Surface Creates the Most Friction?

Aim

The **aim** explains what you are trying to find out.

Sentence starter:

The aim of this investigation is to find out

Hypothesis

The **hypothesis** is your scientific prediction.

Sentence starter:

If I roll a toy car across different surfaces, then

_____ will create the most friction because

Materials

The **materials** section lists the equipment used.

I used:

- _____
 - _____
 - _____
 - _____
 - _____
 - _____
 - _____
-

Variables

The **variables** explain what changed, what was measured and what stayed the same.

Variable Type	My Experiment
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Independent variable	
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Dependent variable	
--------------------	--

Controlled variables	
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Method

The **method** explains the steps followed.

1. _____
 2. _____
 3. _____
 4. _____
 5. _____
 6. _____
 7. _____
-

8. _____

9. _____

10. _____

Results

The **results** show what happened.

Surface	Trial 1	Trial 2	Trial 3	Average Distance	Observation
Tiles					
Carpet					
Towel					
Cardboard					
Soil					
Grass					
Concrete					

Discussion

The **discussion** explains what the results mean.

Sentence starters:

The toy car travelled the furthest on _____.

This means this surface created _____
friction.

The toy car travelled the shortest distance on _____.

This means this surface created _____
friction.

The results show that _____.

Conclusion

The **conclusion** answers the investigation question using evidence.

Sentence starter:

In conclusion, _____ created the most friction. I know this because the toy car travelled _____ on this surface.

My hypothesis was correct / incorrect because _____.

Evaluation

The **evaluation** explains how the experiment could be improved.

Sentence starters:

This experiment was fair because _____.

One thing I could improve next time is _____.

Next time, I could also test _____.

Glossary of Key Scientific Terms

Term	Definition
Force	A push or pull that can make an object move, stop or change direction
Friction	A force that slows down moving objects when surfaces rub together
Surface	The outside or top layer of an object or area
Smooth	Even and not rough or bumpy
Rough	Uneven, bumpy or scratchy
Distance	How far something travels

Term	Definition
Measure	To find the size, amount or length of something
Centimetre	A unit used to measure length or distance
Investigation	A careful test or study to answer a question
Experiment	A scientific test used to find out what happens
Aim	What the investigation is trying to find out
Hypothesis	A scientific prediction that can be tested
Prediction	What you think will happen
Variable	Something that can change in an experiment
Independent variable	The thing you change in an experiment
Dependent variable	The thing you measure or observe
Controlled variable	Something kept the same to make the test fair
Fair test	An experiment where only one thing is changed
Method	The steps followed in an experiment
Trial	One attempt or test in an experiment
Average	A number found by adding results and dividing by how many results there are
Observe	To look carefully and notice details
Observation	What you notice during an experiment
Data	Information collected during an investigation
Evidence	Information that supports an answer or conclusion
Results	What happened in the experiment
Table	A way to organise information in rows and columns

Term	Definition
Graph	A visual way to show data
Conclusion	The final answer based on the results
Evaluate	To explain what worked well and what could be improved
Reliable	Results that are trustworthy because the test was done carefully

Extension Questions

Answer these if you finish early.

1. Why did the car travel furthest on one surface?
 2. Why did the car stop quickly on one surface?
 3. Why is it important not to push the car?
 4. Why should the ramp height stay the same?
 5. How could this experiment be made more accurate?
 6. What would happen if the ramp was made higher?
 7. What surface would be safest for shoes to grip?
 8. Why do car tyres need friction?
 9. Why might too much friction be a problem?
 10. Why might too little friction be dangerous?
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Challenge Investigation

Try a second experiment.

New Question

Does ramp height affect how far a toy car travels?

This time, the surface should stay the same, but the height of the ramp changes.

Possible ramp heights:

- 1 book high
- 2 books high
- 3 books high

New Hypothesis

If I increase the ramp height, then the toy car will travel
_____ because

_____.

Scientific Report Checklist

Use this checklist before submitting your report.

Checklist Item	Tick
I included a clear title.	☐
I wrote the aim.	☐
I wrote a hypothesis using “if” and “then”.	☐
I listed all materials.	☐
I explained the variables.	☐
I wrote the method in order.	☐
I repeated each test three times.	☐
I recorded results in a table.	☐

Checklist Item	Tick
I calculated or identified the average.	☐
I used evidence in my conclusion.	☐
I explained whether my hypothesis was correct or incorrect.	☐
I included an evaluation.	☐
I checked my spelling and punctuation.	☐

Success Criteria

A successful scientific report should:

- explain what was tested
- include a clear hypothesis
- describe a fair method
- identify the variables
- record results clearly
- include repeated trials
- use evidence
- answer the investigation question
- explain what could be improved

Final Reflection

Complete these sentences.

Today I learnt that friction is:

The surface that created the most friction was:

I know this because:

One thing I did well as a scientist was:

One thing I could improve next time is:

Final Reminder

Good scientists do not just watch things happen.

They ask a question, make a prediction, test carefully, measure results and explain what the evidence shows.

In this investigation, your toy car became a tiny science explorer, and every surface became part of the mystery track.