Australian Curriculum Year 4 Science Sample assessment | Student booklet

The force of friction

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| http://farm6.staticflickr.com/5229/5560539738_4c04cf2cfe_b.jpg |
| Image: *Speed (84/365)* by, John Liu, Creative Commons Attribution 2.0, http://flic.kr/p/9tndJN |

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| Students conduct a fair test to establish how friction affects the distance travelled by a toy car. |
| **You will:**   * make predictions * discuss how to make an investigation fair * conduct an investigation * record results * identify patterns in your results * draw a conclusion * apply your science knowledge to a real-life situation. |

## Section 1. Investigating friction

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| --- |
| Friction is a force. If something is moving, friction opposes it. Friction is a force that exists whenever two things rub against each other.  You will conduct an investigation about how friction affects the distance a toy car travels.  In your investigation you will roll a toy car down a ramp and on to different surfaces. You will measure how far the car travels along the different surfaces. |

### Question

##### What you are trying to find out by doing the investigation?

**How does friction affect the distance a toy car will travel?**

### Prediction

##### What you think is going to happen in the investigation:

I think the toy car will travel the greatest distance on the surface.

I think this because

### Materials and equipment

##### Things you will need to conduct your investigation:

* a toy car
* a ramp from which to launch the toy car
* books (to raise the ramp)
* 3 different surfaces, e.g. concrete, carpet, linoleum, tiles, bench top
* a one-metre measuring tape or ruler

### Keeping the investigation fair

##### Getting the best results you can:

It is important to make sure that this investigation is a fair test.

Have a class discussion with your teacher and class members to complete the table below.

|  |  |  |
| --- | --- | --- |
| **One thing that we will  change each trial** | **What we will measure** | **Things that we will keep  the same each trial** |
|  |  |  |

Method

##### Follow these steps to conduct your investigation:

**Step 1:**

* Set up the equipment using one surface, as shown in the photo below.
* Make sure that there is plenty of room at the end of the ramp for the toy car to roll on to the test surface as it leaves the ramp.

**Step 2:**

* Place the toy car at the top of the ramp so its back wheels are on the edge of the ramp.
* Hold it in position.

**Step 3:**

Repeat three times:

* Release the toy car and wait until it stops moving.
* Measure the distance from the end of the ramp to the back wheels of the car.
* Record the distance in centimetres in the results table.

**Step 4:**

* Repeat steps 1, 2 and 3 for the other two surfaces.



### Results

##### A record of the data you collect during the investigation

1. Describe the appearance of each surface, e.g. rough, smooth, bumpy.
2. Record the distance the toy car travelled for each trial and each surface.

Table 1: Results data

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Surface | Appearance | Distance travelled (cm) | | |
| Test 1 | Test 2 | Test 3 |
| Surface 1: |  |  |  |  |
| Surface 2: |  |  |  |  |
| Surface 3: |  |  |  |  |

1. Repeating an experiment more than once helps you to be sure that the data you collect is as accurate as possible. No experiment method is perfect so by repeating it a number of times you can recognise any results that may be inaccurate and don’t fit the pattern of the other measurements taken.

In this experiment you repeated the method for each surface three times, but when drawing a column graph from the data you collected you will use only one of the measurements for each surface.

We will assume that the most **accurate** measurement is the value that sits in the middle of the three measurements you took for each surface.

Complete the table below, using the middle value for each surface from your table of results.

Table 2: Results summary

|  |  |
| --- | --- |
| Surface | Distance travelled (cm) |
| Surface 1: |  |
| Surface 2: |  |
| Surface 3: |  |

1. Use the values from Table 2 in Question 3 to draw a column graph showing the distance the toy car travelled for each of the three surfaces.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Distance travelled (cm) | **Distance travelled over different surfaces** | | | | | | | | | |
| 30 |  |  |  |  |  |  |  |  |  |
| 29 |  |  |  |  |  |  |  |  |  |
| 28 |  |  |  |  |  |  |  |  |  |
| 27 |  |  |  |  |  |  |  |  |  |
| 26 |  |  |  |  |  |  |  |  |  |
| 25 |  |  |  |  |  |  |  |  |  |
| 24 |  |  |  |  |  |  |  |  |  |
| 23 |  |  |  |  |  |  |  |  |  |
| 22 |  |  |  |  |  |  |  |  |  |
| 21 |  |  |  |  |  |  |  |  |  |
| 20 |  |  |  |  |  |  |  |  |  |
| 19 |  |  |  |  |  |  |  |  |  |
| 18 |  |  |  |  |  |  |  |  |  |
| 17 |  |  |  |  |  |  |  |  |  |
| 16 |  |  |  |  |  |  |  |  |  |
| 15 |  |  |  |  |  |  |  |  |  |
| 14 |  |  |  |  |  |  |  |  |  |
| 13 |  |  |  |  |  |  |  |  |  |
| 12 |  |  |  |  |  |  |  |  |  |
| 11 |  |  |  |  |  |  |  |  |  |
| 10 |  |  |  |  |  |  |  |  |  |
| 9 |  |  |  |  |  |  |  |  |  |
| 8 |  |  |  |  |  |  |  |  |  |
| 7 |  |  |  |  |  |  |  |  |  |
| 6 |  |  |  |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |  |  |  |
| 1 |  |  |  |  |  |  |  |  |  |
| 0 |  | | |  | | |  | | |
|  | Surface | | | | | | | | |

### Discussion

##### Describe and explain your results using evidence from the investigation and your science knowledge.

1. Over which surface did the toy car travel the greatest distance?

Was friction high or low between this surface and the wheels of the toy car?

Use the evidence from the results table and the column graph and your observation of the surface to explain how you know this.

1. Over which surface did the toy car to travel the smallest distance?

Was friction high or low between this surface and the wheels of the toy car?

Use the evidence from the results table and the column graph and your observation of the surface to explain how you know this.

### Conclusion

##### What did you find out?

1. Was the investigation question answered? (circle one) Yes / No
2. Was your prediction correct? (circle one) Yes / No
3. How does friction affect the distance a toy car will travel?

## Section 2. Applying your science knowledge

In Section 1, we investigated how friction affects the movement of objects. Sometimes friction can be an advantage, and sometimes it is a disadvantage. It depends on the situation.

Choose **one** of the photos below.

|  |  |
| --- | --- |
| **Slippery slide**  C:\Users\dmur\Downloads\8591237012_54a898cf26_z.jpg  Image: *Space savings,* kimubert, Creative Commons Attribution 2.0, [www.flickr.com/photos/treevillage/8591237012/in/photostream](http://www.flickr.com/photos/treevillage/8591237012/in/photostream/) | **Running shoes**    Image: *26 miles of rock and roll,* George Ruiz, Creative Commons Attribution 2.0, [www.flickr.com/photos/29946035@N08/4735345767/in/photolist-8drTjx-cJMR5y-8EehNW](http://www.flickr.com/photos/29946035@N08/4735345767/in/photolist-8drTjx-cJMR5y-8EehNW) |

1. Is friction an advantage or disadvantage in this situation? advantage / disadvantage  
    (circle one)
2. Explain why friction is an advantage or disadvantage in this situation.