**Collecting Data**

A close-up of a newspaper

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Making **observations** is an important part of any scientific investigation. Every observation gives us pieces of information, called **data**.

There are two types of observation, so two different ways of collecting data.

**Qualitative observations** include things like shape, colour, loudness, hardness, or flavour.

For example, some qualitative observations of the worms shown above are:

* Some are brown
* Some are green
* They are long and thin
* They have stripes

We record data from qualitative observations by writing descriptions, taking photos, and making videos or sound recordings.

**Quantitative observations** includethings like number, length, mass, temperature, or time.

For example, some quantitative observations of the worms shown above might be:

* There are 6 worms
* The largest is 5 centimeters long
* The largest has a mass of 11 grams

We usually record data from quantitative observations by making a table and writing down the numbers with their units. For example, 6 worms, 5 cm, 11 g.

**Tables and graphs**

The data you collect should always be neatly presented in a table. This helps to keep it organized and easy to read.

If the data is quantitative, you can also make a graph. This makes it easy to:

* make comparisons
* see patterns and trends
* communicate the results to other people

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**Investigating worms**

You have been given samples of the three worm species to investigate. You'll need to collect both qualitative and quantitative data so that you can compare the species.

Before you get started, it's important to remember the lab safety rules. There may be traces of chemicals left behind on the measuring equipment and the lab benches. This means that the worms will *not* be safe to taste or eat.

1. Finishthe sentence below to explain why it's not safe to eat the gummy worms used in this investigation. Try to use your own words.

Don’t taste the gummy worms because…. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Qualitative Observations**

1. Record your record your *qualitative observations* about the different worms by completing the two activities below.

Draw a picture of each of your worm species in the space below.

|  |  |  |
| --- | --- | --- |
| **Species A** | **Species B** | **Species C** |

1. **Describe** your qualitative observations of each worm species in the table.

*Hint: You can start by carefully observing their colour, shape, texture, hardness, smell...*

|  |  |
| --- | --- |
| **Worm Species** | **Qualitative Observations** |
| **Species A** |  |
| **Species B** |  |
| **Species C** |  |

|  |  |
| --- | --- |
| 1. **List** the similarities between the three worm species you can observe. | 1. **List** the differences between the three worm species you can observe. |
|  |  |

**Quantitative Observations**

Scientists usually can't work with only qualitative data. Collecting quantitativeobservations by counting and measuring makes it much easier to see contrasts and patterns. It also makes the results of an investigation more accurate and reliable.

Here's what you will need:

* electronic mass balance
* 30 cm ruler
* calculator

## **Measuring mass**

Use the electronic mass balance to measure the mass of each worm in your sample. **Mass** is the amount of matter in an object. In everyday life, we usually call it "weight".

Record the mass (in grams, g) of each worm in the table below. Then use the calculator to work out the average mass for each species. This will make it easier to compare the species.

**Calculating the average**

To calculate an average value, *add* the values together and *divide* by the number of values.

So to calculate the average mass for each worm species, there are two steps:

* *Step 1:* add the three measurements together
* *Step 2:* divide by 3

1. **Record** the mass of each worm in the table. Then calculate the average mass for each worm species.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Worm Species** | **Mass of Worm 1 (g)** | **Mass of Worm 2 (g)** | **Mass of Worm 3 (g)** | **Average mass** |
| **Earthworm** | 3.1 | 3.8 | 3.4 | Step 1: 3.1 + 3.8 + 3.4 = 10.3  Step 2: 10.3 ÷ 3 = 3.4 |
| **Species A** |  |  |  |  |
| **Species B** |  |  |  |  |
| **Species C** |  |  |  |  |

1. Construct a graph of your results on the graph paper provided:

Include the title ***Average mass of three worm species***

Label the correct axis with the labels ***worm species*** and ***average mass (g)***

1. ***Describe*** what your graph tells you about the mass of each worm species in your sample.

Hint: Is it clear which has the largest mass? Which one is it? What about the smallest mass? Are there two species that have the same average mass?

## **Measuring length**

Use the ruler to measure the length of each worm in your sample. Record the length in centimeters, with one number after the decimal point.

For example, for a worm that's 3 centimeters and 7 millimeters long, write 3.7 cm.

Then calculate the average length for each species, using the same two steps that you used to calculate average mass.

1. **Record** the length of each worm in the table. Then **calculate** the average length for each species.

Hint: An example is provided in the first row of the table.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Worm Species** | **Length of Worm 1 (cm)** | **Length of Worm 2 (cm)** | **Length of Worm 3 (cm)** | **Average Length**  **(cm)** |
| **Earthworm** | 13.2 | 13.3 | 13.1 | Step 1: 13.2 + 13.3 + 13.1 = 39.6  Step 2: 39.6 ÷ 3 = 13.2 |
| **Species A** |  |  |  |  |
| **Species B** |  |  |  |  |
| **Species C** |  |  |  |  |

1. **Construct** a graph of your results:
   1. Include the title **Average length of three worm species**
   2. Label the correct axis with the labels **worm species** and **average length (cm)**
2. Describe what your graph tells you about the length of each worm species in your sample. Hint: Is it clear which is the longest? Which one is it? What about the shortest? Are there two species that have the same average length?
3. **Determine** whether the data you've collected give you enough information to be 100% certain which species has the greatest length or mass. **Explain** why or why not.
4. **Explain** why quantitative data can be more useful to scientists than a qualitative description. Hint: Compare these two statements. Worms of Species A are short and stubby (qualitative). Worms of Species A have an average length of 3.4 cm (quantitative).
5. Pretend that one of your classmates was absent today.

They have messaged you to find out what they missed in class. Writea text message back to them to **summarise** what you have learned.

1. Name your three worm species:

Species A:

Species B:

Species C: