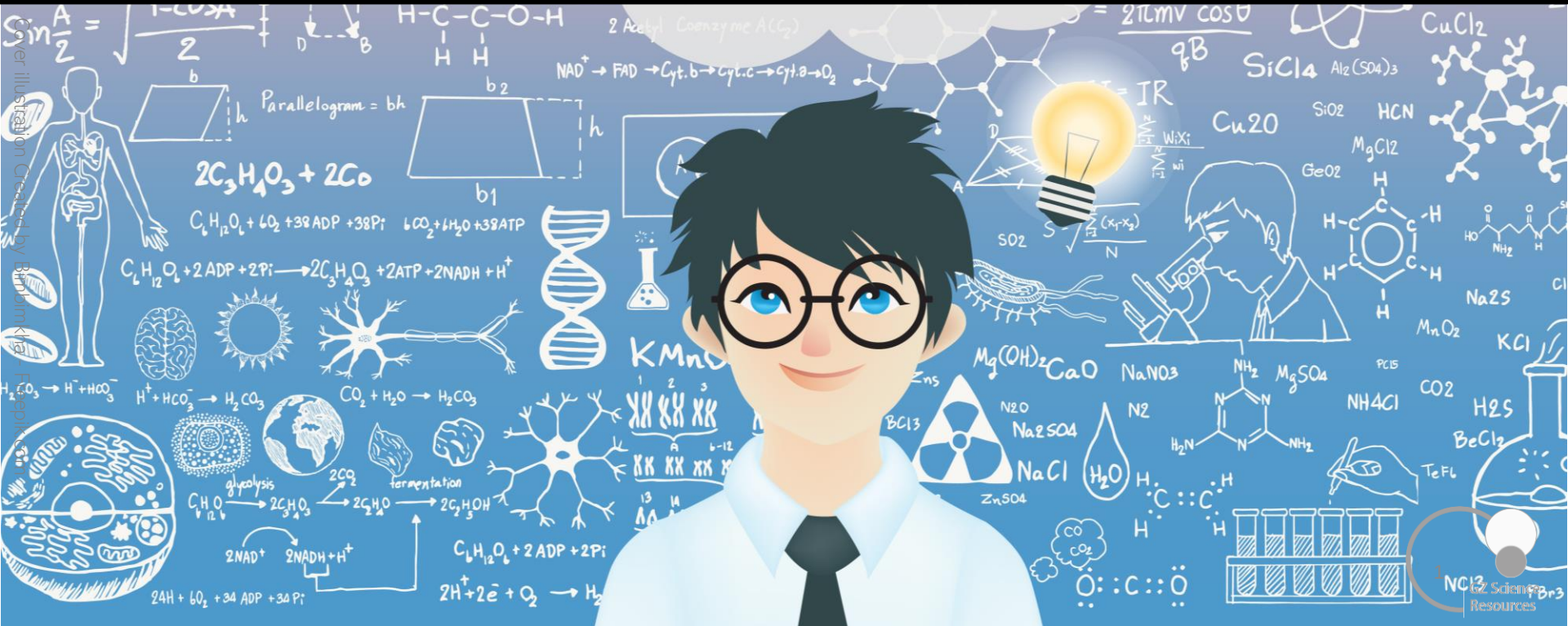
2019
Version

Introduction to Science
Junior Science



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GZ Science Resources

What is Science?

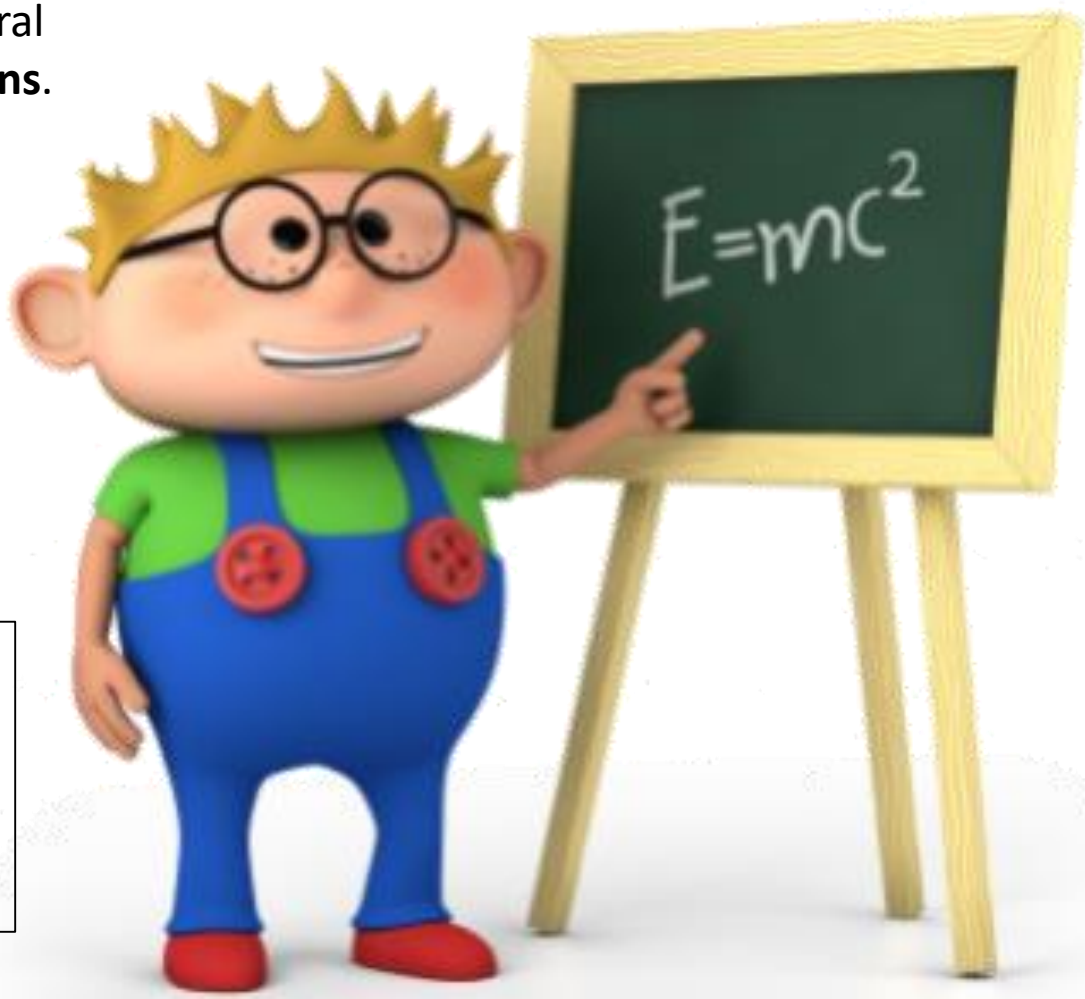
Science is both a collection of **knowledge** and the **process** for building that knowledge.

Science asks **questions** about the natural world and looks for natural **explanations**.

Science works only with **testable** ideas and uses **observations** to make **conclusions**.

Theories are developed based on the **evidence** scientists collect.

Moral judgments, decisions about how to use science discoveries, and conclusions about the **supernatural** are outside the area of science

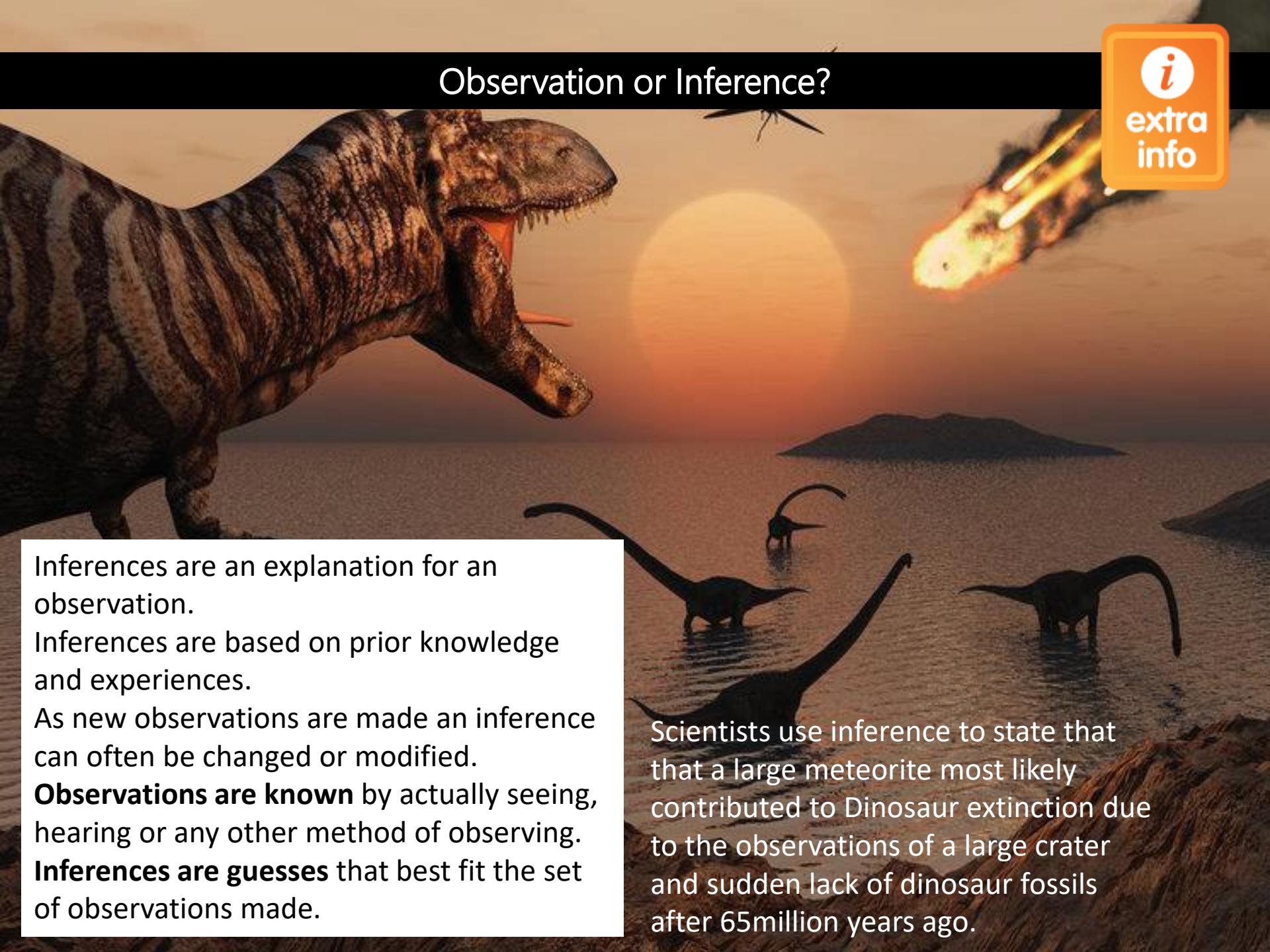


Observation in Science

To observe means to record or make note of something we have experienced. We also think of observations as watching something, but in Science, observations may be made with any of our senses (by seeing, feeling, hearing, tasting, or smelling) or even using tools to make observations that are then changed into something our senses detect.

Observation tools include thermometers, microscopes, telescopes, radars, computer sensors and spaces probes. Sometimes these tools are able to observe and collect data that humans cannot directly sense. By using these tools scientists can often make many more observations and much more **precisely** than our senses are able to.

Observation or Inference?



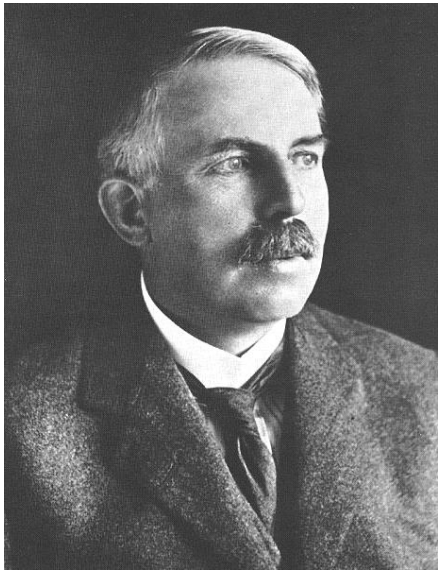
Inferences are an explanation for an observation.
Inferences are based on prior knowledge and experiences.
As new observations are made an inference can often be changed or modified.
Observations are known by actually seeing, hearing or any other method of observing.
Inferences are guesses that best fit the set of observations made.

Scientists use inference to state that that a large meteorite most likely contributed to Dinosaur extinction due to the observations of a large crater and sudden lack of dinosaur fossils after 65million years ago.

Who wants to be a Scientist?

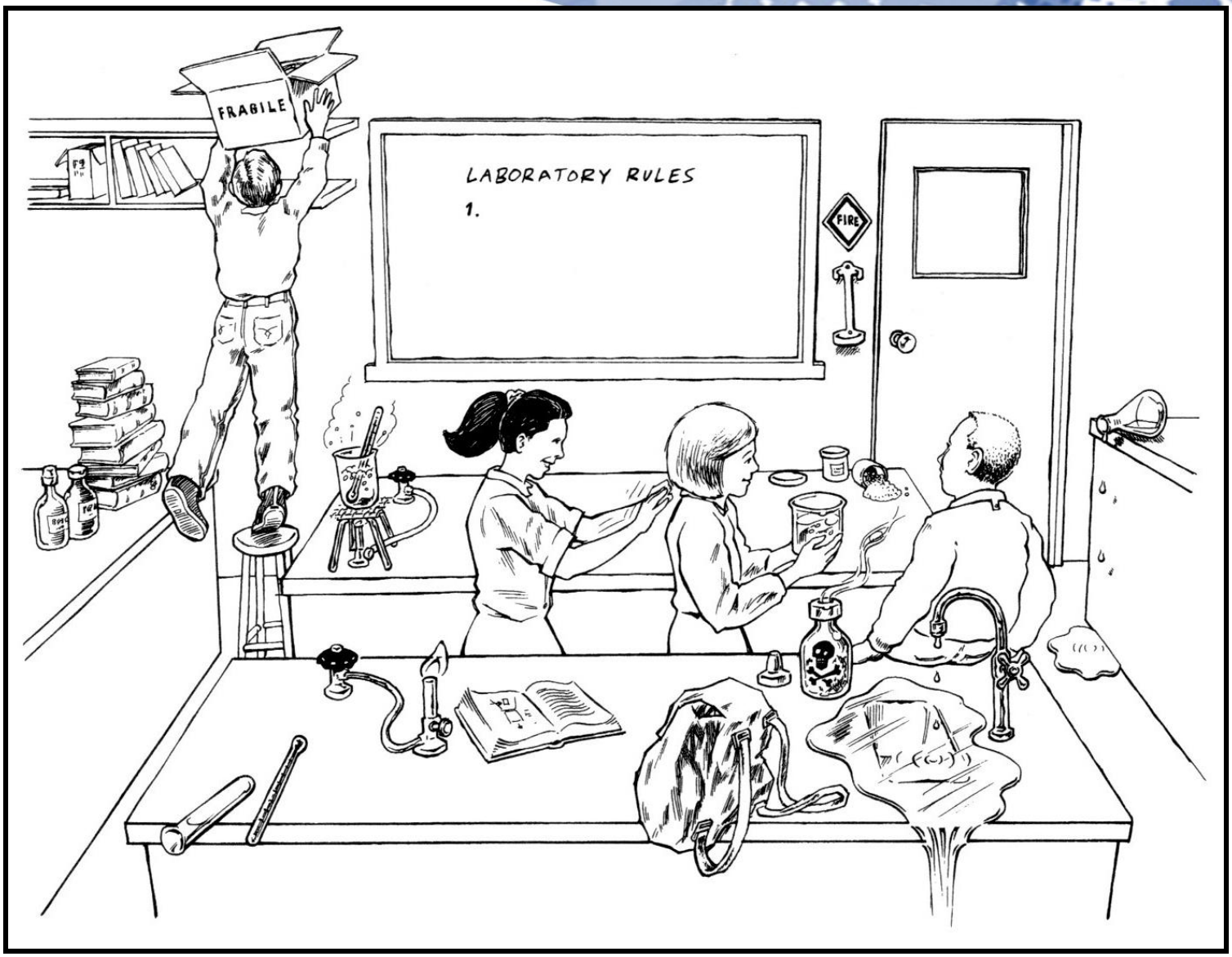
extra info

The New Zealander Joan Wiffen was well known as a tireless hunter of New Zealand Dinosaur bones – disproving the long established idea that no dinosaurs made it across to NZ before it broke away from Gondwana or if they did then New Zealand's active geological past destroyed any evidence of dinosaur fossils. Although she was not formally trained as a scientist, she self taught herself the correct ways of working scientifically.



The New Zealand Scientist Sir Ernest Rutherford completed his secondary schooling and three university degrees here at home then went on to continue his Scientific education at other universities overseas including Cambridge University, England. He was most famously known for inferring the structure of the atom from his testing and tireless observations. Sir Rutherford collaborated with many other scientists and freely shared his evidence with others.

Spot the Dangers in the lab



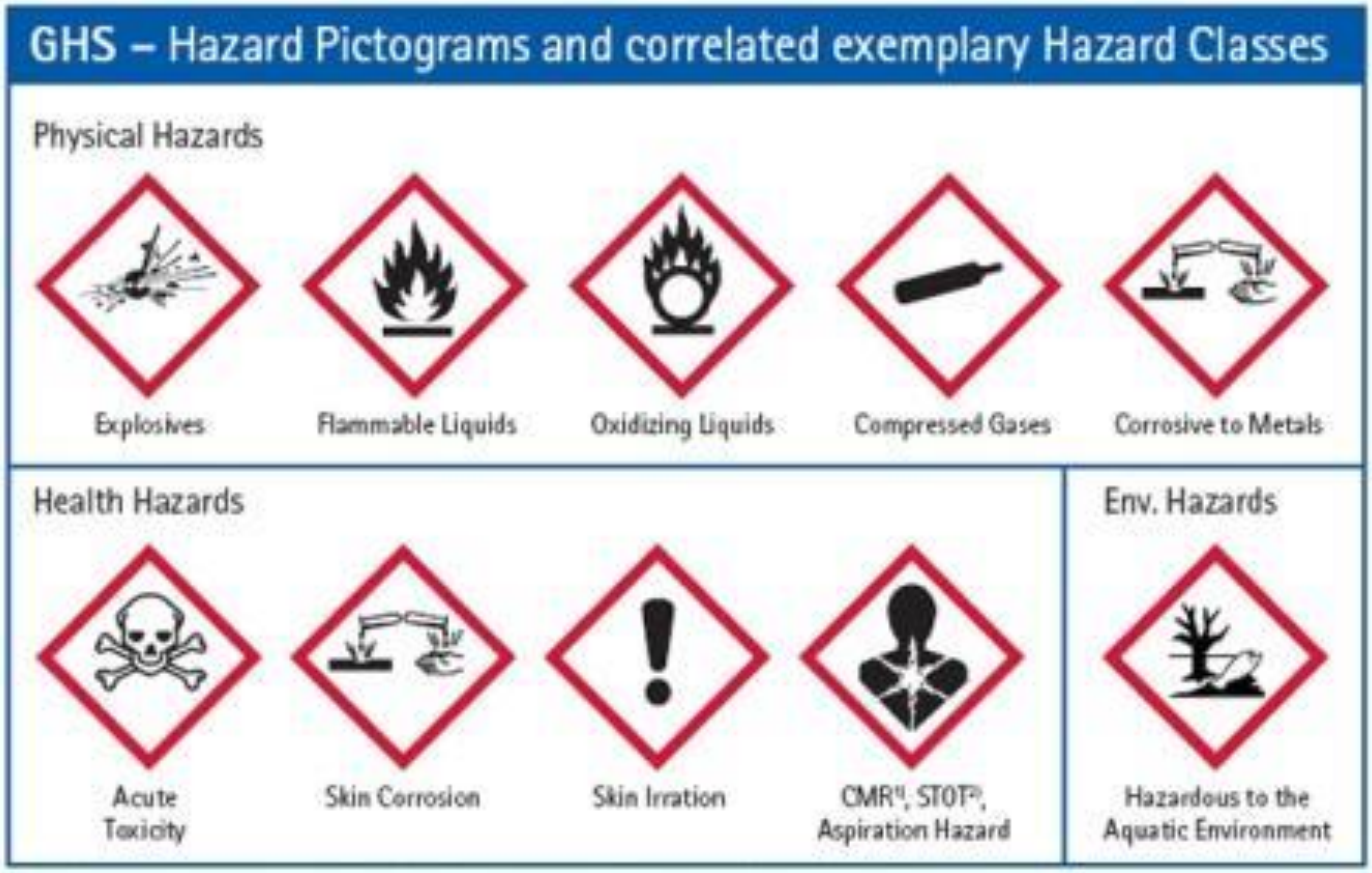
Laboratory Rules

A School Science Laboratory can be a fun place that allows you to investigate and observe Science taking place. It can also be a dangerous place if rules are not followed. To protect yourself and the classroom from harm we need to follow School Lab Rules carefully each time we are in the class or taking part in a practical.

1. Do not smell or taste chemicals.
2. Place bags under your desks.
3. Wear safety equipment if asked.
4. Tie long hair back during practicals.
5. No running in class.
6. Tell the teacher if you break equipment.
7. Clean up your work area after practicals.
8. No eating in the class.
9. ……
10. ……

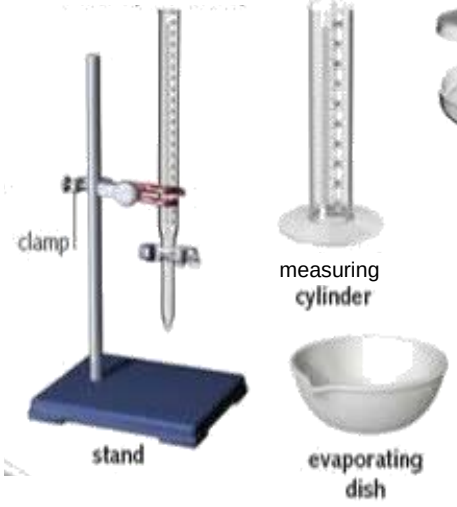
Laboratory safety symbols

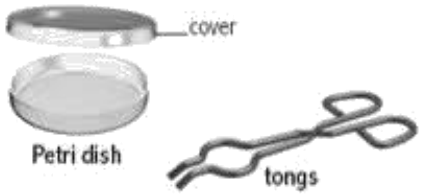
Easy to recognise safety Hazchem symbols are often used in Labs and on labels of chemicals when special care is required. A chemical may be poisonous or be explosive or burn when it touches skin. Safety symbols and Lab rules are designed to warn and protect you from dangerous situations.

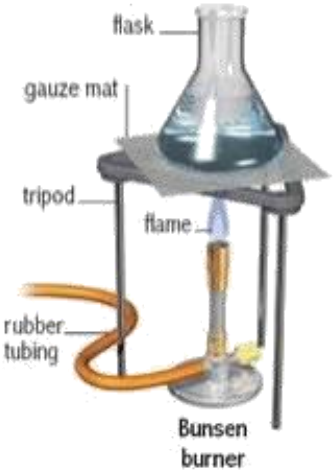


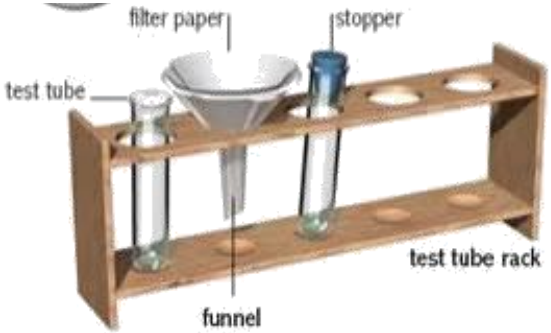
Common Laboratory equipment

Science labs contain equipment that are used to carry out investigations and experiments. This equipment may be quite different from what we have in our homes but it is often designed for specific uses.
The names and uses of the equipment will need to be learnt along with how to use it.

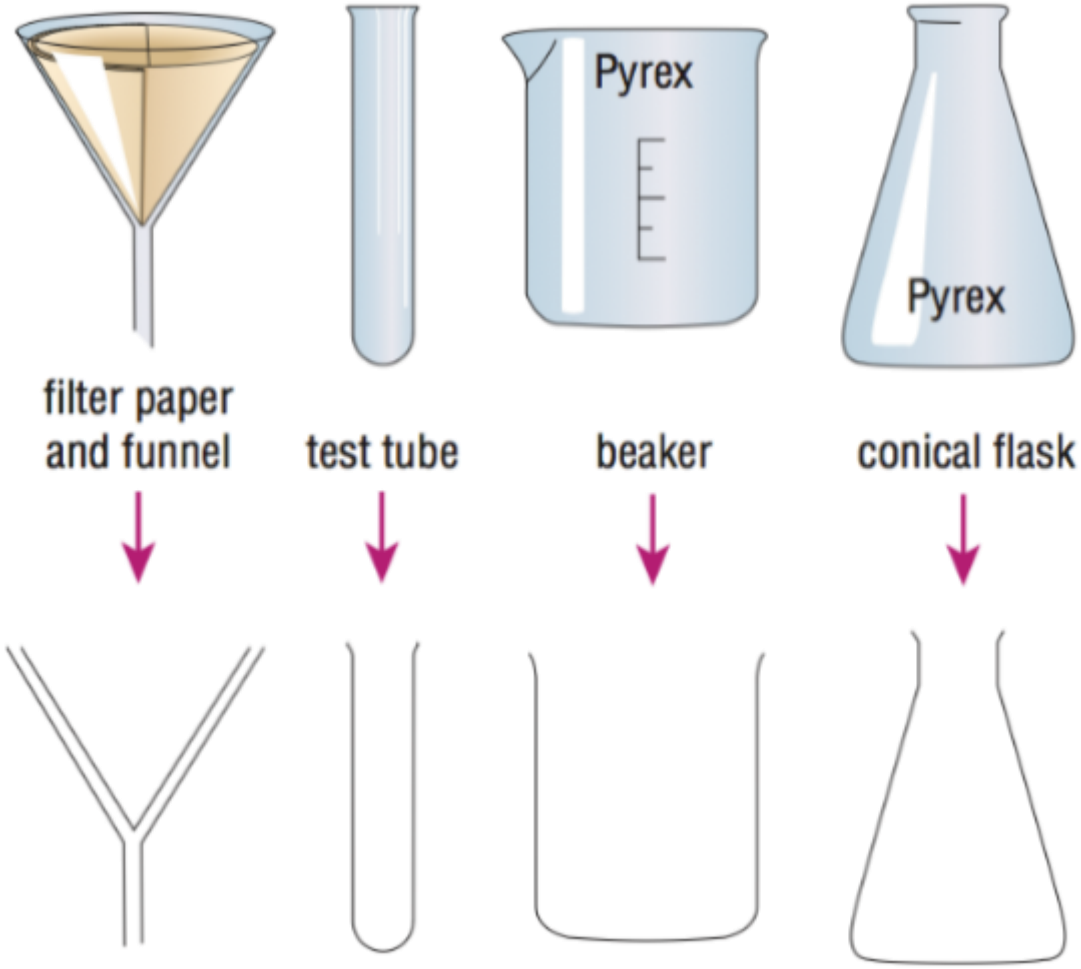






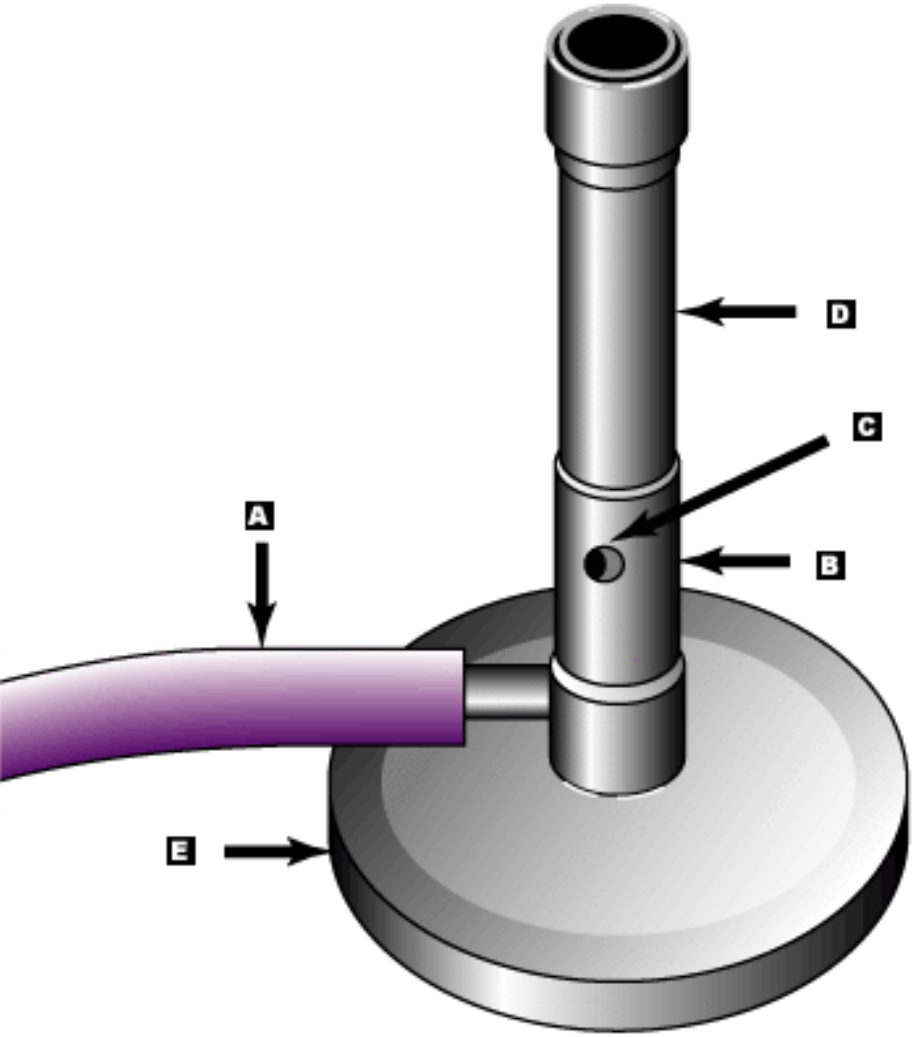


Drawing equipment in Science



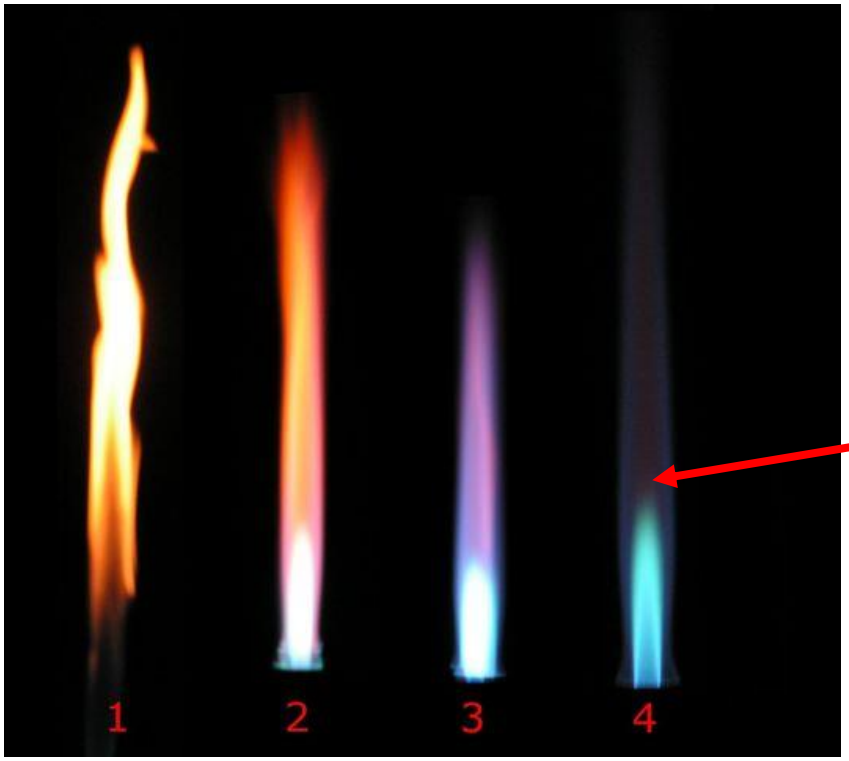
In the science laboratory, we use special equipment. Often we have to draw the equipment. We use diagrams to show the equipment, which saves us time drawing. The scientific diagrams are recognised worldwide.

Draw and label the Bunsen Burner



Part of the Bunsen Burner	Function
A. Gas hose	To allow gas to enter the burner
B. Collar	To control the amount of air entering the burner
c. Air Hole	To allow air to enter the burner
D. Barrel	To raise the flame to a suitable height for heating and burning
E. Base	To support the burner and make it more stable

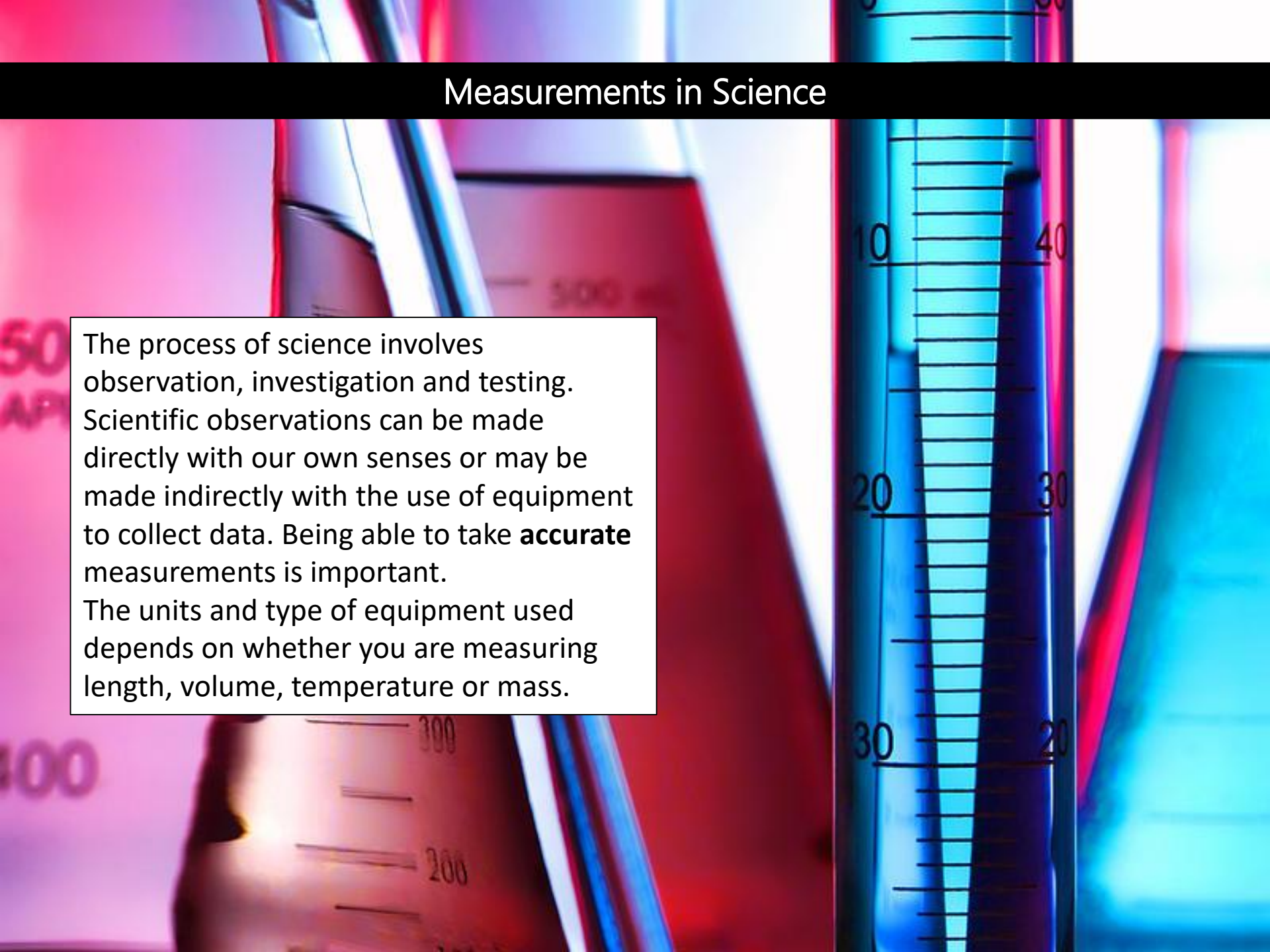
The Bunsen Burner Flame



When using the Bunsen Burner to heat boiling tubes etc. place it at the hottest place at the top of the bright blue flame.

The Bunsen Burner burns gas with oxygen in the air to make a hot flame used in the laboratory. When the air hole is closed, (1) the flame is large and orange. This flame only partly allows oxygen to burn with the gas so is cooler and creates soot. As the air hole is opened, more (2-4) the flame becomes bluer and hotter. The best flame to use is (4), with the air hole mostly open.

Measurements in Science



The process of science involves observation, investigation and testing. Scientific observations can be made directly with our own senses or may be made indirectly with the use of equipment to collect data. Being able to take **accurate** measurements is important.

The units and type of equipment used depends on whether you are measuring length, volume, temperature or mass.

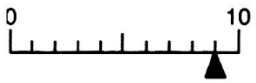
Measuring in Science

Quantity	Unit	Symbol	Equipment used
Volume	litre	L	flask
	millilitre	mL	measuring cylinder
Temperature	Celsius	°C	thermometer
Mass	kilograms	Kg	Scales
	grams	g	Scales
Length	Metres	m	Metre ruler
	millimetres	mm	Hand ruler

Note: **Weight** is the result of force (gravity) acting on mass and is measured in Newton's using a spring balance. Weight and Mass are often confused.

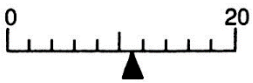
Measurements in Science

1 Fill in the readings on the scales shown.



A _____

B _____



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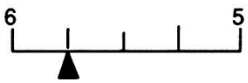
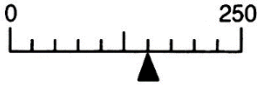


D _____

E _____



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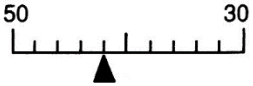

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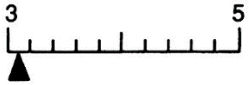
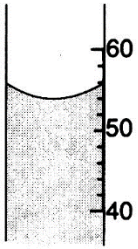
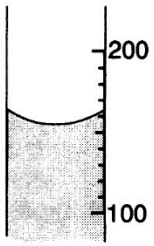


H _____

2 What do these measuring cylinders and pipettes read?



a _____



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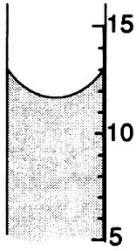

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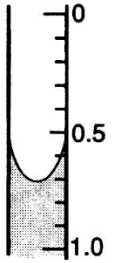

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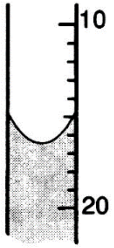
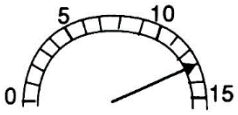


e _____

3 What amounts do these meters read?



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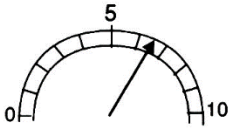

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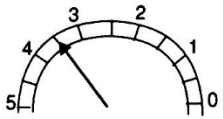


c _____

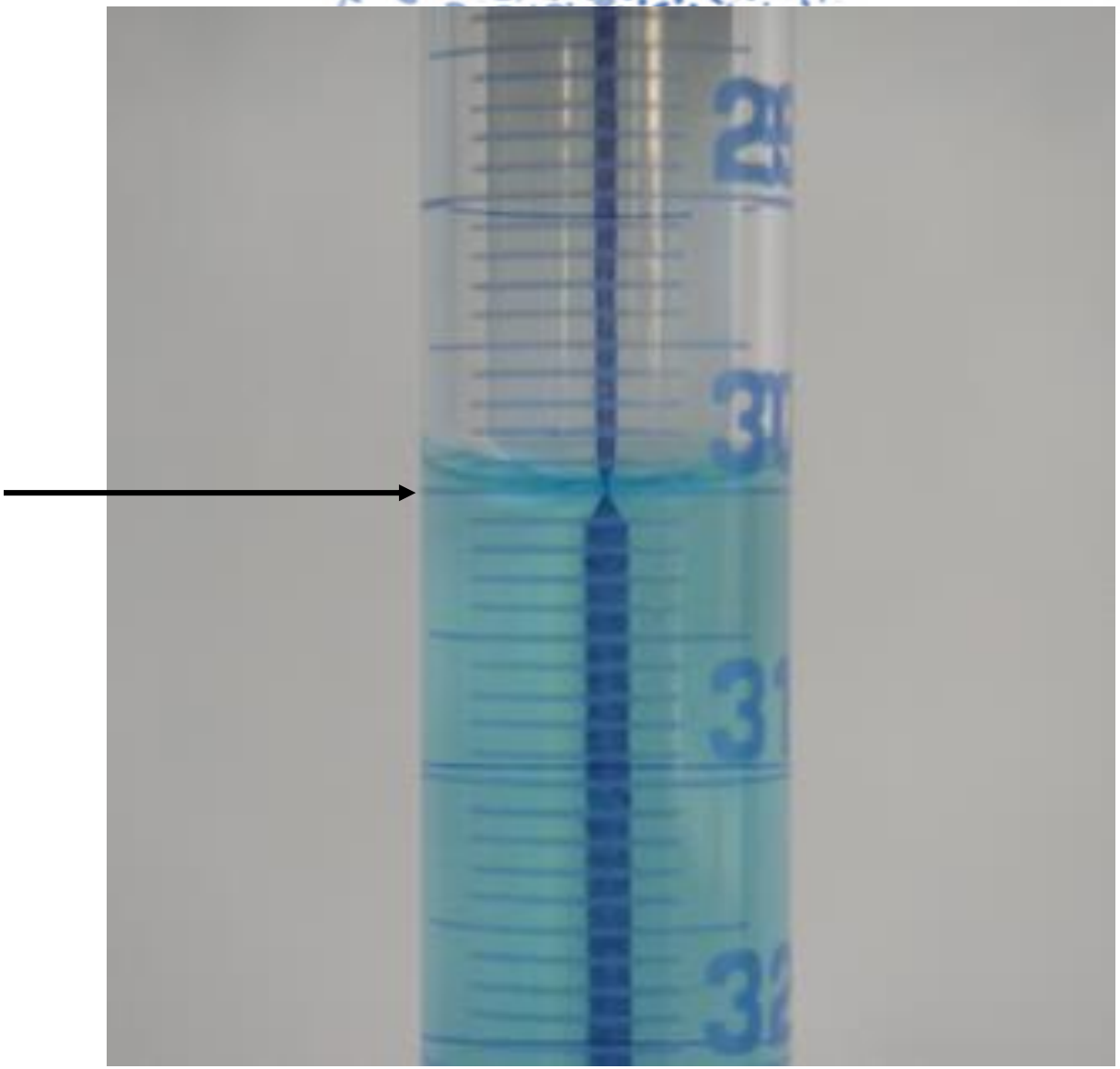
As well as recording the number what must we also record?

Where do we look from when reading measuring cylinders and pipettes?

Why is the surface of the liquid not flat?

Measuring volume

Water is a liquid that “sticks together”. In a narrow tube or measuring cylinder the water surface tends to curve up the sides. This is called a **meniscus curve**. A measurement reading is to be taken from the **bottom** of the meniscus curve because only a very small volume of liquid is actually around the side.



Collecting Data

Data that is collected from an investigation can be analysed (in order to explain and interpret it) easier if placed into a clearly labelled and laid out **data table**. The left column is the data of the variable (factor) that you are changing. The right hand side columns are for the data of the variables you are measuring.

The table must have:

- ❑ **A heading linked to the aim**
- ❑ Labelled quantities, units and symbo
- ❑ Values (often numerical) of data collected

Data tables can also contain **processed data** such as results from multiple trials that have been averaged to give a more reliable value.

Data Collected

This is chart of the numerical data collected in my experiment…

Independent Variable (This is the *one thing I changed in my experiment.*)	Trial 1	Trial 2	Trial 3	Average (Add the three trials together and divide by three.)

Processing Data - Averaging

When collecting and measuring data in investigations, such as that for calculating speed, errors can occur. This may be due to the measuring instrument and the way it is used. Data can also be recorded incorrectly.
Repeating the investigation a number of times and averaging out the measurements can help reduce random errors and **increase reliability.** This value is called the **mean**.

The mean is the most common measure of average.
To calculate the mean add the numbers together and divide the total by the amount of numbers:
Mean = sum of numbers ÷ amount of numbers

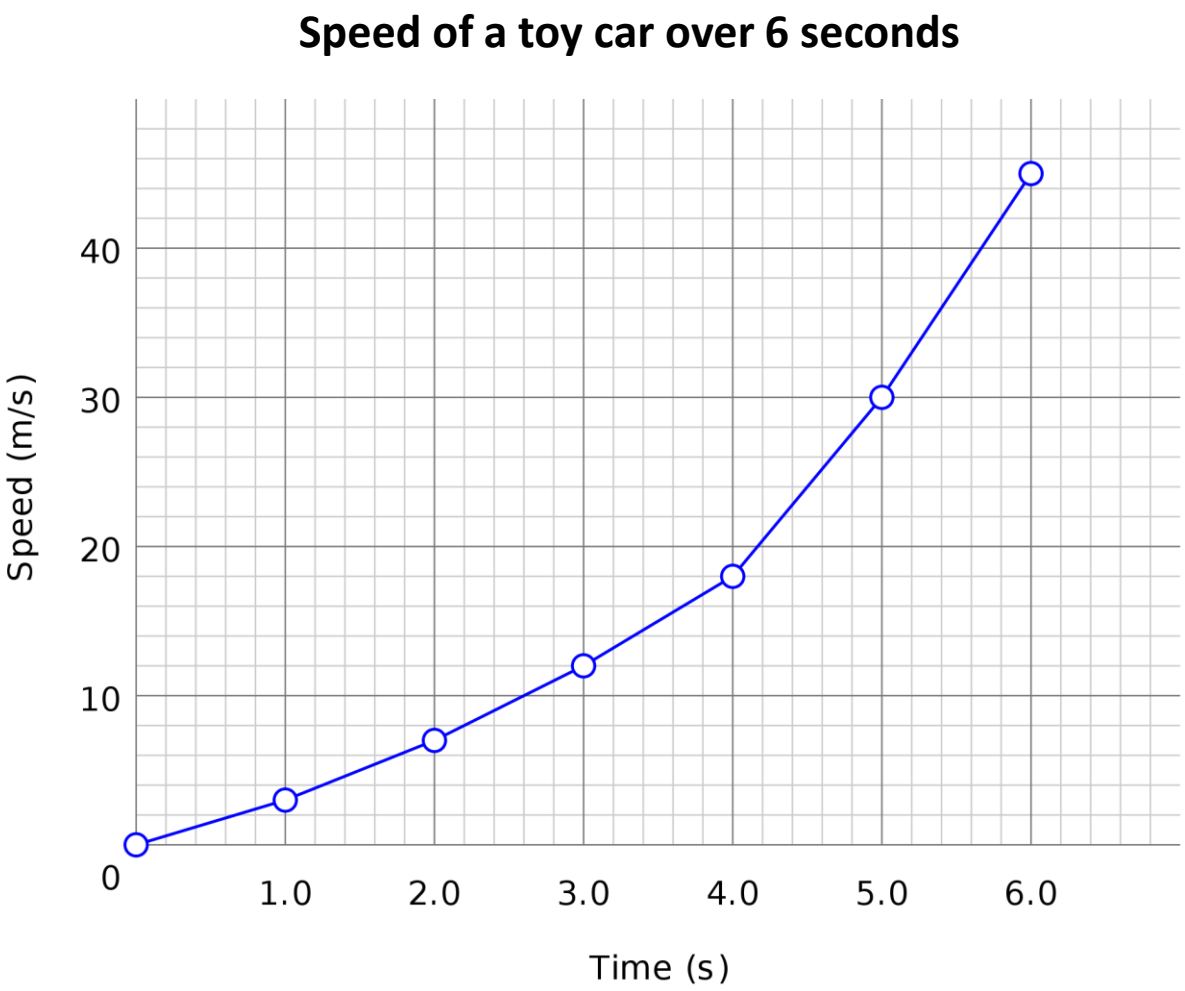
Distance walked in 1 minute

	Trial 1	Trial 2	Trial 3
Distance (m)	113	121	119

Mean = (113 + 121 + 119) **÷ 3**
= 117.7 m

Drawing a line Graph

Graphs are used to show patterns in data more easily than a data table. Often processed (averaged) data is used.



A well-drawn line graph must have the following features:

- ❑ A suitable heading
- ❑ Evenly spaced numbered axes
- ❑ Labels with units
- ❑ Correctly plotted line.

Use the acronym SALT when plotting graphs:
Scales **A**xes **L**abelling **T**itle