



Image by brgfx

## 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.

A cartoon illustration of a science laboratory. On the left, a Bunsen burner is lit and heating a test tube held by a clamp on a stand. The test tube contains a red liquid. In the center, there are two racks of test tubes containing various colored liquids (blue, green, yellow, orange, pink, purple). To the right, there are several beakers and flasks containing liquids of different colors (yellow, orange, blue, pink). A boy with brown hair, wearing a yellow shirt, black shorts, and large safety goggles, is standing on the right side of the illustration, pointing towards the text. The background is a solid purple color.

## Observation and Inference 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.

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.

## Laboratory Rules

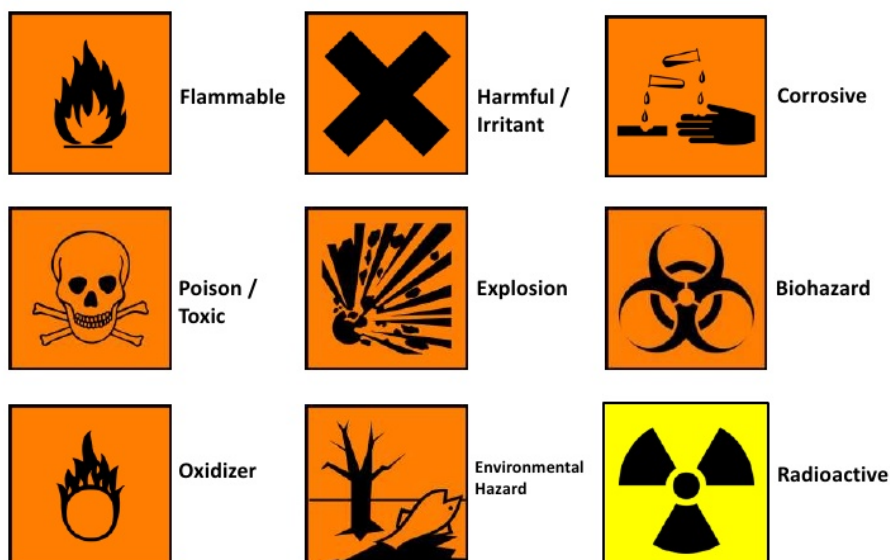
A School Science Laboratory can be a fun place that allows you to investigate and observe Science taking place. It can also be a dangerous place if rules are not followed. To protect yourself and the classroom from harm we need to follow School Lab Rules carefully each time we are in the class or taking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

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



## Laboratory safety symbols

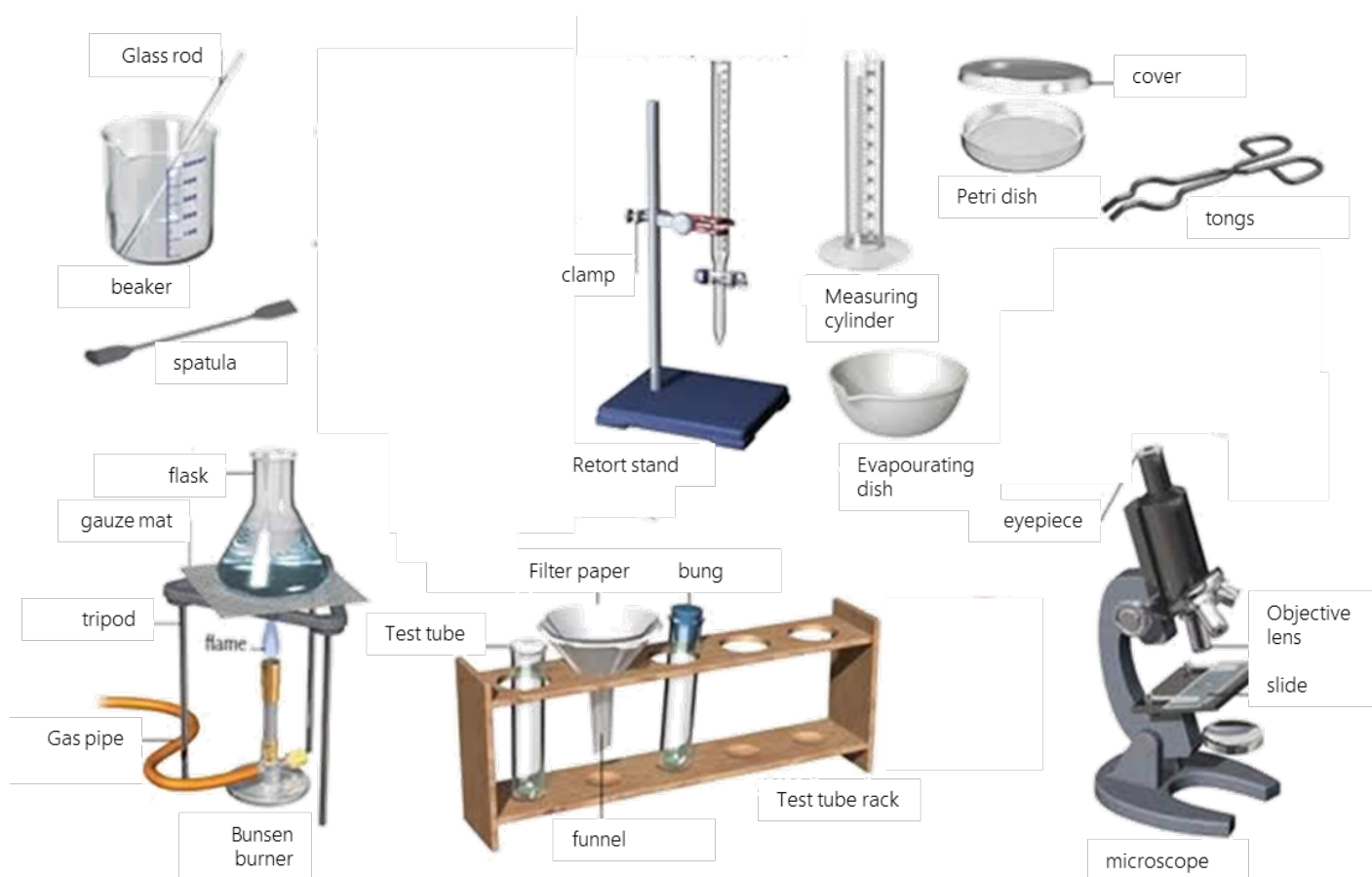
Easy to recognise safety Hazchem symbols are often used in Labs and on labels of chemicals when special care is required. A chemical may be poisonous or be explosive or burn when it touches skin. Safety symbols and Lab rules are designed to warn and protect you from dangerous situations.



## Common Laboratory equipment

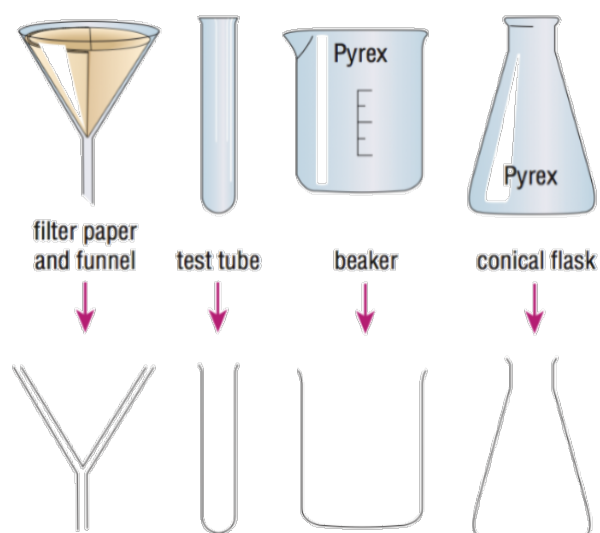
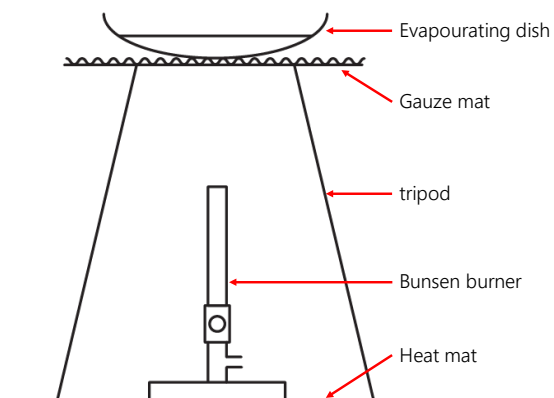
Science labs contain equipment that are used to carry out investigations and experiments. This equipment may be quite different from what we have in our homes, but it is often designed for specific uses.

The names and uses of the equipment will need to be learnt along with how to use it.



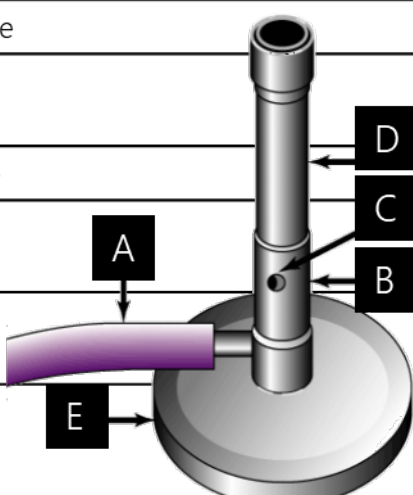
## Drawing equipment in Science

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



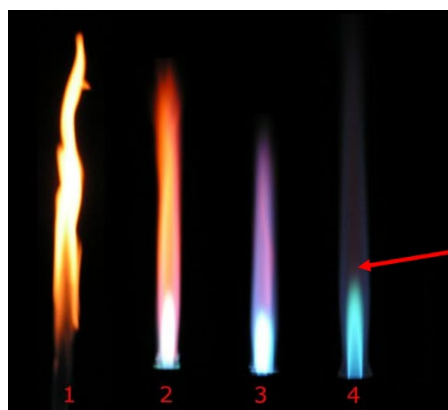
## The Bunsen Burner

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

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. When lighting, open the airhole a little to start with a cooler flame. Then open the air hole more (2-4), and the flame becomes bluer and hotter. The best flame to use is (4) with the air hole mostly open.

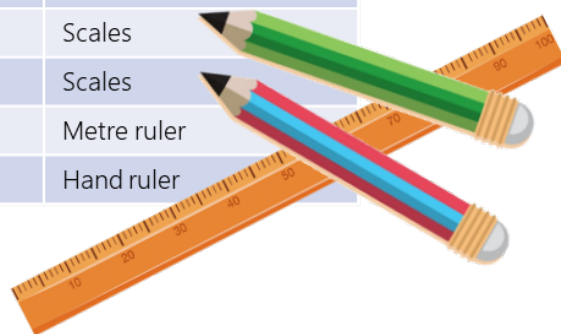


When using the Bunsen Burner to heat boiling tubes etc place it at the hottest place at the top of the bright blue flame.

## 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 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.

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



## 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 symbols
- ☐ 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 <small>(This is the one thing I changed in my experiment.)</small>	Trial 1	Trial 2	Trial 3	Average <small>(Add the three trials together and divide by three.)</small>

	A	B	C	D	E
1		Bears	Dolphins	Whales	
2	2017	8	150	80	
3	2018	54	77	54	
4	2019	93	32	100	
5	2020	116	11	76	
6	2021	137	6	93	
7	2022	184	1	72	
8					

## 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**.

### Distance walked in 1 minute

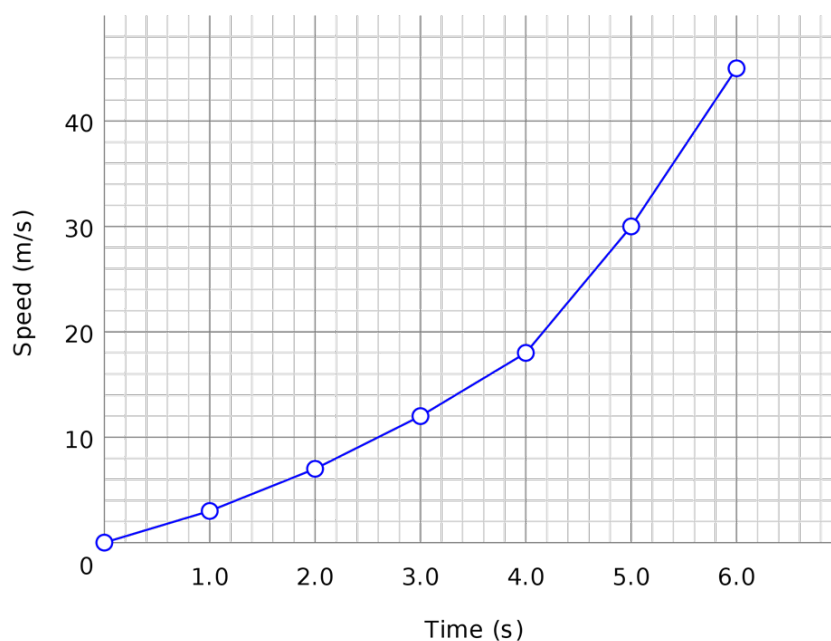
	Trial 1	Trial 2	Trial 3
Distance (m)	113	121	119

$$\text{Mean} = (113 + 121 + 119) \div 3 \\ = 117.7 \text{ m}$$

## Drawing a line Graph

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

### Speed of a toy car over 6 seconds

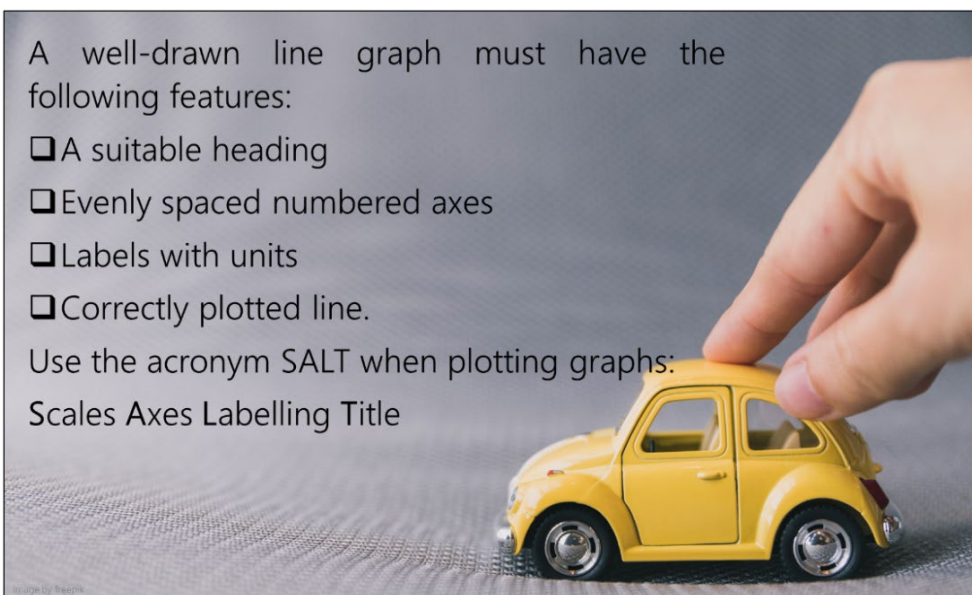


A well-drawn line graph must have the following features:

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

Use the acronym SALT when plotting graphs:

Scales Axes Labelling Title







1. Use the picture to Identify the following statements as either Observation or Inference (tick box)



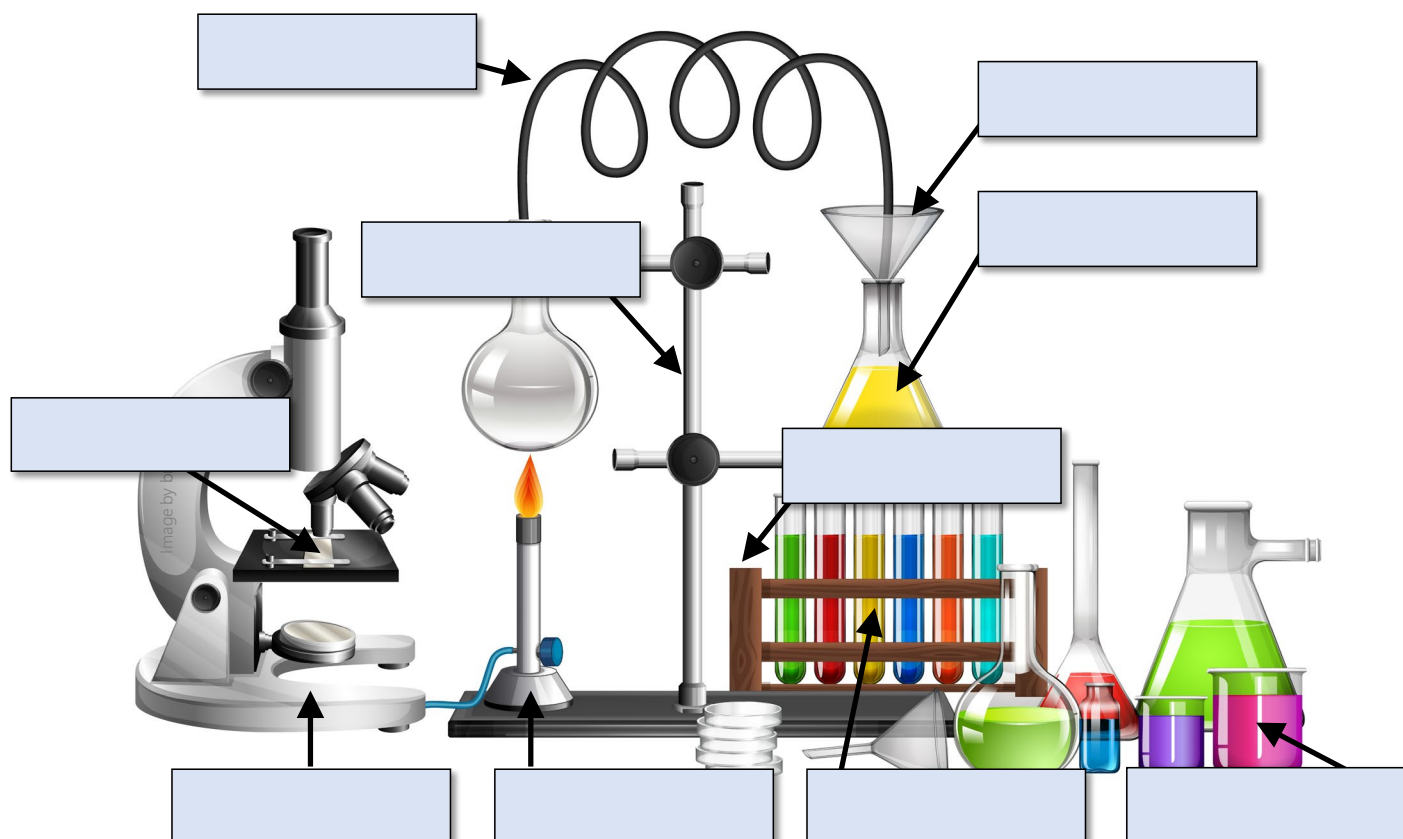
Statement	Observation	Inference
The two dinosaurs have noticed each other		
The volcano is erupting close to the dinosaurs		
The T Rex was about to attack the triceratops, who was going stay and defend itself		
Predator dinosaurs like the T Rex have sharp teeth to help them rip meat from their prey		
The erupting volcano will disrupt the T Rex and allow the triceratops to escape		
The triceratops lives in a dangerous environment		

2. Match the following laboratory safety symbols with their labels

<i>Radioactive</i>	<i>environmental hazard</i>	<i>harmful/irritant</i>	<i>poison/toxic</i>	<i>flammable</i>
	<i>Biohazard</i>	<i>explosion</i>	<i>corrosive</i>	<i>oxidizer</i>



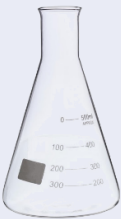





3. Identify the following lab equipment

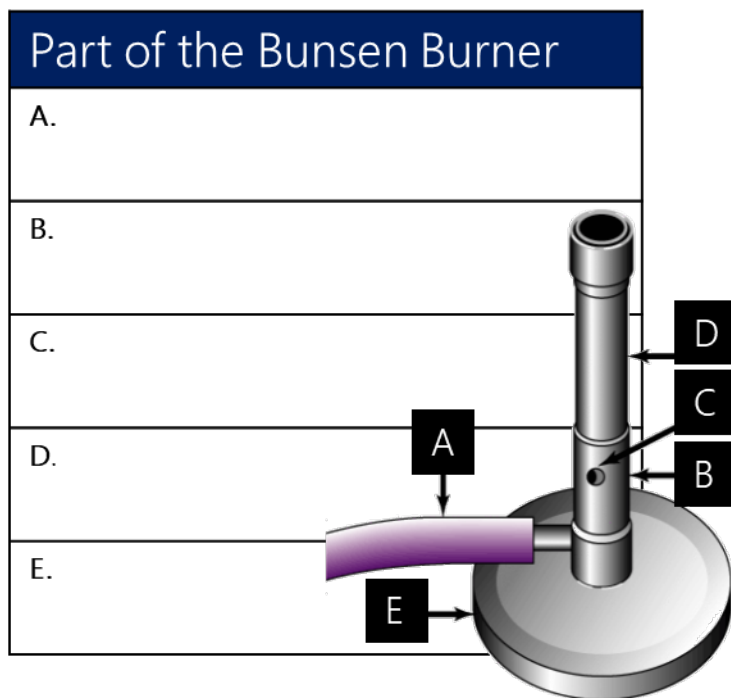


Test tube    Bunsen Burner    conical flask    funnel    slide    Test tube rack  
Beaker    delivery tube    retort stand    microscope

4. Complete the table below to draw **scientific diagrams** of the following laboratory equipment

Laboratory Equipment	Scientific Drawing	Laboratory Equipment	Scientific Drawing
Beaker 		Bunsen burner 	
Conical flask 		funnel 	
Test tube 		tripod 	

4. Label the following parts of the Bunsen burner



6. a. Which colour flame is the hottest from the Bunsen burner?

b. Explain the steps required to set up a Bunsen burner with this colour flame

7. Fill in missing units, symbols and Equipment used

Quantity	Unit	Symbol	Equipment used
Volume		L	flask
	millilitre		measuring cylinder
Temperature	Celsius	°C	
Mass	kilograms		Scales
		g	Scales
Length	Metres		Metre ruler
		mm	Hand ruler



8. A student was in charge of writing down the temperature measurements from a melting ice investigation. He roughly wrote them down on paper.

Use them to complete the data table provided in their workbooks – and give the table a heading.

Water temperature (°C) taken every 30 seconds

- 4	- 44	- 98
- 6	- 56	- 100
- 11	- 67	- 100
- 16	- 78	
- 23	- 93	
- 32	- 96	

Time (min)			
0		4.5	
0.5		5.0	
1.0			
		6.0	
2.0		6.5	
2.5			
4.0			