Scientific Method, Apparatus, Data

Question 1: List and explain all the steps of the Scientific Method

(There are many variations taught for the Scientific Method - list what you have been taught at school.)

Step	Name	Explanation
1		
2		
3		
4		
5		
6		
7		

Scientific Method, Apparatus, Data

Understanding variables in scientific experiments and data sets:

Variables are things that can change. In Science there are three types of variables: Dependent variables, Independent variables and Controlled/Fixed variables.
When a scientific experiment is done or if scientific data is collected and analysed, these variables play a very important role.
All scientific experiments start with an aim or a question, e.g.

Does the colour of the roof of a house, influence the temperature inside the house?

Independent variable: Which variable will change in my experiment? **[WHAT CHANGES?]**
In the example given it will be the different colours used to paint the roofs of a number of houses.

Dependent variable: What will I measure? **[WHAT IS MEASURED?]**
Remember the dependent variable DEPENDS on the independent variable.
In the example given the temperatures measured in each of the houses will be the dependent variable.

Controlled/Fixed variable: Which variables will stay the same? **[WHAT STAYS THE SAME?]**
For any experiment to be a **FAIR TEST**, all the other variables must stay the same.
In the example give the controlled variables can be that the temperature should be measured at exactly the same time of the day, the houses should be of exactly the same size and all the houses should be exposed to the same amount of sunshine.

Question 1: *Read the following experiment and answer the questions which follow:*

The children in the Science Class have to measure the time it takes for an ice cube to melt in water of different temperatures. Each group has five ice cubes that will be placed, with forceps, in a different glass beaker with temperatures of 0° Celsius, 25° Celsius, 50° Celsius, 75° Celsius and 100° Celsius. The temperature in each glass beaker has to be measured before inserting the ice cube. They then have to measure the time it takes for the ice cube to completely dissolve in the water.

1.1 What is the aim of this experiment? (2)

_____

_____

1.2 Formulate a hypothesis for this experiment. (2)

_____

_____

1.3 Specify the variables: (3)

Independent variable: _____

Dependent variable: _____

Controlled variable: _____

_____

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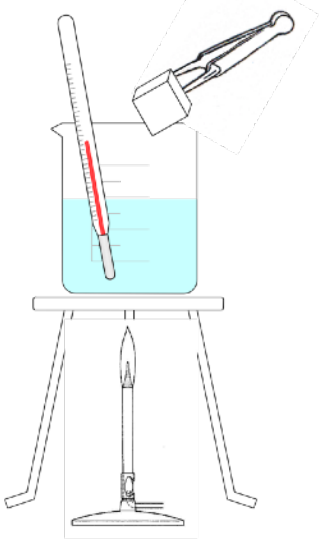
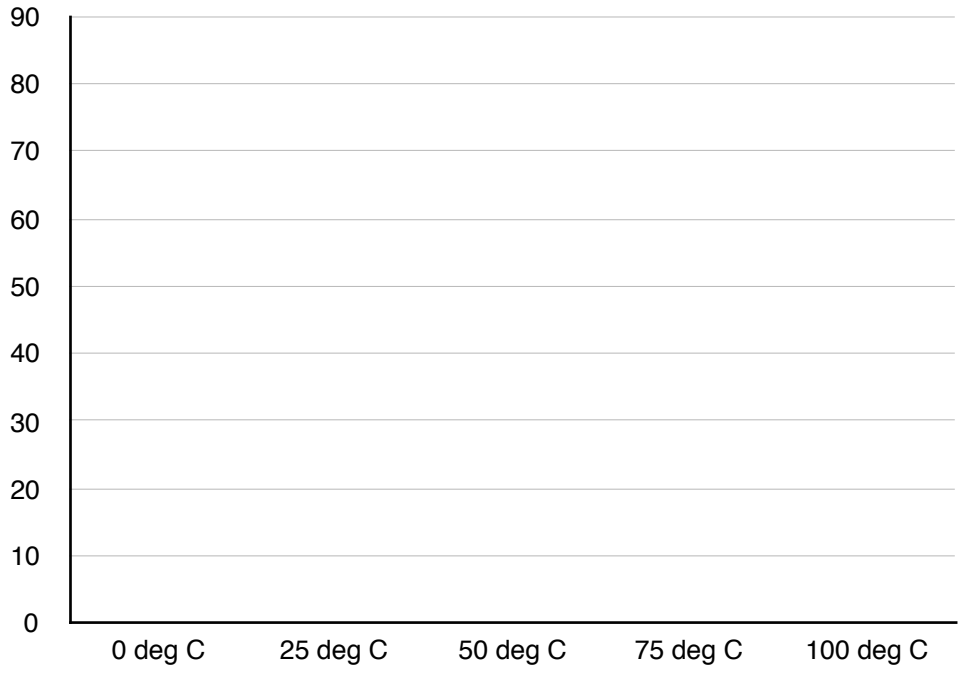
1.4 Label the diagram of the experiment below: (7)



1.5 The following results were observed:

	0° Celsius	25° Celsius	50° Celsius	75° Celsius	100° Celsius
Beaker 1	85 seconds				
Beaker 2		45 seconds			
Beaker 3			20 seconds		
Beaker 4				15 seconds	
Beaker 5					10 seconds

1.6 Draw a bar graph below, showing the results of the experiment. (8)
Label the axis and give the graph a heading.



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Question 2: *Experiment*

An experiment was done to find out which liquid used for watering a plant, will result in the best growth. Four plants of the same type and roughly the same size were planted in four identical plant pots with equal amounts of the same soil. Each pot was watered with the same amount of either tap water, river water, salt water or carbonated water every day for 2 weeks. The length of each plant was measured before the experiment and then at the end of the 2 weeks.

2.1. List the six steps of the Scientific Method. Use the experiment above to complete the explanation column. (8)

Step	Explanation
1.	
2. Research	Research can be done on the Internet to find information on the influence of water quality on plant growth.
3.	
4. Experiment	
5.	The plant watered with salt water stopped growing and quickly died. The plant watered with carbonated water grew a little and then also died. The plants watered with tap water and river water continued to grow and the plant watered with river water grew the most in the two weeks.
6. Conclusion	

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2.2 Identify the variables: (3)

Dependent variables: _____

_____

Independent variables: _____

_____

Controlled variables: _____

_____

2.3 Give one other variable that can also influence the outcome of this experiment. (1)

_____

_____

Question 3. *Complete the table below:* ½ each (4)

Use	Name	Image
To produce a heat flame to heat experiments, use a _____		
To investigate specimens or for the evaporation of small amounts of liquid, use a _____		
To measure millilitres and litres accurately for experiments, use a _____		
To hold small amounts of liquids for heating and evaporation, use an _____		

Scientific Method, Apparatus, Data

Question 4: *Experiment*

An experiment was done with different light bulbs to see which type of light bulb has the longest lifespan. All the light bulbs were fixed to the same type of lamp and monitored. The following results were recorded:

The Incandescent bulb lasted for 1 500 hours, the CFL (Compact Fluorescent Light) bulb lasted for 10 000 hours, the Halogen bulb lasted for 1 000 hours and the LED (Light-Emitting Diode) bulb lasted for 50 000 hours.

Type of light bulb	**Number of Hours lasted**
Incandescent	1 200 hrs
CFL	10 000 hrs
Halogen	1 000 hrs
LED	50 000 hrs

4.1 Formulate a scientific question for the experiment. (2)

_____

_____

4.2 What is the fixed or constant variable in this experiment? (1)

_____

4.3 Which variable is measured (dependent variable)? (1)

_____

4.4 Which variable is changed (independent variable)? (1)

_____

4.5 After analysing the data, write a conclusion for this experiment. (3)

_____

_____

_____

MEMO:

Question 1: List and explain all the steps of the Scientific Method

(There are many variations taught for the Scientific Method - list what you have been taught at school. This is a more comprehensive and detailed version.)

Step	Name	Explanation
1	Problem or Question	The scientific method starts when you ask a question about something that you observe: How, What, When, Who, Which, Why, or Where?
2	Gather information	Rather than starting from scratch in putting together a plan for answering your question, you want to use the library and Internet research to help you find the best way to do things and insure that you don't repeat mistakes from the past.
3	Hypothesis	A hypothesis is an educated guess about how things work. It is an attempt to answer your question with an explanation that can be tested. A good hypothesis allows you to then make a prediction: "If _____*[I do this]* _____, then _____*[this]*_____ will happen." State both your hypothesis and the resulting prediction you will be testing. Predictions must be easy to measure.
4	Experiment	Your experiment tests whether your prediction is accurate and thus your hypothesis is supported or not. It is important for your experiment to be a fair test. You conduct a fair test by making sure that you change only one factor at a time while keeping all other conditions the same. You should also repeat your experiments several times to make sure that the first results weren't just an accident.
5	Gather and analyse data	Once your experiment is complete, you collect your measurements and analyse them to see if they support your hypothesis or not.
6	Conclusion	After analysing the data and measurements, a conclusion is made and scientists decide if the hypothesis was correct or not. Scientists often find that their predictions were not accurate and their hypothesis was not supported, and in such cases they will communicate the results of their experiment and then go back and construct a new hypothesis and prediction based on the information they learned during their experiment. This starts much of the process of the scientific method over again.
7	Communication	To complete an experiment, the results have to be communicated in a scientific report or in a scientific meeting.

MEMO:

Question 1: *Read the following experiment and answer the questions which follow:*

The children in the Science class have to measure the time it takes for an ice cube to melt in water of different temperatures. Each group has five ice cubes that will be placed, with forceps, in a different glass beaker with temperatures of 0° Celsius, 25° Celsius, 50° Celsius, 75° Celsius and 100° Celsius. The temperature in each glass beaker has to be measured before inserting the ice cube. They then have to measure the time it takes for the ice cube to completely dissolve in the water.

1.1 What is the aim of this experiment? (2)

The aim is to determine the time it will take for an ice cube to completely dissolve in water of different temperatures.

1.2 Formulate a hypothesis for this experiment. (2)

The ice cube should dissolve very quickly in the water with the highest temperature and it will take the longest time to dissolve in the water with the lowest temperature.

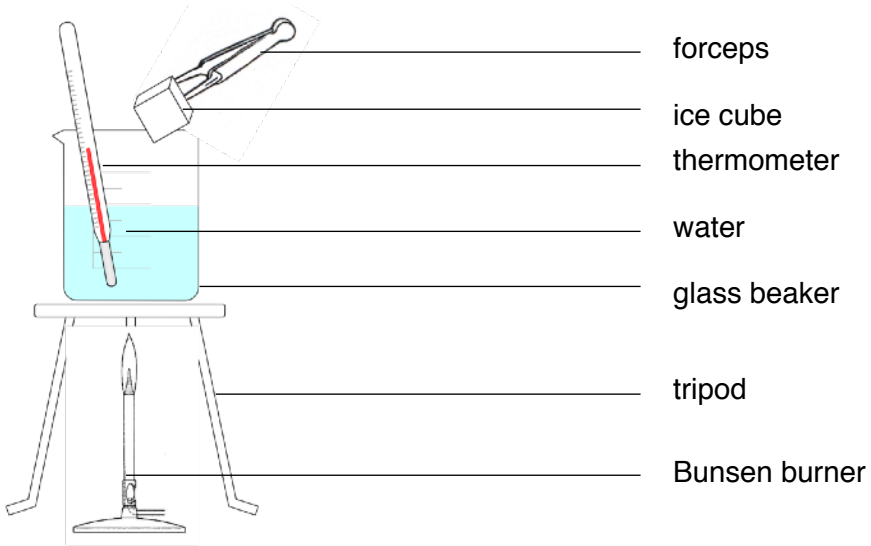
1.3 Specify the variables: (3)

Independent variable: [WHAT CHANGES?] The different temperatures of the water in each of the glass beakers.

Dependent variable: [WHAT IS MEASURED?] The time measured for each ice cube to melt.

Controlled variable: [WHAT STAYS THE SAME?] The same amount of water in each glass beaker. The ice cubes should all be exactly the same size.

1.4 Label the diagram of the experiment below: (7)



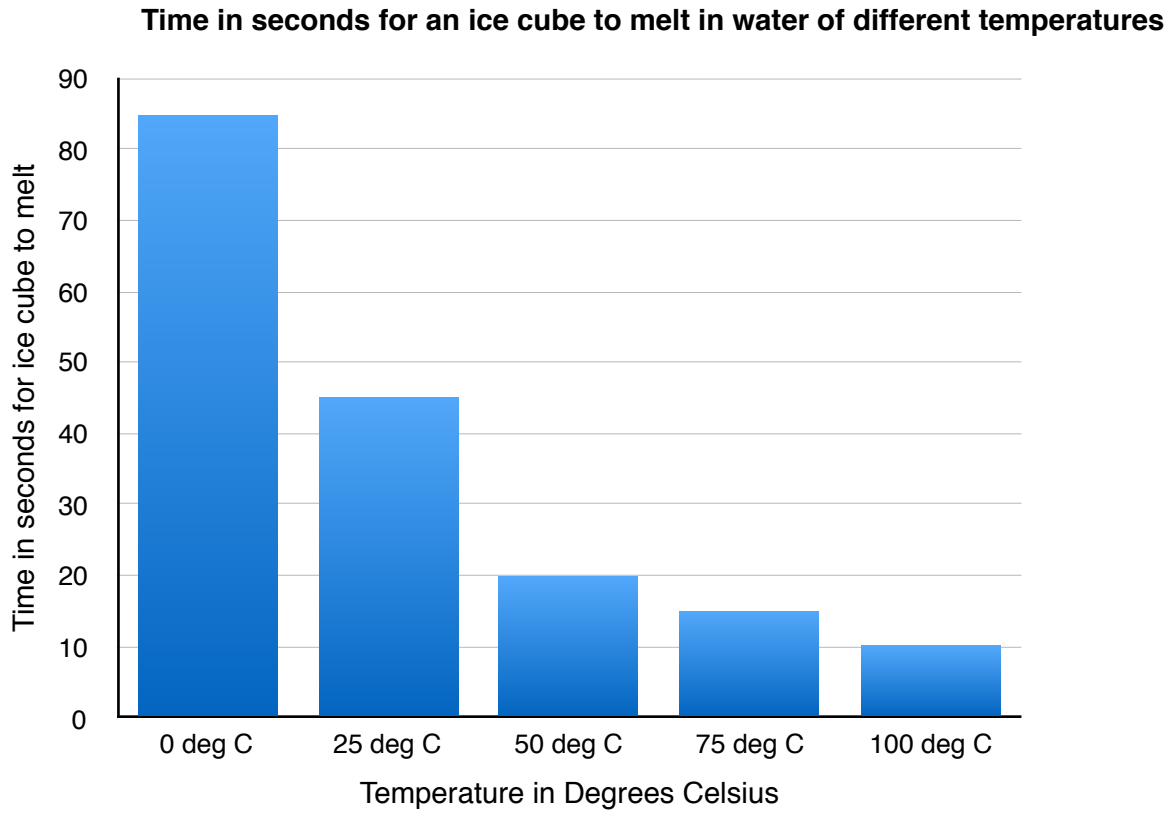
MEMO:

1.5 The following results were observed:

	0º Celsius	25º Celsius	50º Celsius	75º Celsius	100º Celsius
Beaker 1	85 seconds				
Beaker 2		45 seconds			
Beaker 3			20 seconds		
Beaker 4				15 seconds	
Beaker 5					10 seconds

1.6 Draw a bar graph below, showing the results of the experiment. (8)

Label the axis and give the graph a heading.



Question 2: *Experiment*

An experiment was done to find out in which liquid a plant would grow the best. Four plants of the same type and roughly the same size were planted in four identical plant pots with equal amounts of the same soil. Each pot was watered by the same amount of either tap water, river water, salt water or carbonated water every day for 2 weeks. The length of each plant was measured before the experiment and then at the end of the 2 weeks.

2.1. List the six steps of the Scientific Method. Use the experiment above to complete the explanation column.

MEMO:

Step	Explanation
1. Aim/ Question	The aim of this experiment is to determine how various liquids (tap water, salt water, river water or carbonated water) affect plant growth. Question: Does the type of liquid with which a plant is watered affect the growth of the plant?
2. Research	Research can be done on the Internet to find information on the influence of water quality on plant growth.
3. Hypothesis	If the plant is watered with river water, then the plant will grow the fastest.
4. Experiment	1. Plant four plants of the same type and size into four separate plant pots. 2. Pour equal amounts of the four different types of water into a measuring cylinder 3. Measure and document the length of each plant, using a measuring tape or ruler. 4. Water plants every day for 2 weeks. 5. Measure and document the length of each plant again.
5. Results	The plant watered with salt water stopped growing and quickly died. The plant watered with carbonated water grew a little and then also died. The plants given tap water and river water continued to grow and the plant watered with river water grew the most in the two weeks.
6. Conclusion	Plants cannot grow if given salt or carbonated water. Tap water has less nutrients than river water (clean river water). My hypothesis was correct, the plants grew the best in the river water.

2.2 Identify the variables: (3)

Dependent variable: The amount each plant grew in two weeks, measured in centimetres.

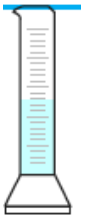
Independent variable: Four types of water used to water the plants; tap water, salt water, river water and carbonated water.

Controlled variables: Same type of plants of the same length, same soil and same sized pot and same amount of water given to each plant.

2.3 Give one other variable that can also influence the outcome of this experiment. (1)

Sunlight is required for all plants to grow. If all the plants were not exposed to the same amount or quality of sunlight, the results will be influenced.

Question 3: *Complete the table below:* ½ each (4)

Use	Name	Image
To produce a heat flame to heat experiments, use a _____	Bunsen Burner	
To investigate specimens or for the evaporation of small amounts of liquid, use a _____	watch glass	
To measure millilitres and litres accurately for experiments, use a _____	graduated/measuring cylinder	
To hold small amounts of liquids for heating and evaporation, use _____	evaporating dish	

Question 4: *Experiment*

An experiment was done with different light bulbs to see which type of light bulb has the longest lifespan. All the light bulbs were fixed to the same type of lamp and monitored. The following results were recorded:

The Incandescent bulb lasted for 1 500 hours, the CFL (Compact Fluorescent Light) bulb lasted for 10 000 hours, the Halogen bulb lasted for 1 000 hours and the LED (Light-Emitting Diode) bulb lasted for 50 000 hours.

4.1 Formulate a scientific question for the experiment. (2)

What type of light bulb has the longest lifespan? (What type of light bulb will last the longest?)

4.2 What is the fixed or constant variable in this experiment? (1)

The fixed or constant variable is the type of lamp that is used.

4.3 Which variable is measured (dependent variable)? (1)

The number of hours the light bulb will last is the dependent variable.

4.4 Which variable is changed (independent variable)? (1)

The different types of light bulbs used are the independent variables.

4.5 After analysing the data, write a conclusion for this experiment. (3)

The light bulb that lasted the longest was the LED light bulb that lasted 50 000 hours. The light bulb that lasted the shortest was the Halogen light bulb. If buying light bulbs, depending on the price, it would be best to buy LED light bulbs.