CHAPTER 3

CHAPTER 3

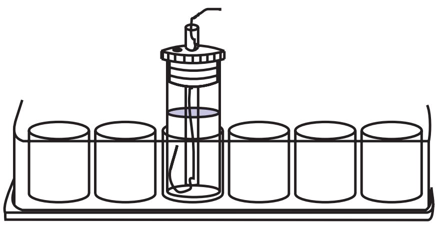
Activity 3.1 EVEN FLAMES NEED AIR TO KEEP GOING

Focus question: Why do veld fires become so uncontrollable during windy days?

You will need:

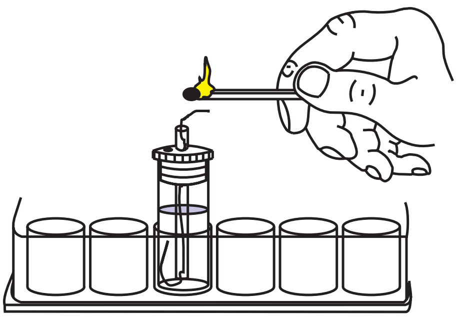
- 1 comboplate
- 1 microburner
- 1 sample vial
- matches

STEP 1



Assemble the microburner and put it into one of the large wells.

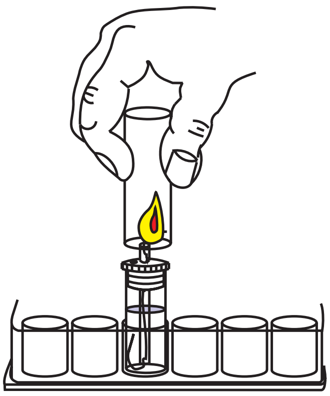
STEP 2



Light the microburner.

STEP 3

Cover the microburner with an inverted sample vial.



Answer the following questions :

Q1 What do you observe?

Q2 What was in the sample vial when you first placed it over the burner?

Q3 What causes things to burn?

Q4 What are you actually cutting out when you put the inverted sample vial over the microburner?

Q5 What things do you need to start a fire?

Q6 When making a fire for a 'braai', we normally use things like cardboard to fan the fire to resuscitate it. Why is this?

Q7 During windy days, veld fires are normally not easy to control. Why do you think this is the case?

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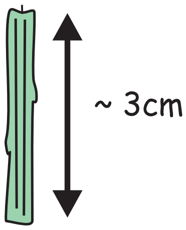
Activity 3.2 IS ALL THE AIR USED IN BURNING?

Focus question: Is it the whole part of air which is responsible for burning or is it some special part of air?

You will need:
- 1 Petri dish
- 1 large sample vial
- 1 birthday candle
- matches
- lime water (calcium hydroxide solution)

STEP 1

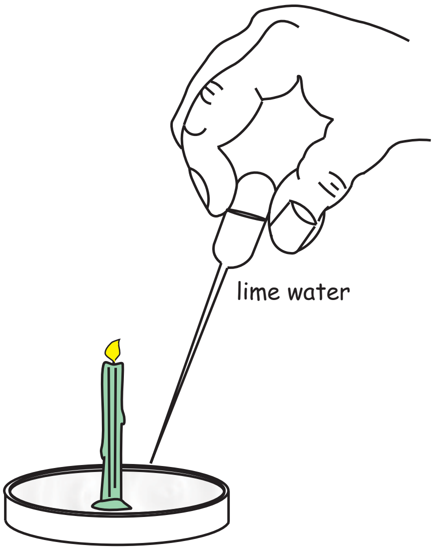


Shorten a birthday candle so that it is about 2.5 - 3 cm long.

STEP 2

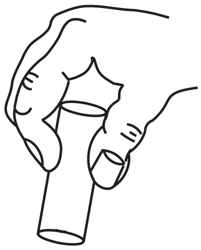
Light the candle and let some wax fall into the bottom of the Petri dish. Push the base of the candle into the wax to support it in the Petri dish.

STEP 3

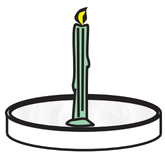


Fill the Petri dish almost to the rim with lime water.

STEP 4



Put the sample vial over the burning candle into the lime water. Note what happens.



Q1 Describe what happens.
Q2 Why does the candle stop burning?
Q3 Why does the water rise in the vial?
Q4 Where does the space which the water fills come from?
Q5 The water does not keep rising until the vial is filled. What stops the water from doing that?
Q6 What was in the vial before inverting it over the burning candle?
Q7 What does the colour of the lime water in the vial tell us?
Q8 Name three gases which are involved in this activity.
Q9 What roles are these gases playing in this activity?

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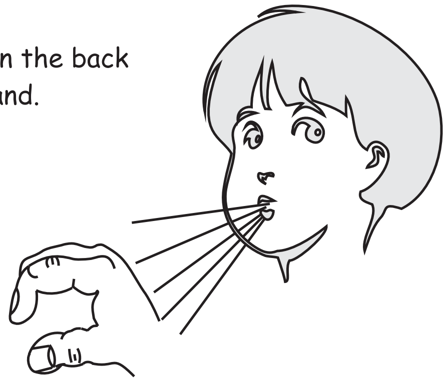
Activity 3.3 STUDYING MY BREATH

Focus question: Name things which are found in your breath

You will need:
- 1 comboplate
- 1 sample vial
- 1 straw (per 4 kits)
- 1 marker/pen
- 1 propette
- lime water
- a pair of scissors

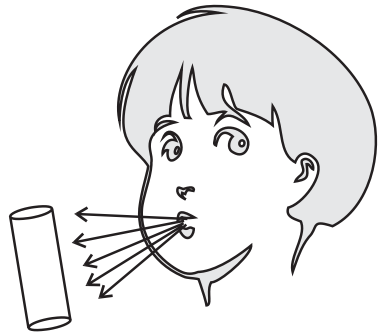
STEP 1

Breathe on the back of your hand.



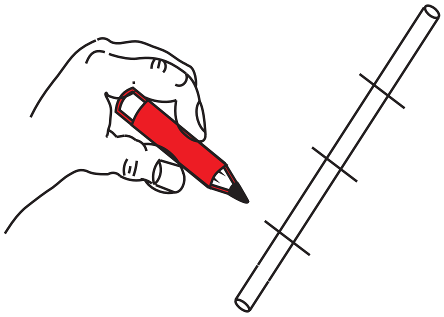
Q1 Explain how it feels.
Q2 Is your breath cold or warm?
Q3 Why is this?

STEP 2



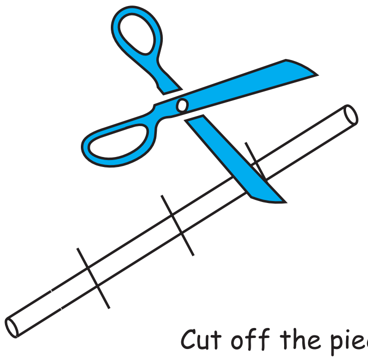
Take a sample vial and breathe onto its surface.
Q4 What do you see?
Q5 Is there water in your breath?

STEP 3



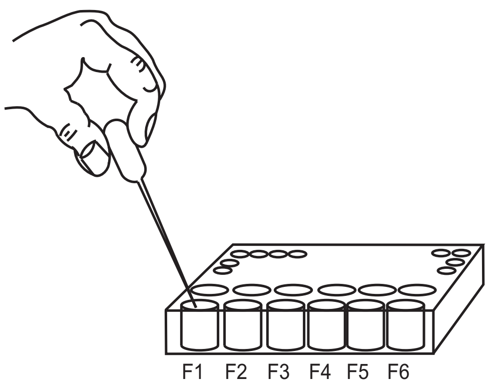
Share a straw with three of your friends by dividing the straw into 4 equal pieces using a marker (pen).

STEP 4



Cut off the pieces.

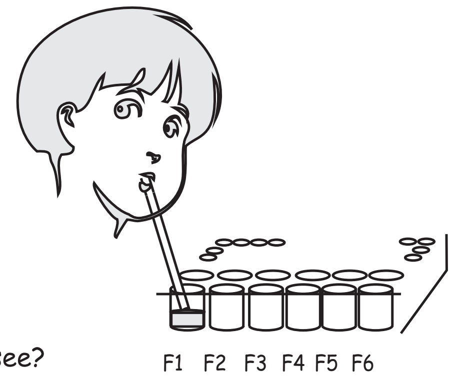
STEP 5



Half fill a large well of the comboplate with clear lime water.

STEP 6

Insert the piece of straw into the lime water and gently blow into it with your mouth.



Q6 What do you see?
Q7 Is your breath a mixture of gases or is it a liquid? Why?
Q8 What colour is the lime water after breathing into it?
Q9 Name four things you have noted about your breath in this activity.

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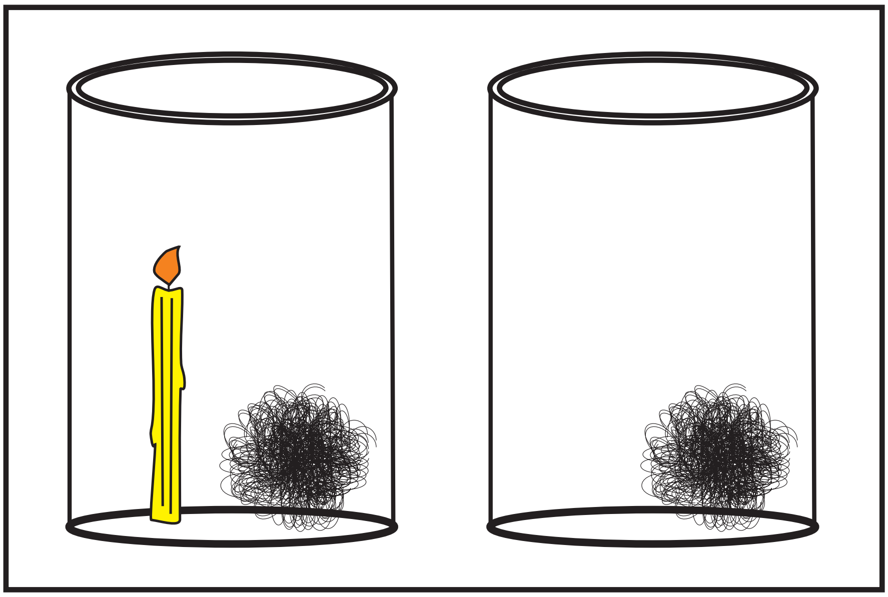
Activity 3.4 RUSTING AWAY

Focus Question: What causes rusting?

You will need:

- 1 propette
- matches
- 1 steel wool ball
- 1 birthday candle
- 2 glass containers with lids (e.g. jam jars)
- water



STEP 1

Wet the steel wool ball by spraying with water from the propette.

STEP 2

Divide the steel wool ball into two equal balls.

STEP 3

Light the birthday candle and use the melted wax drops to stick the candle inside the floor (towards the side) of one of the glass containers.

STEP 4

Place one steel wool ball inside this container and the other inside the other container.

STEP 5

Light the candle and seal both containers with their lids.

STEP 6

This candle will eventually go out.

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STEP 7

Observe what happens to the two steel wool balls over a period of two days.

Q1 What did you observe?

Q2 Why did this happen?

Q3 What does this activity show about the role of oxygen:

a) in rusting?

b) in combustion?

Q4 What are the similarities and the differences between these two chemical reactions (rusting and combustion)?

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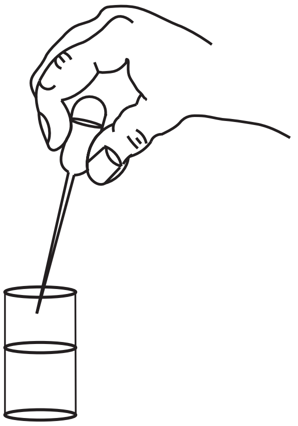
ACTIVITY 3.5 PRODUCTION AND TESTING OF CARBON DIOXIDE ON MY COMBOPLATE

1. Making enough lime water for five.

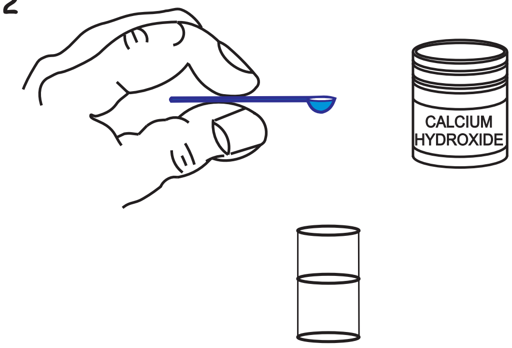
You will need
- 2 vials with lids
- propette
- microspatula
- microfunnel
- piece of cotton wool
- calcium hydroxide

STEP 1



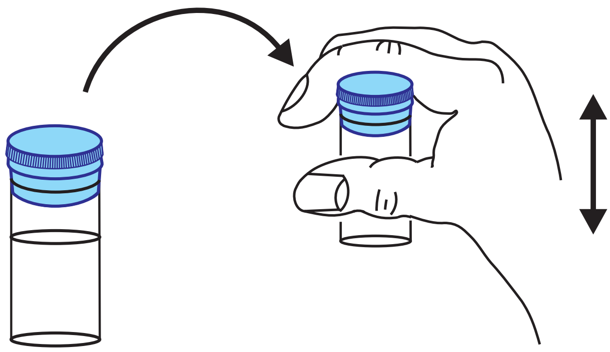
Use a propette to fill 2/3 of a sample vial with water.

STEP 2



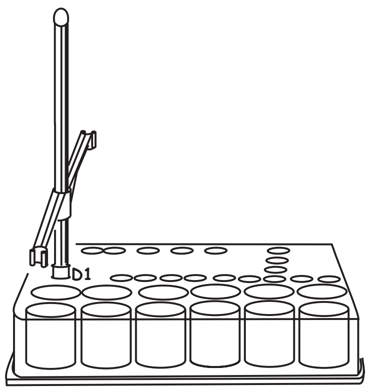
Add 8 microspatulas of calcium hydroxide and stir.

STEP 3



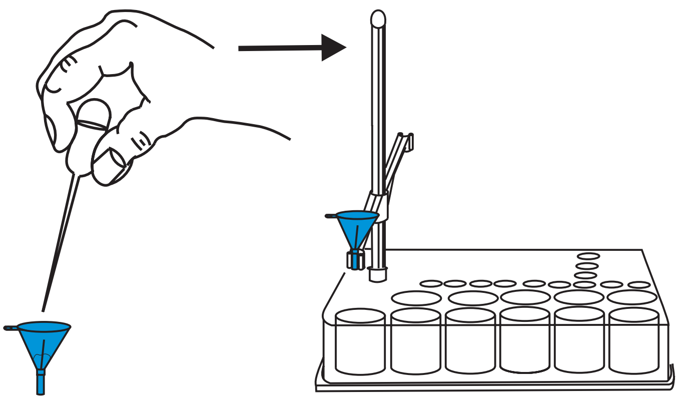
Close the lid and take turns to each give twenty shakes.

STEP 4



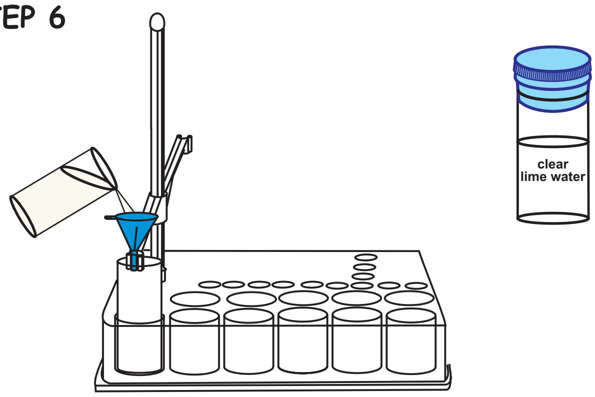
Insert the microstand into well D1 and lower the arm as shown in the picture.

STEP 5



Fit thick pieces of cotton wool into the microfunnel and spray it with few drops of water from a propette to make it wet. Clamp the microfunnel to the microstand arm.

STEP 6



Insert a vial into well F1 and move the microstand arm such that the funnel is directly above the vial. Pour the mixture in the vial carefully into the funnel. When filtration is complete, keep the vial containing the lime water closed.

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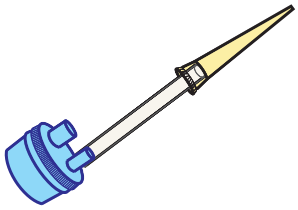
2. Preparing and testing of carbon dioxide:

You will need:

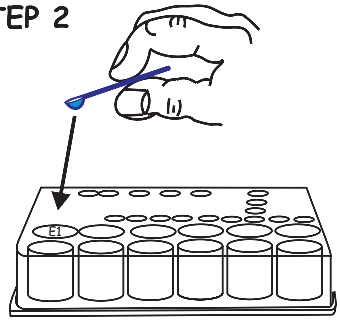
- comboplate
- lid 1
- syringe
- microspatula
- silicone tube
- plastic tip

STEP 1



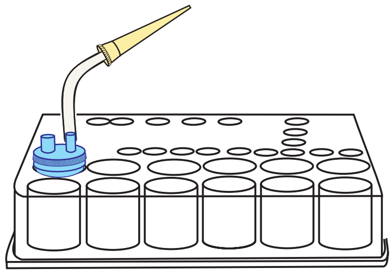
Fit one end of the silicone tube into the plastic tip firmly and the other end to the smaller opening of the lid.

STEP 2



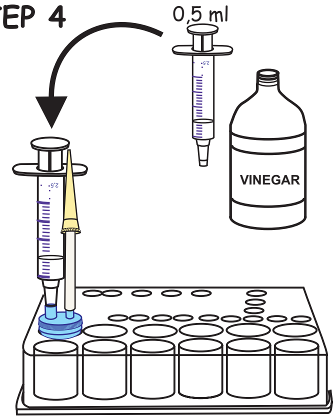
Add 4 microspatulas of sodium bicarbonate into well E1.

STEP 3



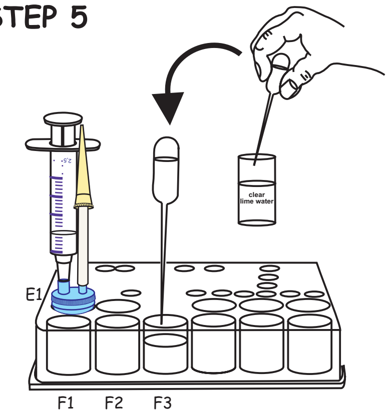
Use the lid in step 1 to close well E1.

STEP 4



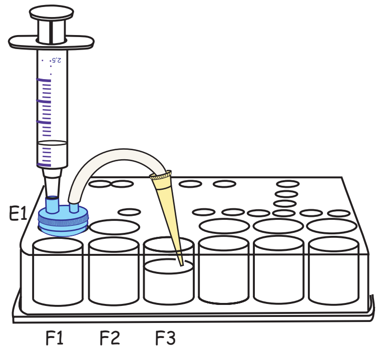
Draw 0.5 ml vinegar into the syringe and fit the syringe carefully into its inlet in the lid on well E1.

STEP 5



Use a propette to 2/3 of well F3 with the clear lime water you prepared.

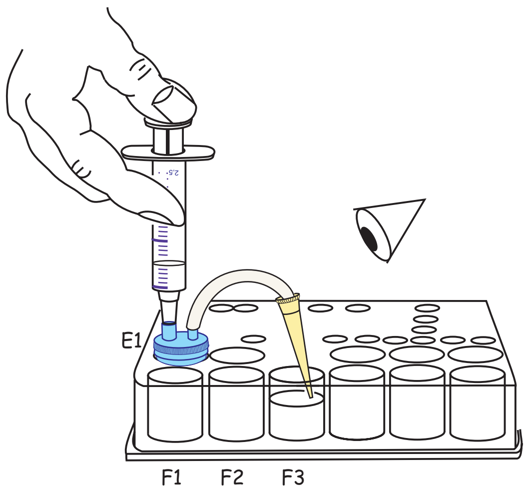
STEP 6



Insert the plastic tip into the lime water in well F3.

STEP 7

Release the vinegar slowly from the syringe making sure that the liquid from well E1 does not flow up the tube. Observe carefully what happens in well F3.



Answer the following questions:

Q1 What do you see?

Q2 What causes the bubbles?

Q3 Which gas causes clear lime water to turn milky?

Q4 What happens when you add vinegar to sodium bicarbonate?

Q5 Why do you think it’s important to keep lime water in a closed container?

Q6 Is there carbon dioxide in the air?

Q7 How do we test for carbon dioxide?

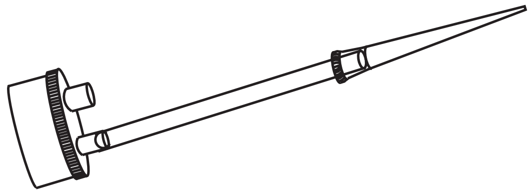
Activity 3.6 MY MICRO FIRE EXTINGUISHER

Focus question: What is inside the fire extinguishers hanging in our buildings?

You will need:

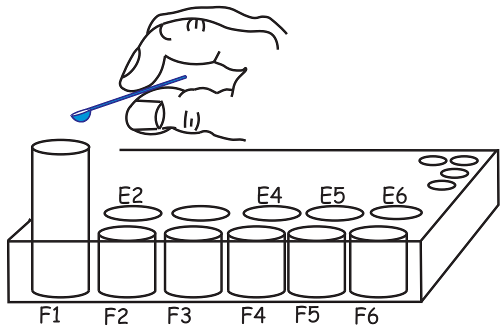
- 1 comboplate
- 1 x lid 1
- 1 syringe
- a plastic tip
- 1 small vial
- 1 microspatula
- 1 x 10 cm silicone tube
- vinegar
- sodium bicarbonate

STEP 1



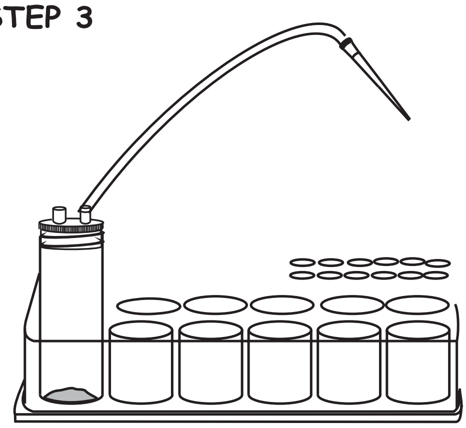
Fit one end of the silicone tube firmly into the plastic tip and the other end to the smaller opening of the lid.

STEP 2



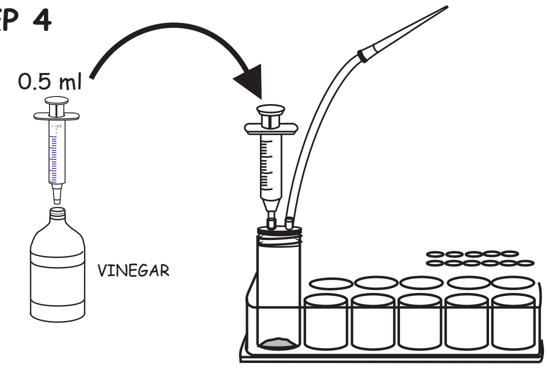
Add 10 microspatulas full of sodium bicarbonate into the vial in well F1.

STEP 3



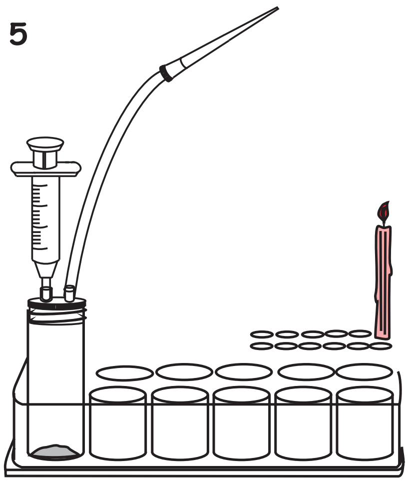
Use the lid in step 1 to close the vial.

STEP 4



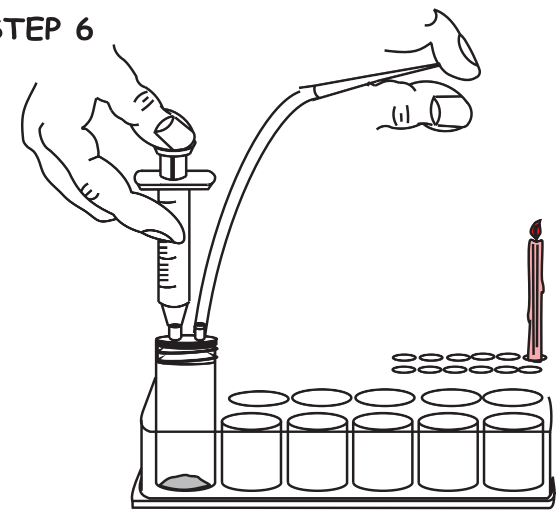
Draw 0.5 ml of vinegar into the syringe and fit the syringe carefully into the syringe inlet (the bigger hole) of the lid on the vial.

STEP 5



Insert a birthday candle into well A12 (small well) of the comboplate and light it. Make sure that the lid in F1 is tightly closed.

STEP 6



Release the vinegar slowly from the syringe with your left hand while blocking the end of the plastic tip with the index finger of your right hand.

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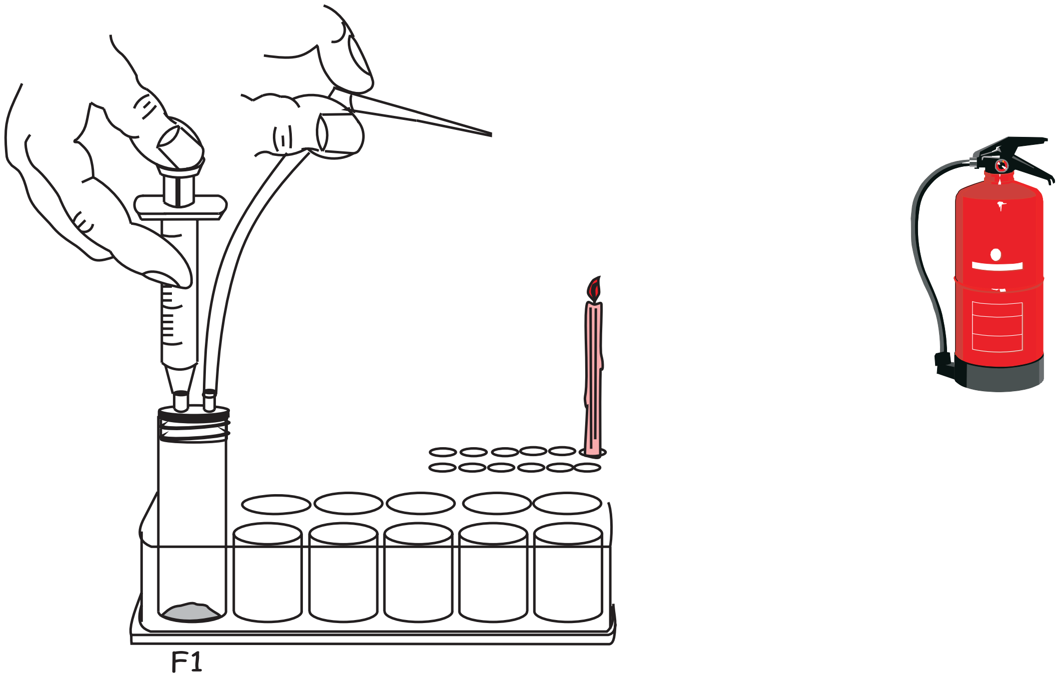
STEP 7



Point the plastic tip at the candle and remove your finger. (Take care that the tip is never in contact or too close to the flame.)

Q1 What happens?

Q2 What is the name of the gas that is formed when vinegar mixes with sodium bicarbonate?

Q3 What will happen if this gas is bubbled in clear lime water?

Q4 What is an acid and what is a base in this activity?

Q5 Does the gas produced in well F1 support combustion (burning) or not?

Q6 Can the principle behind the extinguisher you have made be used to put out huge fires?

Q7 What do you think is actually inside the fire extinguishers used in our everyday lives?

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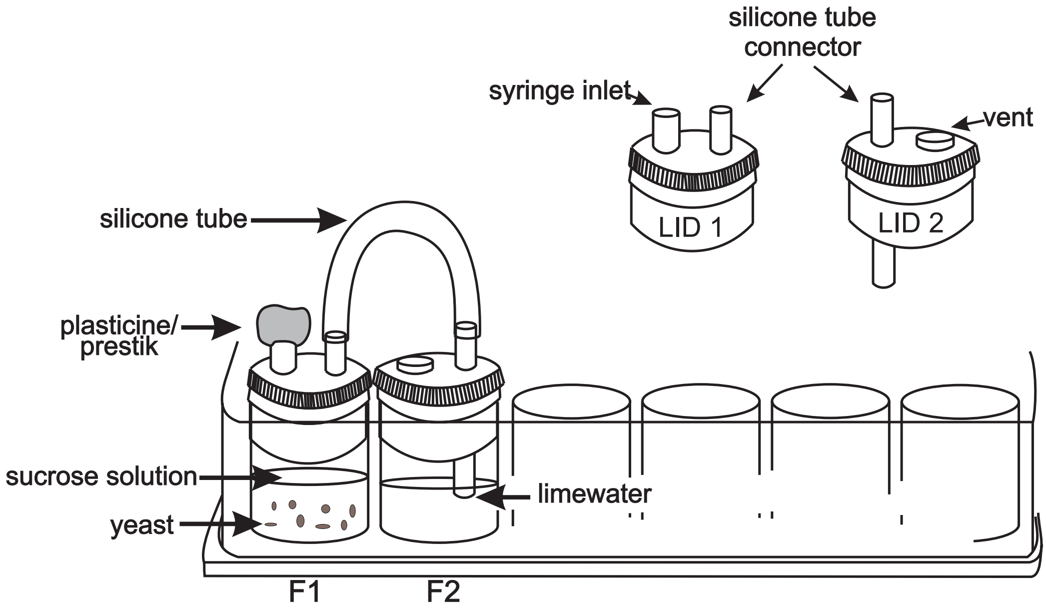
Activity 3.7 The Chemical Reactions In Bread Making

You will need:

•1 comboplate •1 syringe •1 propette •1 microspatula •lid 1
•lid 2 •1 silicone tube •sugar •yeast •prestik •warm water



What you need to do:

1. Put 5 microspatula scoops of sugar and 5 of yeast in well F1.
2. Push lid 1 securely into well F1 and attach one of the silicone tubes to the tube connector on the lid.
3. Use a propette to fill well F2 to $\frac{3}{4}$ with clear limewater and close the well securely with lid 2 as shown on the diagram.
4. Attach the other end of the silicone tube to the tube connector on lid 2.
5. Use a syringe to draw 1 ml of warm water and fit the syringe into lid 1 on well F1.
6. Add the warm water from the syringe into well F1, replace the syringe with a piece of prestik, and leave to stand while observing carefully what happens.

   a) What do you observe in well F1?
   b) What do you observe in well F2?
   c) What does the colour change of the lime water indicate?

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What happened in this activity is what happens in the process of bread making. The yeast respires with oxygen by feeding on the sugars and breaking them down into carbon dioxide and water. In bread making, this causes the dough to rise. Letting the dough stand in a warm place allows fermentation to proceed, therefore resulting in the dough rising. As you bake the bread in an oven, the yeast is killed and carbon dioxide expands, thus giving the bread a spongy texture.

As indicated in the picture below, carbon dioxide has many uses in our everyday lives. Study the pictures below and complete the table that follows.

Object in Picture	How is carbon dioxide involved?
Birthday cake	
Lit candle	
Coke	
Fire extinguisher	
Champagne	

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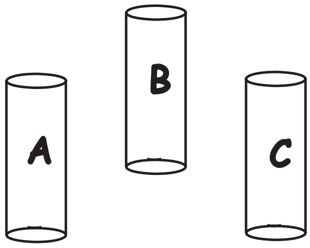
Activity 3.8 THE CASE OF THE DISAPPEARING SUGAR

Focus question: What happens to sand and sugar when mixed with water?

You will need:

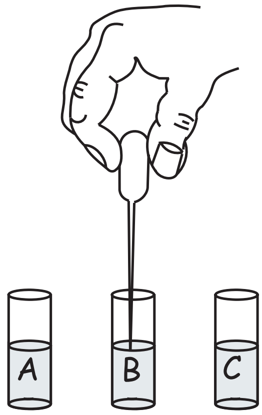
- 3 sample vials
- 2 microspatulas
- sugar
- water
- sand

STEP 1



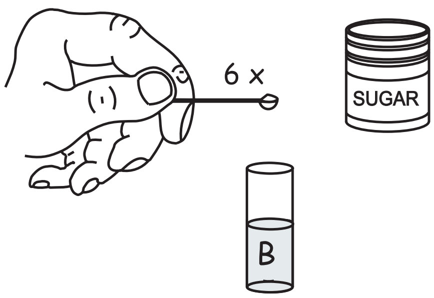
Label the one sample vial A, the second B and the third C.

STEP 2



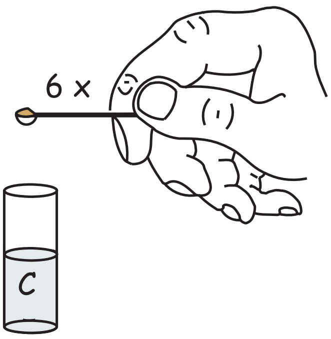
Fill 2/3 of each sample vial with water.

STEP 3



Add six microspatulas full of sugar into vial B and stir.

STEP 4



Add six microspatulas of sand into vial C and stir.

Q1 What has actually happened to the sugar?

Q2 Has the sugar gone or is it still there?

Q3 Can you tell the difference between the contents of vial A and vial B by just looking at them? Give reasons for your answer.

Q4 Has the sugar melted?

Q5 What is the solvent and solute in this activity?

Q6 What do we call the water with dissolved sugar in it?

Q7 What is the difference between sugar and sand in this activity?

Q8 Has the mass of the contents in vial B increased when you added sugar?

Q9 If it is there, is it still sugar or has it formed a new substance with water?

Q10 Which of the three sample vials contains a mixture of different substances?

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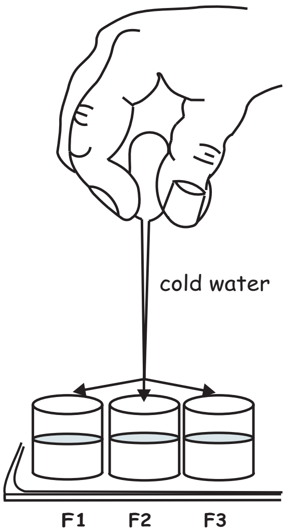
Activity 3.9 MELTING AND DISSOLVING: IS THERE A DIFFERENCE?

Focus question: What happens to the particles when a substance melts and when a substance dissolves?

You will need:

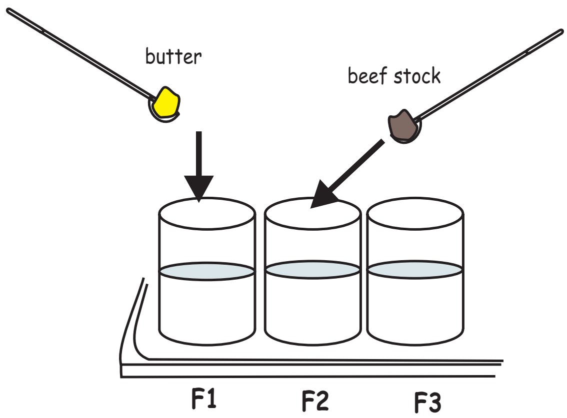
- 1 comboplate
- 1 microspatula
- 3 x pieces of butter
- 3 x pieces of beef stock
- methylated spirits
- hot water
- sugar
- cold water

STEP 1



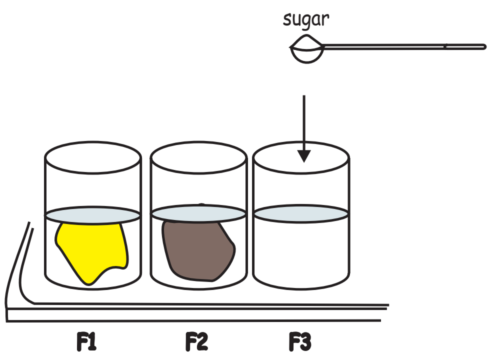
Half fill wells F1, F2 and F3 with cold water.

STEP 2



Use a microspatula to put a piece of butter in well F1 and a piece of beef stock in well F2.

STEP 3



Add a microspatula full of sugar to well F3 and stir.

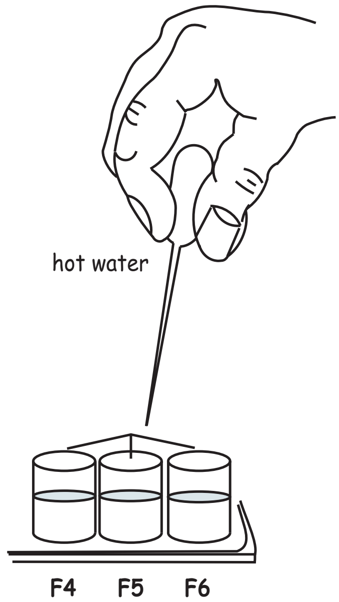
Q1 What do you notice? ____________________

____

Q2 Is there a difference? ____________________

____

STEP 4



Put equal volumes of hot water in wells F4, F5 and F6.

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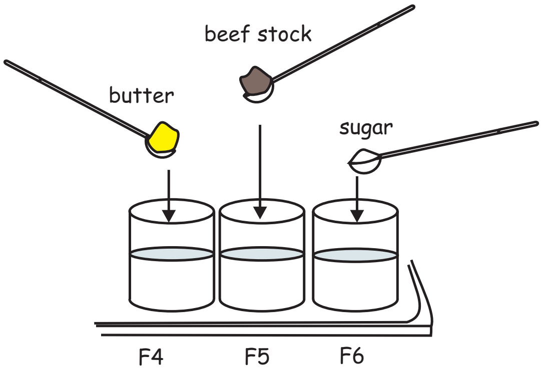
STEP 5



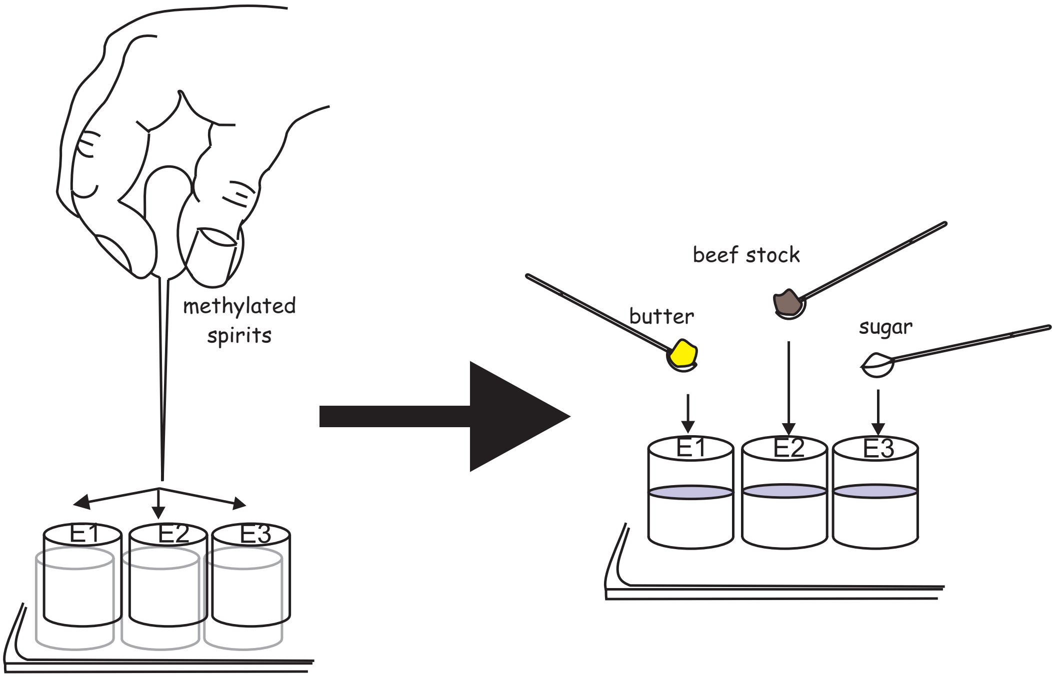
Q3 What happened?

Q4 Why do you think it happened?

Q5 What is the difference in the behaviour of these substances in hot water and cold water?

Repeat steps 2 and 3 with the hot water in wells F4, F5 and F6.

STEP 6



Put equal volumes of methylated spirits in wells E1, E2 and E3 and repeat steps 2 and 3.

Q6 Describe what happened.

Q7 What do you notice when you compare methylated spirits with water?

Q8 Which substance/s dissolved in water?

Q9 Which substances dissolved in the methylated spirits?

Q10 Which substances melted in water?

Q11 Which substances melted in the methylated spirits?

Q12 What happens to the particles when a substance melts, and when a substance dissolves?

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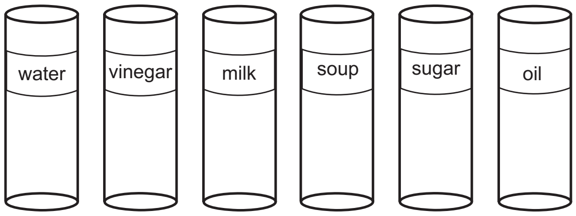
Activity 3.10 What type of a mixture is it?

Focus Question: How can we use light to distinguish between different types of mixtures?

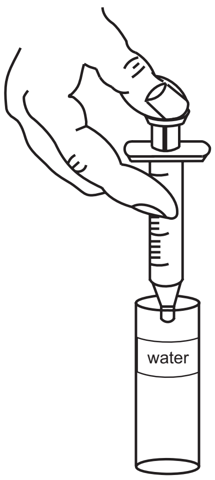
You will need:

- 6 small vials with lids
- 6 small labels
- 6 microspatulas
- syringe
- a small torch
- clean water
- vinegar
- milk
- soup
- sugar
- oil

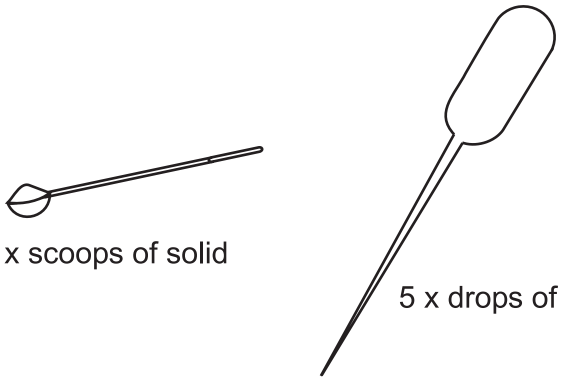
1. Label each vial for one of the following substances: water, vinegar, milk, soup, sugar and oil. Stick the labels towards the top of the vial.



2. Use a syringe to put 4 ml of water into each vial.



3. Use a clean propette each time to add 5 drops of the liquid substances into the appropriately labeled vial, and a clean microspatula to add 5 scoops of a solid substance to an appropriate vial.



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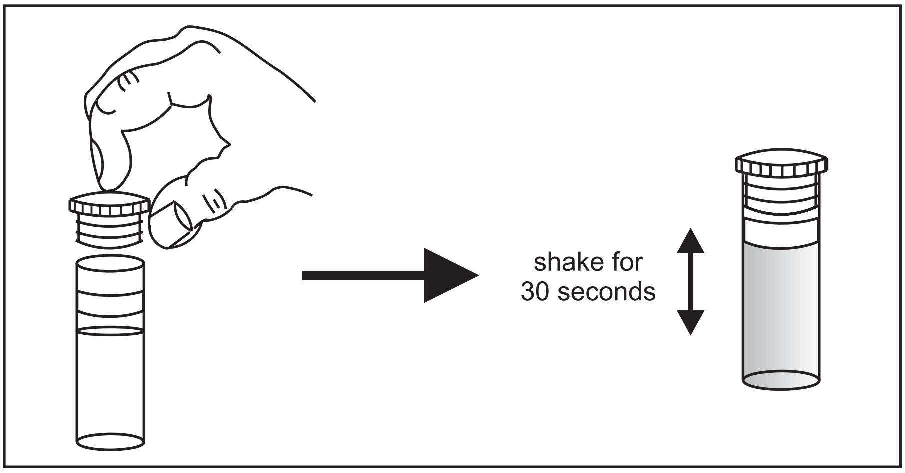
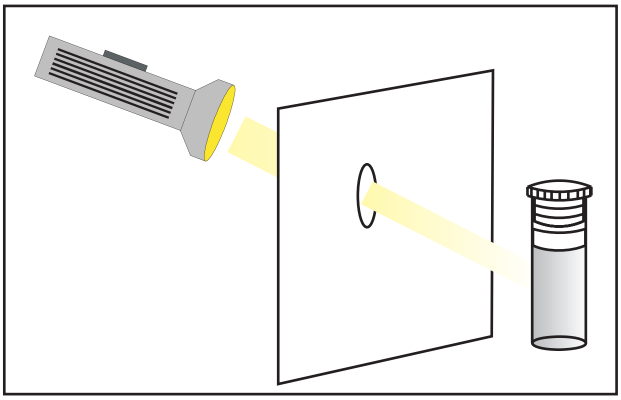
4. Close each vial with a lid and shake it vigorously for about 30 seconds. Leave until the swirling stops.



5. Without further disturbing, let your partner shine the torch through a hole in a piece of cardboard and through the vial marked "water". Look at the vial from the side. Can you see a beam of light as it passes through the mixture? ___________



6. Repeat step 5 with the other mixtures, writing down your observations in the table below.

Mixture (water + ...)	See the light? Yes/No	Type of Mixture
water		
vinegar		
milk		
soup		
sugar		
oil		

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Step 4

Study the figure. Use it as a model and draw your insect's head in detail showing compound eyes, simple eyes, antennae, mouthparts.

II The Thorax

Q10 Look at the ventral (under) surface of the insect. Into how many parts is the thorax divided?

Q11 The legs are attached to the thorax. How many legs does the insect have?

Q12 Are all the legs the same? Answer this question fully.

Q13 Watch the insect for a while. Does it use the legs only for walking or does it use the legs for other things? Answer this question as fully as possible.

Q14 How many wings does the insect have?

Q15 Are the wings all the same? Answer this question as fully as possible.

Q16 In your notebook, draw one leg and one wing of your insect.

III The Abdomen

Q17 Look at the abdomen from the side. You may see little holes on some of the segments. These are the spiracles or breathing holes of the insect. Which segments have spiracles?

Q18 Why do you think we would not see spiracles on all insects?

WHAT THE INSECT DOES

I How the insect moves

Step 5

Watch the insect carefully. Find out which legs are on the ground at the same time when it walks. In other words, does the insect move its first two legs, then the next, then the next; or does it move all the legs on one side and so on?

II How the insect eats

Step 6

Continue to watch the insect carefully.

Q19 What does the insect eat?

Q20 How does food get into the insect's body? Does it use its legs, does it "lap" like a dog and so on?

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Step 1

Write the following names on each of the four labels: sugar, egg, milk, oil.

Step 2

Stick one label towards the top of each of the four vials.

Step 3

Insert one vial in each of the first four F wells of the comboplate.

Step 4

Fill all the four vials to one fourth with oil.

Step 5

Add to each of the four vials 0.5 ml of water, using a syringe.

Step 6

Use a syringe to add 0.5 ml of vinegar to each of the four vials.

Step 7

Close the vials with lids and shake each vigorously for 30 seconds. Leave them to settle and note what happens.

Q2 What do you observe?

Step 8

Use a clean microspatula to put 6 scoops of sugar (sucrose) into the vial labelled **sugar** and repeat the procedure to put mustard flour in the vial labelled **mustard**.

Step 9

Use a clean propette to put 6 drops of egg yolk in the vial labelled **egg** and repeat the step with milk (lactic acid) into the vial labelled **milk.**

Step 10

Close the vials with lids and shake each vial for about 30 seconds. Leave them to stand and observe what happens.

Q3 What do you observe?
Q4 Which of the constituent substances of mayonnaise do you think serves as an emulsifier? Give your reasons.
Q5 Why is mayonnaise said to be an emulsion?
Q6 Which constituent substance of mayonnaise is in greatest proportion?

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Activity 3.12 The Different Colours in a Dot

Part A

Focus Question: Is the ink a mixture or a pure substance?

You will need

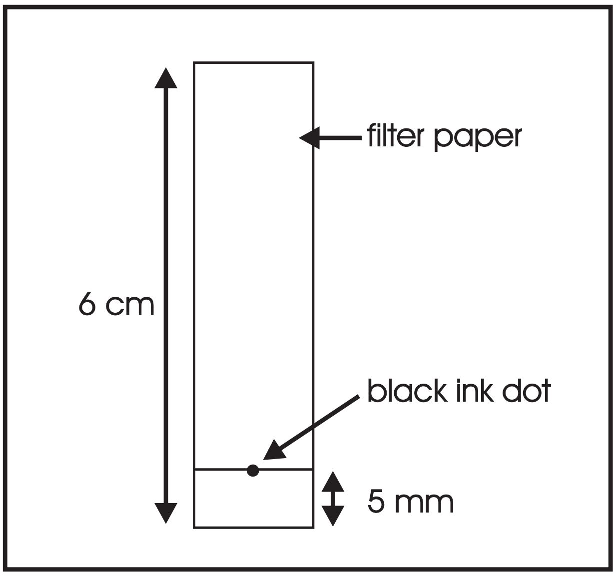
- comboplate
- 6 strips of filter paper (6cm x 1cm)
- Pair of scissors
- 6 different coloured pens*
- 6 small vials
- 1 measuring ruler
- 1 propette
- Methanol

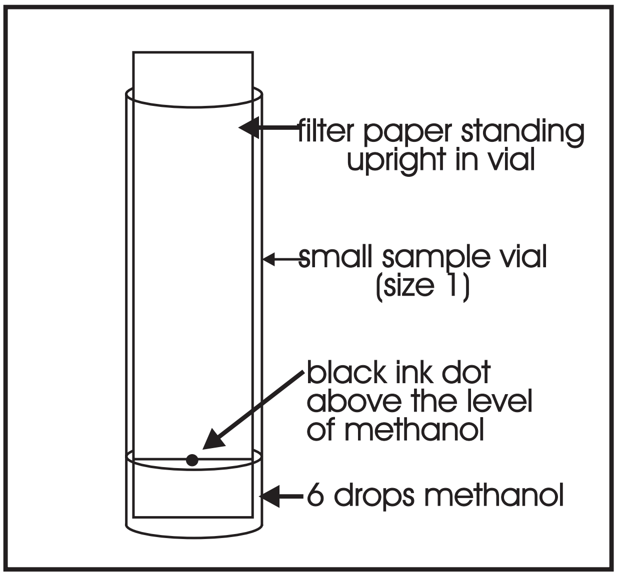
Step 1

Cut out 6 strips of filter paper according to the dimensions: 6 cm x 1 cm.

Step 2

Make a dot on each strip of filter paper with a different coloured marking pen about 5 mm from its bottom, as shown in the diagram below.





Step 3

Place the vials one in each of the six F wells of the comboplate.

Step 4

Use a propette to put 6 drops of methanol into each of the 6 vials. Avoid spilling drops of methanol on the sides of the vials as this will affect the separation.

Step 5

Carefully lower each strip into one of the vials so that the small ink dot on the strip is just above the level of the methanol.

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Step 6

Leave the setup undisturbed for a while, watching carefully what happens.

Q1 Describe what you see.

Q2 Describe what you see on each strip after about 10 to 15 minutes.

Q3 Are the inks mixtures or pure substances? Explain your answer.

Q4 Which component in each of the coloured inks is most soluble in methanol? Explain.

Q5 Which component in each of the coloured inks is the least soluble in methanol? Explain.

Q6 Is the black ink a homogeneous or a heterogeneous mixture? Explain your answer.

Part B

Focus question: Do all manufacturers of black felt-tipped pens use the same mixtures of chemicals to make their black inks?

Step 7

Repeat the above procedures using different black pens made by different manufacturers.

Q7 Explain your findings.

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Activity 3.13 Separating a Mixture of Water and Methylated Spirits

Focus question: Which distinguishing property of the constituent of the mixture is being used for separation in this activity?

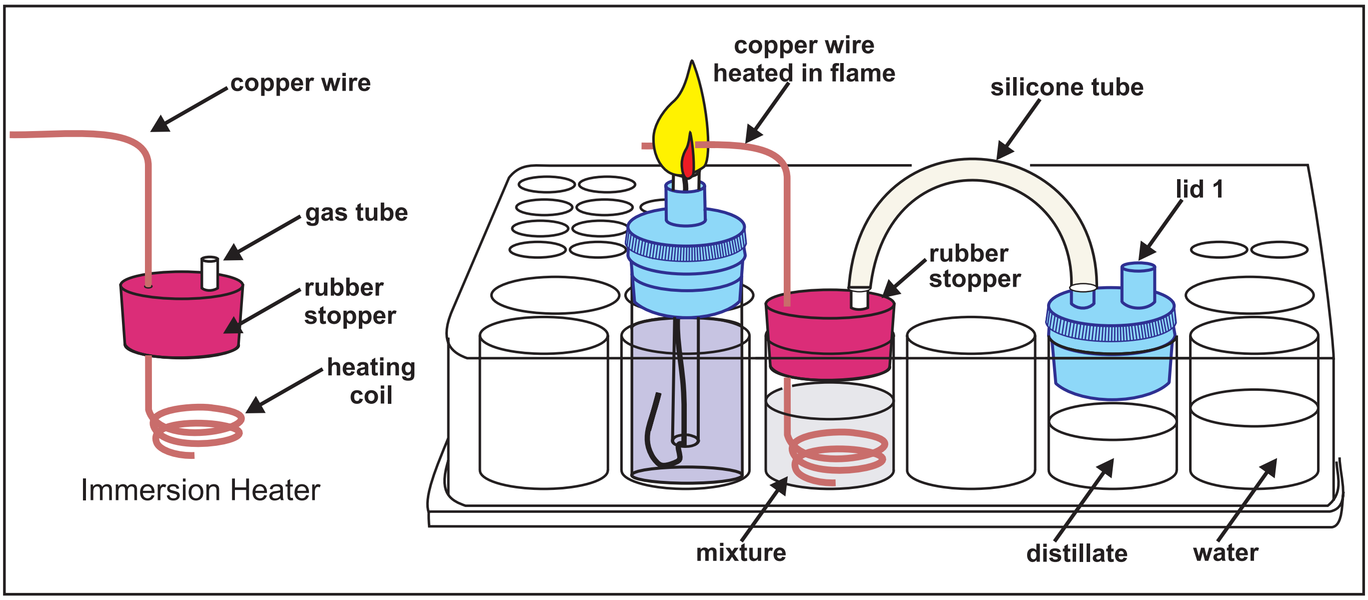
You will need:

- comboplate
- 2 x syringes
- microburner
- silicone tube
- immersion heater
- microspatula
- water
- methylated spirits
- box of matches
- anhydrous copper sulphate
- cobalt chloride paper

What you need to do:

Part 1

1. Study the experimental set-up picture below and use it together with the instructions and the equipment in the kit, to set up and do the experiment.



Using one of the syringes, draw 2 ml of water and place 1 ml in well F3 and the other 1 ml in well F6. The water in well F6 is to help approximate the volume of the distillate, which will be collected in well F5.

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1. Using the other syringe, draw 1 ml of methylated spirits and place in well F3. Use the end of a microspatula to mix the contents in well F3.
2. Seal well F3 with the immersion heater. Make sure the copper wire is over well F2 and that the **coil does not in any way touch the walls or the bottom of well F3**.
3. Fill the microburner with methylated spirits and place it in well F2.
4. Seal well F5 with lid 1 ensuring that the small outlet is facing inward as shown in the diagram.
5. Connect one end of the silicone tube to the protruding glass tube of the immersion heater and the other end to lid 1.
6. Light the burner to commence heating the immersion heater as shown in the diagra. As you heat, observe what happens. Note what happens in the silicone tube.

Q1 Describe your observations.

Q2 How long does it take the mixture to start boiling?

7. Make sure that the heating is gentle to avoid the bubbles of boiling liquid rising up the tube. The liquid collecting in well F5 is called a **distillate**.
8. When the volume of distillate is about $\frac{3}{4}$ of the volume of water in well F6, you may stop the heating and wait for everything to cool.

We can determine whether a liquid is water or not, by using anhydrous copper sulphate or a cobalt chloride paper. Water turns the grey anhydrous copper sulphate blue.

Part 2 What is the nature of this liquid distillate?

9. Observe the nature of the liquids in wells F3, F5 and F6. Place 1 microspatula of anhydrous copper sulphate in wells A1, A2 and A3. Use a propette to put 2 drops of the contents of well F3 in well A1.

Q3 What happens?

10. Use a clean propette to put 2 drops of the contents of well F5 into well A2.

Q4 What do you observe?

11. Use another clean propette to put 2 drops of the water from well F6 into well A3.

Q5 What do you note? Explain your observation.

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12. Dip one piece of cobalt chloride paper into each of the liquids (in well F3, F5 and F6).

Q6 Explain your observations.

13. Place a drop of each liquid on a flat piece of paper and observe which one permeates into the paper faster than the others.

Q7 Explain your observations.

14. Light the microburner again. Dip one piece of cotton string into each of the three liquids and expose it to a flame to check as to which will catch fire.

Q8 Explain your findings.

Q9 Do you think you managed to separate the water from the methylated spirit? Use the evidences you got from the four tests you did above to support your response.

Q10 What is the name of this separation method?

Q11 Which distinguishing property of the constituents of the mixture is being used in this separation technique?

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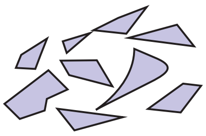
Activity 3.14 THE MAGIC PROPETTE

Focus question: What causes attraction?

You will need:

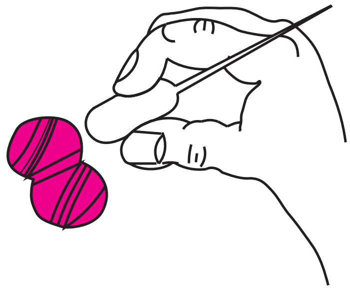
- 1 comboplate
- 1 propette
- 1 microspatula
- 1 tooth pick
- a ball of wool
- sugar
- 1 nail
- 1 glass rod
- 1 ruler(plastic)

STEP 1



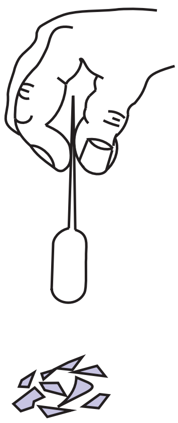
Tear a piece of paper into very small pieces.

STEP 2



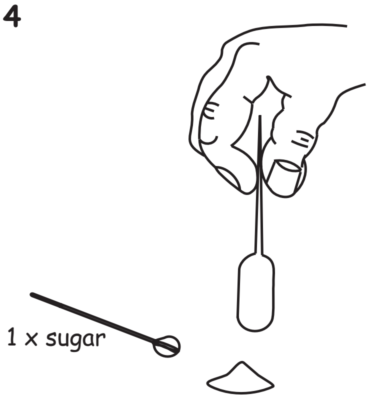
Rub the propette firmly with the ball of wool or on a woollen outfit.

STEP 3



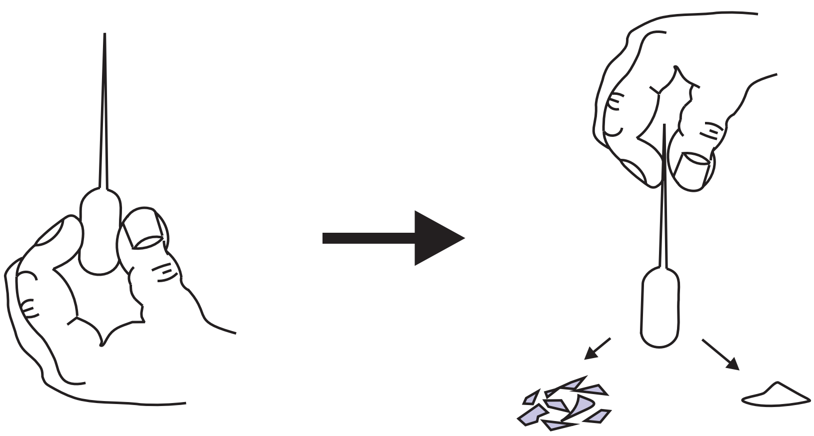
Hold the propette just above the torn up pieces of paper and observe what happens.

STEP 4



Pour one heaped microspatula of sugar on your table and try the rubbed propette on it.

STEP 5



Touch the rubbed area of the propette with your fingers and try the propette on the pieces of paper and the sugar again.

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STEP 6

Rub other objects (a nail, toothpick, ruler, glass rod, microspatula, comboplate) and try them on the pieces of paper and the sugar. Then complete the table below.

OBJECT	MATERIAL	Effects on Paper and Sugar
propette	plastic	
a nail	iron	
toothpick	wood	
ruler	plastic	
glass rod	glass	
microspatula	plastic	
comboplate	plastic	

Answer the following questions:

Q1 What happens when you bring a rubbed propette close to the pieces of paper and sugar?

Q2 What are you actually doing when you rub the propette with wool?

Q3 What is static electricity?

Q4 Where do the charges (which pull the pieces of paper and the sugar) come from?

Q5 Is an electric charge produced on any kind of material we rub?

Q6 What kind of materials get charged with rubbing?

Q7 How can we make a charged object lose its charge?

Q8 Is an electric charge produced only on those parts where the object has been rubbed?

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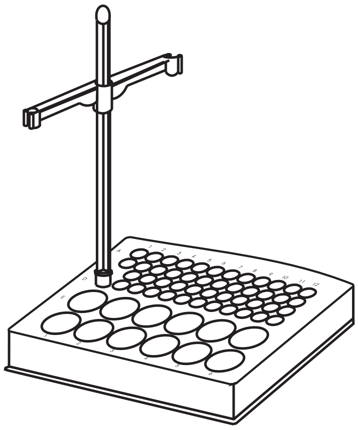
Activity 3.15 THE WIGGLY FALLING WATER

Focus question: What causes the water jet to be drawn towards the propette?

You will need:

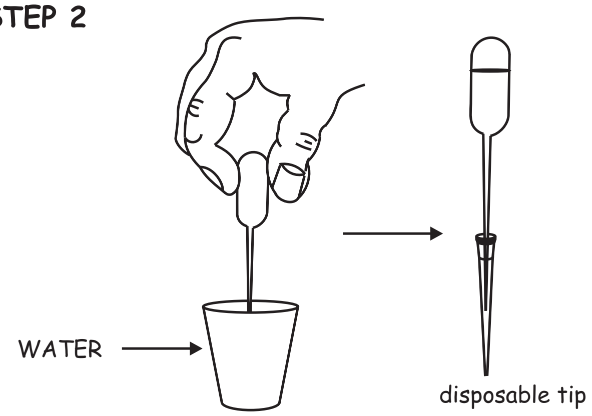
- 1 comboplate
- 1 disposable tip
- 2 propettes
- a ball of wool
- cotton thread
- prestik
- 1 microstand

STEP 1



Insert a microstand into well D1.

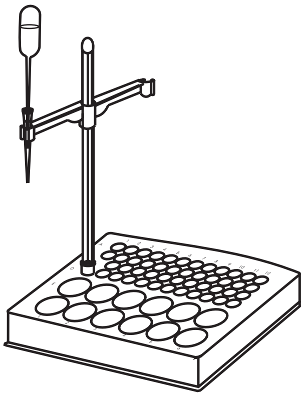
STEP 2



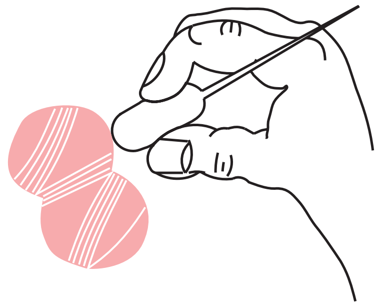
Fill one propette with water and fit the disposable tip over the end of the propette.

STEP 3

Insert the propette into one side arm of the microstand and turn the arm so that the disposable tip is directly above well F1.

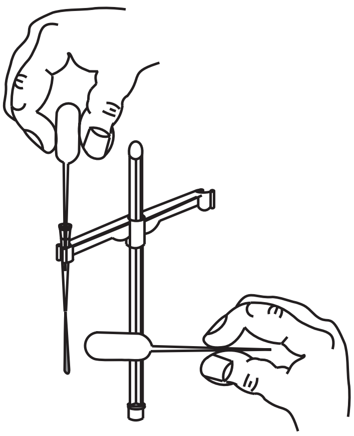


STEP 4



Rub the other propette with wool a number of times.

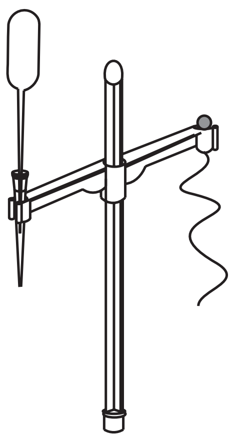
STEP 5



Squeeze the water out of the propette with one hand so that it jets out while holding the charged propette close to the water jet.

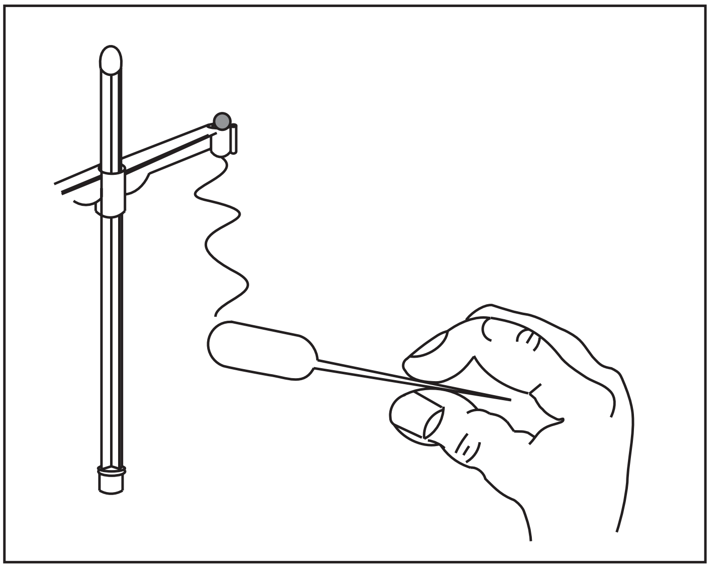
Q1 What happens?

STEP 6



Use a piece of prestik to fix one end of a 6cm long cotton thread to the other side arm of the microstand.

STEP 7



Hold the charged propette close to one end of the cotton thread.

Q2 What happens?

Q3 What causes the water jet to be drawn towards the propette?

Q4 What causes the cotton thread to become straight?

Q5 Describe how you would put a static charge on something.

Extension Questions

Q6 Is an electron positively or negatively charged?

Q7 What happens to the electrons when you rub a propette with a woollen cloth?

Q8 Why is there a crackling sound sometimes when you undress?

Q9 What is lightning and how is it formed?

Q10 Why is there thunder after a lightning flash?

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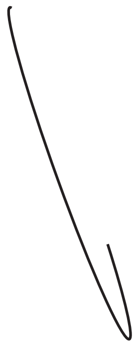
Activity 3.16 MY ALUMINIUM STRIP ELECTROSCOPE

Focus question: When and why are the foil strips flying apart?

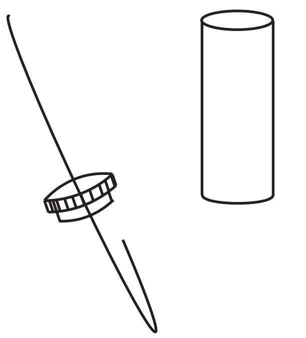
You will need:
- propette
- vial (with lid)
- 2 strips of aluminium
- paper clip (electroscope wire)
- ball of wool

STEP 1



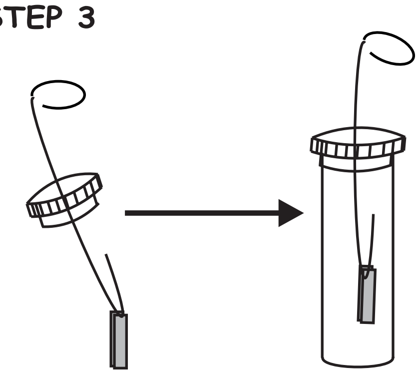
Use a paper clip to make an electrode wire by unwinding it as shown in the picture.

STEP 2



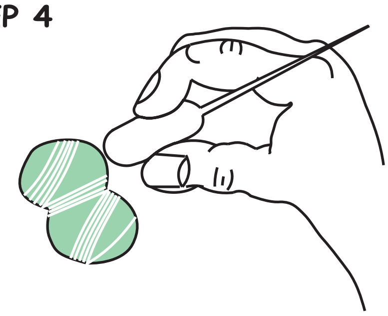
Pierce the lid of a vial with the pointed end of the wire as shown in the picture.

STEP 3



Assemble the electroscope by bending the wire as shown and sliding the two pieces of foil.

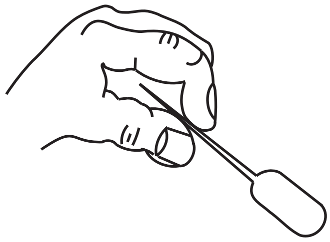
STEP 4



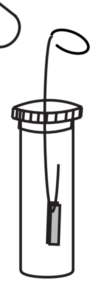
Rub the bulb of the propette firmly with the ball of wool, a cloth or a cotton wool.

Q1. What happens to the bulb as you rub it?

STEP 5

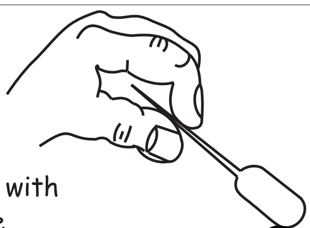


Bring the bulb of the propette close to the wire without touching it.

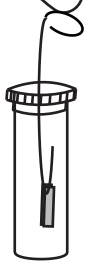


Q2. What do you observe?
Q3. Explain what happens in terms of the movement of free electrons.

STEP 6



Touch the lid of the vial with the bulb of the propette.

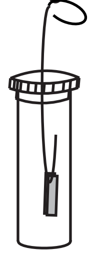


Q4 What do you observe?
Remove the bulb.
Q5 What happens?
Q6 Explain your observations.
Q7 Are the charges on the foil strips and those on the bulb 'like' or 'unlike'?

STEP 7

Repeat step 4 to 6 using a glass rod.
Q8 What happens?
Q9 How do you explain your observations?
Q10 When and why are the foil strips flying apart?

Extension questions
Q11 What is a static electricity detector called?
Q12 Why is it not suitable to try static electricity during humid weather?



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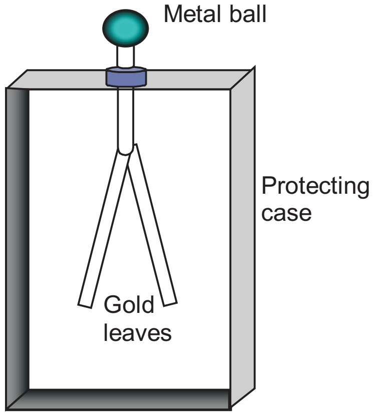
In this activity, you made your own electroscope. An electroscope is a device we use to detect charge. It consists of two metallic movable leaves, which are enclosed in a case to protect them from humidity and air currents. The leaves are usually made of gold. The leaves are connected through a conductor to a metal ball outside the case.

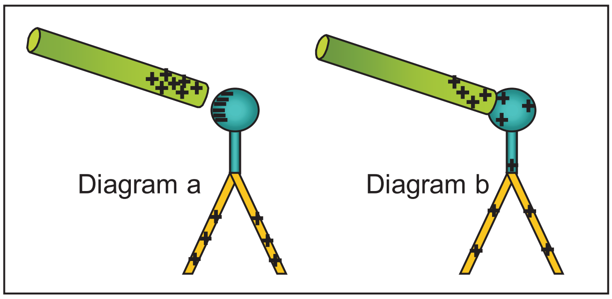


Electroscope

Q13. The two diagrams below show how to charge an electroscope with a charged object.

a) Which diagram shows charging the electroscope by conduction?

b) Which diagram shows charging the electroscope by induction?

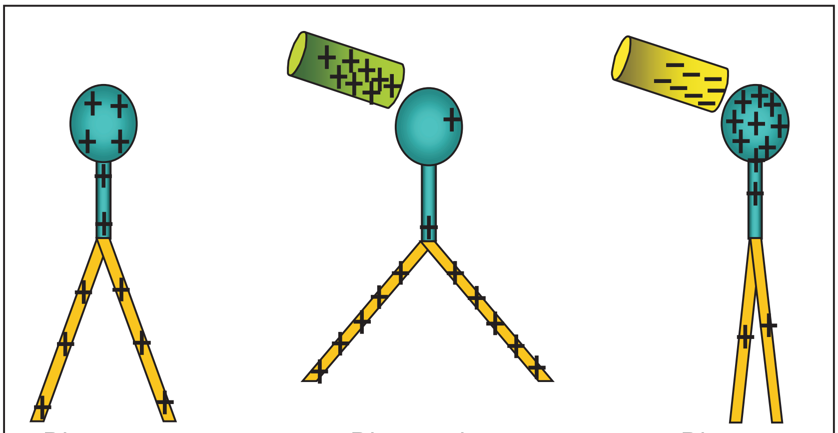


c) Think of the differences between the two methods of charging the electroscope. How do the two methods affect the charge of the electroscope and that of the charged object?

Q14 We can use an electroscope to determine the sign of the charge of an object. The diagram below shows how to do this.

a) Explain what the diagram describes.

b) Is it necessary for the electroscope to be charged beforehand?



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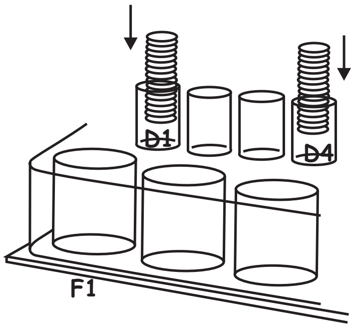
THE LIGHT BULB ON MY COMBOPLATE

Focus question: What are the energy transformations taking place in this activity?

You will need:

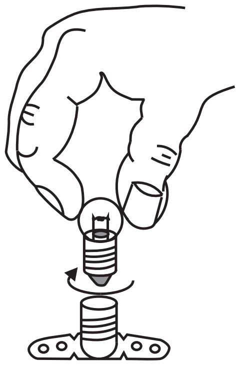
- 1 comboplate
- 2 x springs
- 1 bulb
- 2 x strips of copper
- a bulb holder
- 1.5 V cell

STEP 1



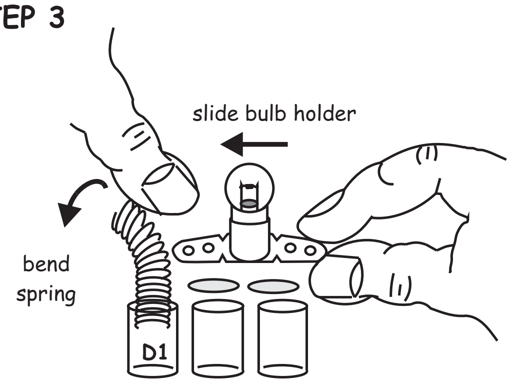
Put one spring into well D1 and the other spring into well D4.

STEP 2



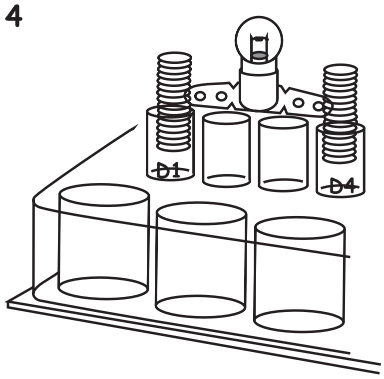
Screw the bulb into the bulb holder.

STEP 3



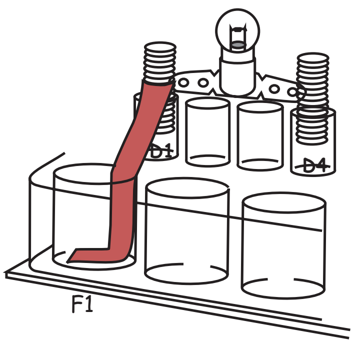
Bend spring D1 to one side and slide one end of the bulb holder into the spring.

STEP 4



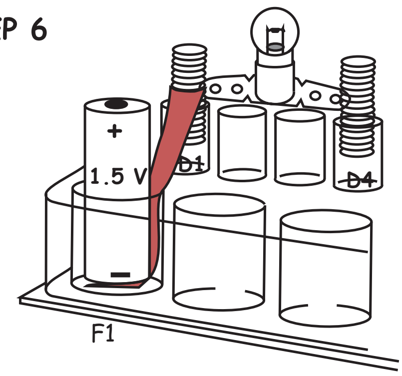
Slide the other end of the bulb holder into spring D4 in the same way.

STEP 5



Slide the end of one copper strip into the spring in well D1 and push the other end into well F1.

STEP 6



Put a cell with the negative (-) end down, on top of the copper strip in well F1.

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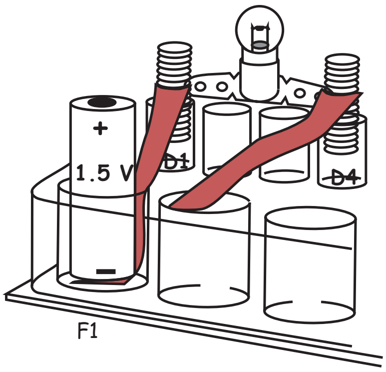
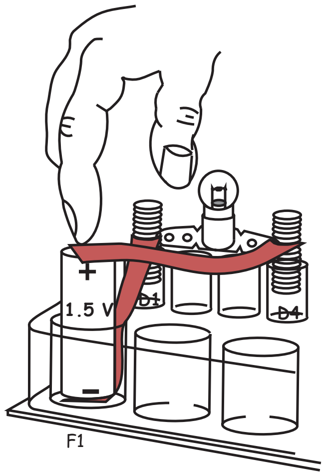
STEP 7	STEP 8
 Slide one end of the other copper strip into the spring in well D4.	 Touch the loose end of the second strip to the positive (+) end of the cell.

Q1 What happens when you touch the loose end of the second copper strip to the positive end of the cell?

Q2 What happens when you remove the loose end of the strip from the cell?

Q3 Why do you think the light goes on as you touch the positive end of the cell with the strip and goes off when you remove it?

Q4 Where does the energy come from which makes the bulb glow?

Q5 What kind of energy is stored in the cell?

Q6 What are the energy transfers on the comboplate?

Q7 What are the energy transformations on the comboplate?

Q8 What forms a circuit on the comboplate?

Q9 What will happen to the brightness of the light if you replace the strips with longer ones?

Q10 When is the circuit open?

Q11 When is the circuit closed and what happens when it is closed?

Q12 How do you make use of this energy transformation in your home and elsewhere in your life? List them.

Q13 Where does energy, which makes lights, stoves and televisions in our homes work, come from?

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ACTIVITY 3.18 EXPLORING MICRO-ELECTRICITY PIECES

Focus Question: How do the different micro-electricity pieces work?

What you need

- a comboplate
- a bulb
- a bulb holder
- 6 x springs
- LED light emitting diode
- 2 x long copper/zinc strips
- 2 x connecting wires
- 1.5 volt cell
- an A4 sheet of white paper

Part 1

WHY DO WE USE ELECTRIC CIRCUITS?

Q1 We use electric circuits to transfer electrical energy to various electrical devices. These devices transform the electrical energy into other forms of energy, which we find useful!

a Make a list of five devices which you can find at home, or you see in the shops, which work with electricity.

b What are these devices used for?

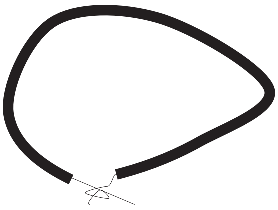
c What energy transformation/s take place in these devices?

WHAT IS AN ELECTRIC CIRCUIT?

Q2 An electric circuit is a **closed** path or "loop", made out of materials which are good conductors of electricity. But this is not enough!

a Phoka is a learner in your group. He takes a piece of wire. He connects the ends of the wire together. He says: "**This is an electric circuit**!".

Phokas wire-loop



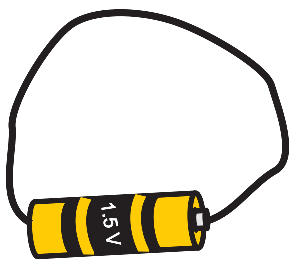
Is Phoka right? Is there an electric current in Phoka's wire loop?

b What must Phoka do to have an electric current in his loop? Explain to him.

c Phoka connects a 1,5 V cell across his wire. Did he make an electric circuit?

d Andile, who is also a learner in your group, has her doubts about Phoka's circuit. She says: "This is the most useless circuit I have ever seen! It is of no use!"

Phokas second wire-loop



Is Andile right? Is Phoka's circuit a "useless" circuit? Explain.

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e So finally, what is an electric circuit and what parts does it need to be made of to make it "useful"?

Part 2

What to do: Work steps 1 to 4 below, individually.

1 Put the A4 sheet of paper flat on your desk in front of you. Put micro-electricity pieces on the A4 paper.

2 Look at the diagram of the electricity pieces. Find the name of each component in the diagram.

3 Divide your components into four parts/categories,

  i the power sources and any other accessories which you think go with them.

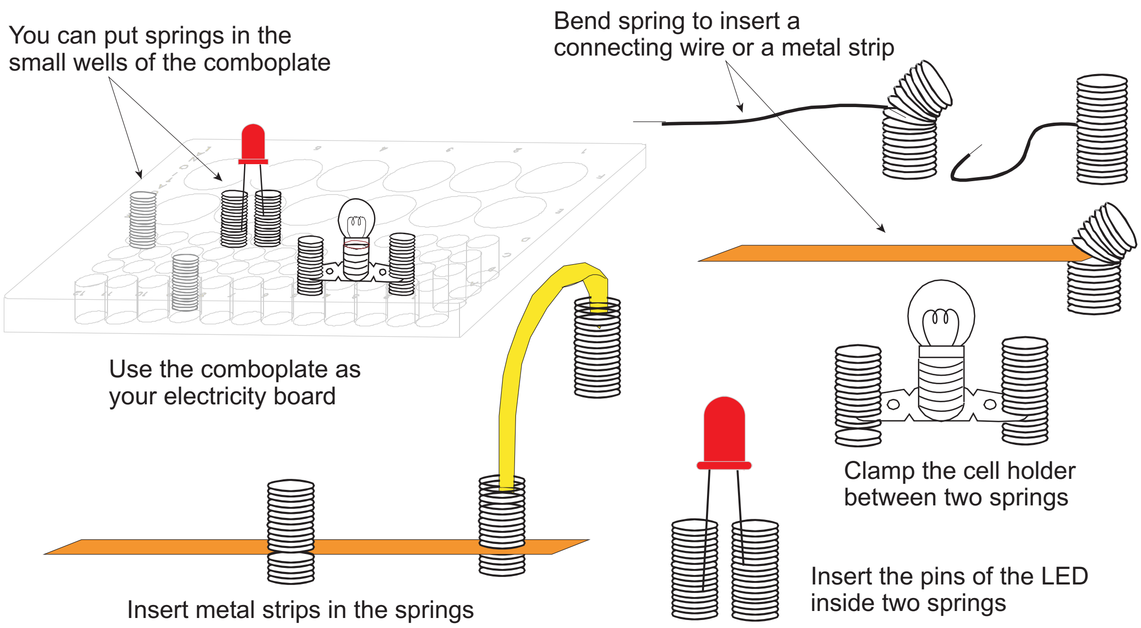
  ii the electrical devices, which you think "will do something" when you connect them in a circuit.

  iii components which you think you can use for the connections, i.e. which you can use to connect a power source to an electrical device to complete a closed conducting path.

  iv components which do not belong in any of the above three categories. Think of ways you can use these components with your kit.

4 Look at how the other members of your group have divided their components. Discuss any differences.

5 Here are some ideas of how to use some of the components in the kit. But of course, you may have better ones. You must try your ideas!



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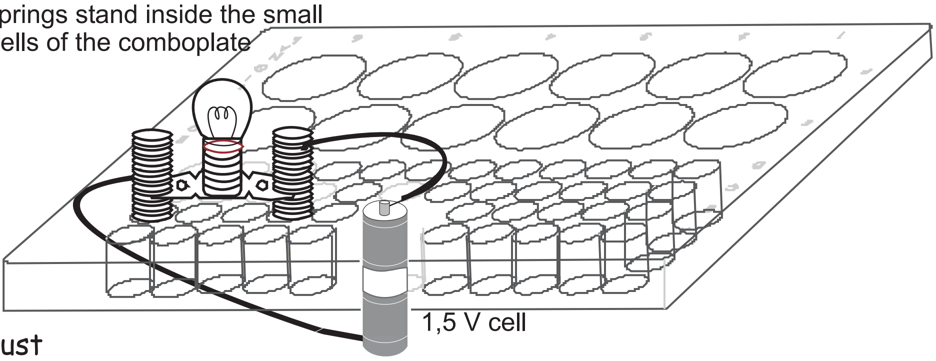
Part 3

MAKE YOUR OWN CIRCUIT

6 The following diagram, shows a simple electric circuit - for inspiration! Your task is to make a bulb glow, using components from your micro-electricity kit.



Each learner in your group must make a **different** circuit. And each circuit must be different from the one shown in the diagram.

When you have finished, discuss the circuits you and your group have made. Discuss which connections or components you found the easiest to use. Discuss which type of connection/s you found more firm or sturdy.

Part 4

FIND OUT HOW IT WORKS

7 Among the micro-electricity pieces, is a little red bulb, the LED. This is a diode. Diode is a Greek word for "Two-Way".

Your task is to find out how it works. How can you make it glow? Why is it called "Two-Way"?

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ACTIVITY 3.19 LIGHTEN UP, PREDICT AND EXPLORE

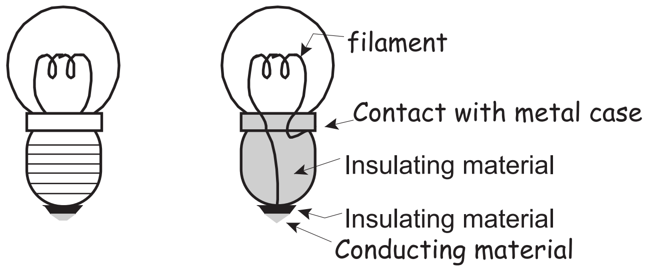
Focus Question: What forms an electric circuit?

What you need

- a bulb
- 1.5 volt cell
- connecting wires

Step 1

The diagram alongside, shows what a bulb looks like inside.

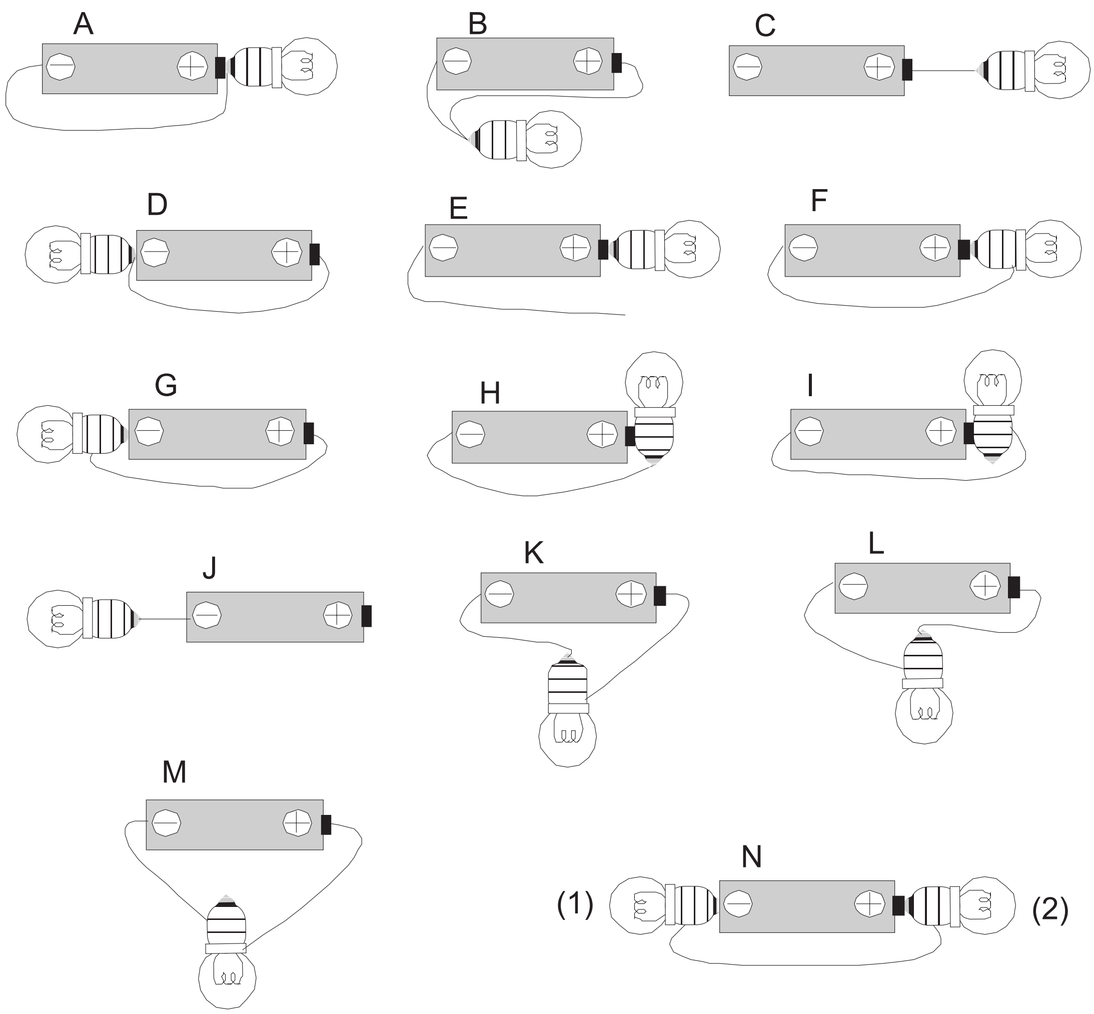


Step 2

Predict which of the bulbs in the following figures will light up.

Work on your own.

Q1 Record your predictions in the table on the next page.



Q2 Compare your predictions with those of other members of your group. Where you differ explain the reason for your prediction. Make a group prediction and record it in the table on the next page.

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Bulb	Your Prediction	Group's Prediction	Observation	Comments
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
L				
M				
N(1)				
N(2)				

Step 3

Test your group predictions using the micro-electricity kit equipment.

Q3 Record your observations in the table above.

Q4 Compare your observations with your predictions. Explain the results you observe. Add your comments in the table above.

Q5 To conclude, what is necessary to make a bulb light up?

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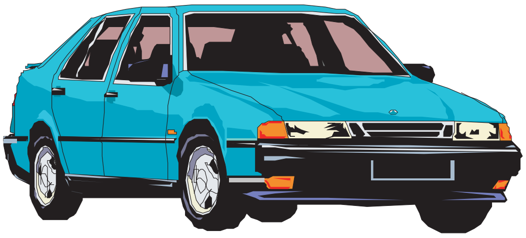
ACTIVITY 3.20 CAR HEADLIGHTS

To use the electrical energy in cells or batteries to make light bulbs glow we need a closed circuit. There are two common types of circuits, the series circuits and the parallel circuits. In a series circuit, all the parts of the circuit are connected, one after the other, so there is only one path for the transfer of electrical energy. In a parallel circuit, the parts are connected so that there is more than one path.



Part 1

Organise yourselves in pairs or groups of three. Select one person to take notes. Discuss the following factors about the main headlights of a car (or taxi):

Q1 during which part of the day are the headlights of a car used?

Q2 the importance of passenger safety when designing car headlights

Q3 what would happen if one of the car headlights was broken for example, by a stone thrown up from another car?

Q4 the electric circuit in a car which connects the car battery to the two headlights.

After you have noted down your answers to the above points, draw a diagram representing an electric circuit which consists of the two headlights of a car, the car battery (source of electrical energy) and the wires that connect the headlights to the car battery.

Part 2

What you need

micro-electricity pieces

What to do

Step 1

Select some of the micro-electricity pieces and set up a circuit to represent your circuit drawing of the headlights of a car.

Step 2

When you have finished the above Activity get together with your group and work through this section.

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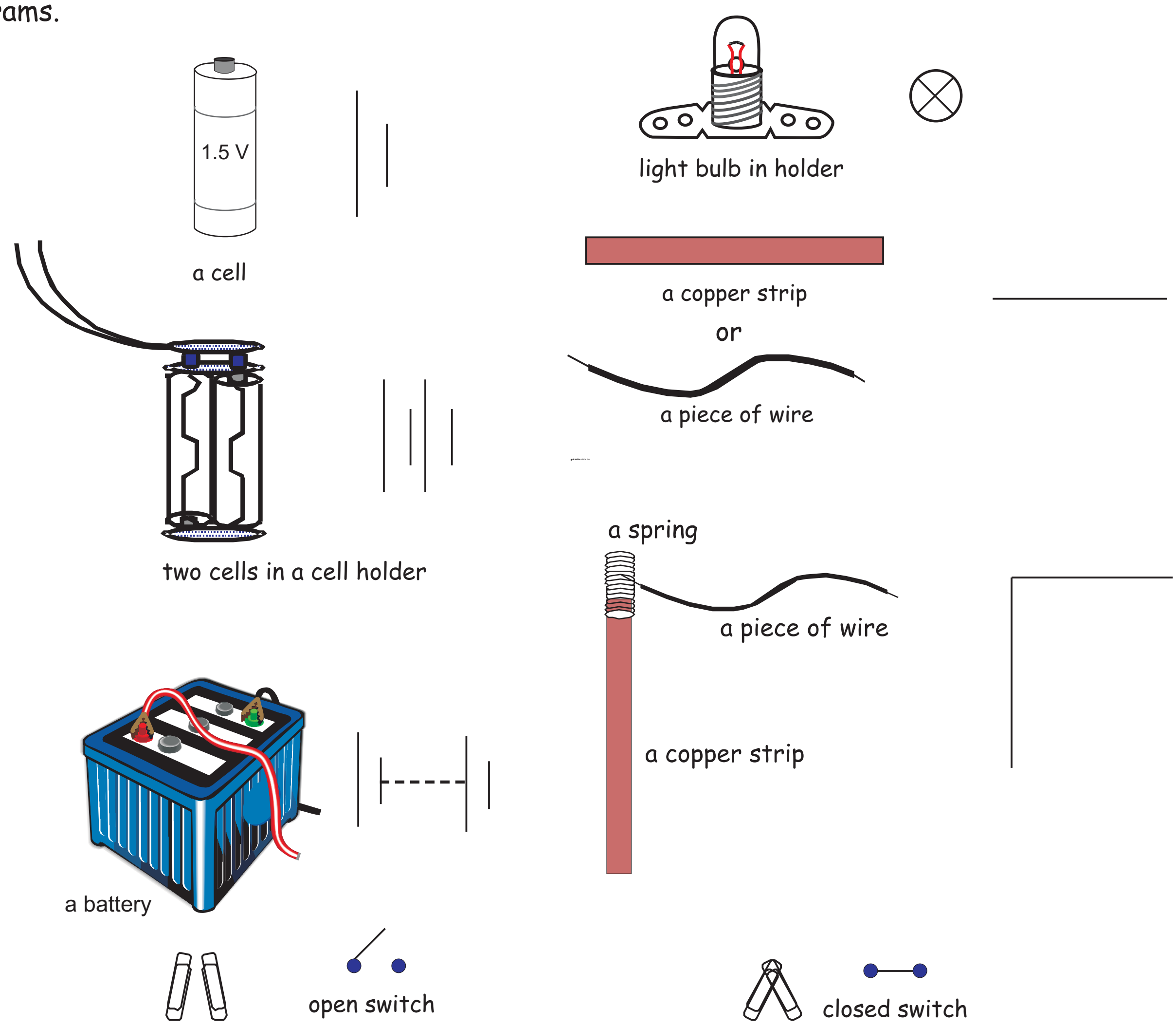
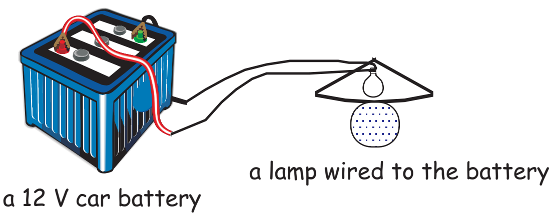
Q5 Which circuit, series or parallel, describes the circuit you have constructed? Explain.

Step 3

You can spend a lot of time drawing the real parts (components) of a circuit. It is much easier to use symbols to represent the components of a circuit. Below are some of the symbols used to draw circuit diagrams.



Use some of the symbols to draw a circuit diagram of the circuit below.



Q6 Use the circuit symbols and draw a circuit diagram to represent your circuit of car headlights.

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Activity 3.21 HOW DO WE FIND OUT IF PLANTS STORE STARCH AND SUGARS?

INTRODUCTION

Plants store food. People eat some of the food that plants store. Plants can store sugars, starch, oil or protein. Plants can store some of these or all of them. It is easy to test for the presence of sugars and starch.

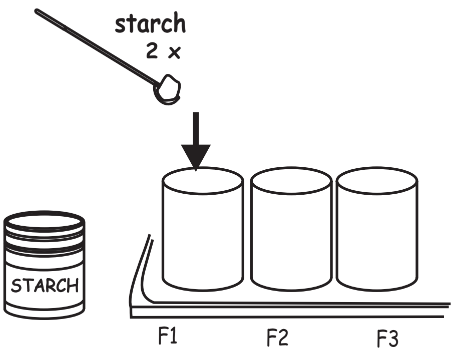
PART 1 STARCH

To test for starch you need:

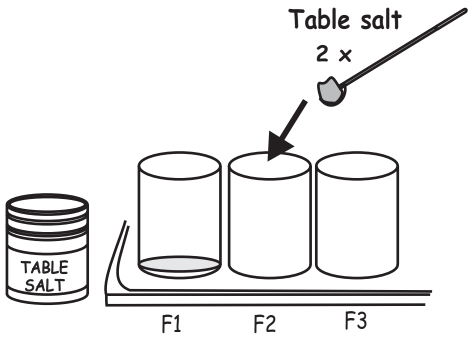
- comboplate
- propette
- laundry starch or other powdered starch
- table salt
- iodine solution

What to do:

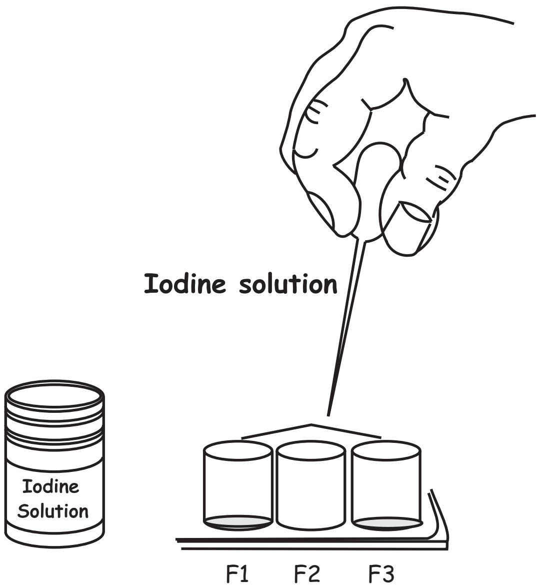
1 First place two microspatulasful of starch in well FI of the comboplate.



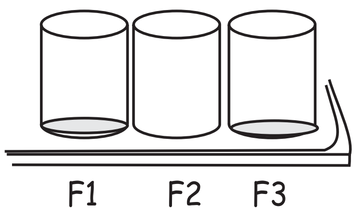
2 Then place two microspatulasful of salt in well F3 of the comboplate.



3 Use the dropper to drop a little iodine solution on the starch in well FI and on the salt in well F3.



4 Observe the colour of the starch and the salt mixture in wells FI and F3.



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Copy and complete the following sentences into your notebook.

Q1 If we add ....to a substance and the mixture turns blue - black, it means that the substance contains ....

Q2 If we add iodine solution to a substance and the substance turns yellowish ...., it means that the substance does not contain ....

Now you can test different fruits and vegetables to find out if they contain starch. Try carrots, potatoes, maize, beans, carrots, oranges, lemons, pumpkins, spinach.

Write down what you found out. You could use a table like the one underneath.

Plant	Does it contain starch?
Mealie	Yes

You can also test foods like bread, milk, fish and pasta.

PART 2 SUGAR (glucose)

INTRODUCTION

You have already tested some plants to find out if they contain starch. Now we will find out which plants store sugars. The sugar we are testing for is called glucose.

To test for glucose you need:

- comboplate
- microspatulas
- 2 propettes
- glucose powder
- starch powder
- tap water
- hot water
- Benedict's solution
- lunch box

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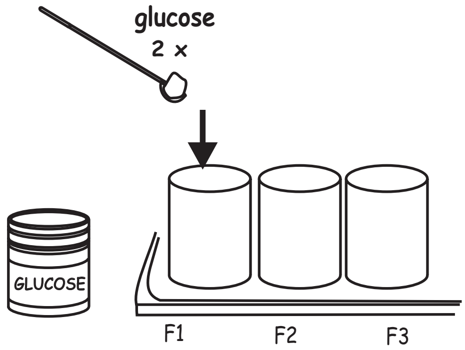
What to do:

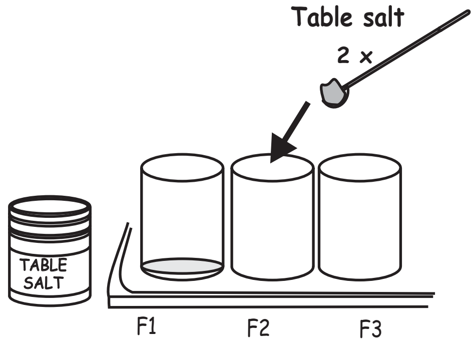
STEP 1

First place two microspatulasful of glucose powder in well F1 of the comboplate.



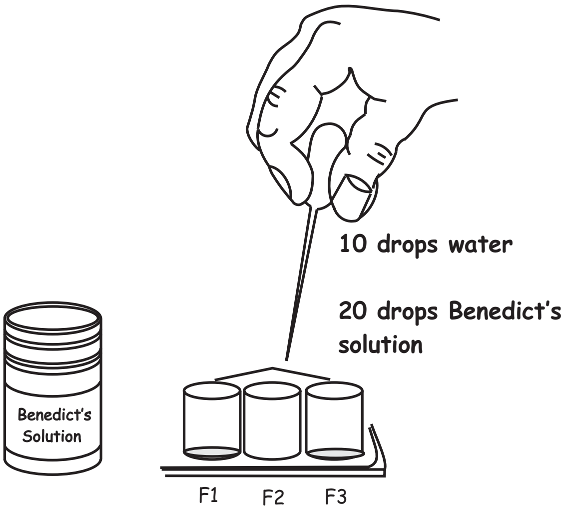
STEP 2

Then place two microspatulas of starch powder in well F3 of the comboplate.



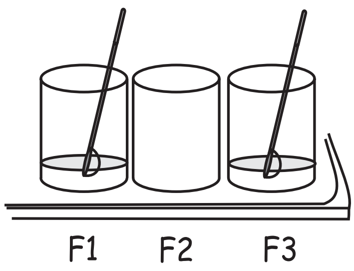
STEP 3

Add 10 drops of water and 20 drops of Benedict's solution to wells F1 and F3.



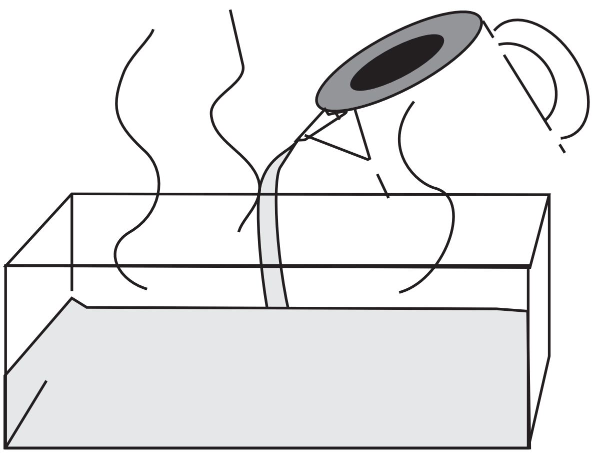
STEP 4

Stir the contents of wells F1 and F3 with clean microspatulas.



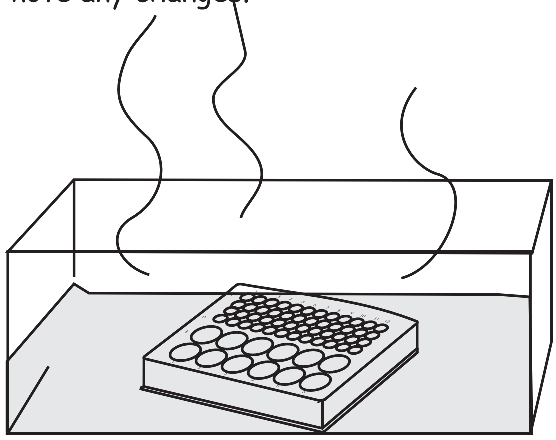
STEP 5

Half fill the lunch box with hot water.



STEP 6

Float the comboplate® in the hot water in the lunch box. Observe wells F1 and F3 carefully for about 10 minutes and note any changes.



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Answer the questions below:

Q1 What is the colour of Benedict's solution?

Q2 What is the colour of the mixture in well Fl?

Q3 What is the colour of the mixture in well F3?

Q4 Copy and complete the following sentences into your notebook.

If we add .... to a substance and heat it and the substance turns reddish, it means that the substance contains ....

If we add .... to a substance and heat it and the substance stays blue, it means that the substance does not contain ....

Now you can test different fruits and vegetables to find out if they contain sugars like glucose.

Q5 Write down what you find out. You could use a table like the one you used for the starch test.

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RADMASTE Centre, University of the Witwatersrand, Johannesburg, South Africa
Tel: (+) 27 11 717 4802 Fax: (+) 27 11 403 8733 email: unesco@radmaste.wits.ac.za website: www.microsci.org.za

Activity 3.22 WHAT DO YOUR TEETH LOOK LIKE?

INTRODUCTION

All living things need food. Humans eat different kinds of food which we take into our mouths. Before we swallow our food, we chew it using our teeth. Humans and other mammals have 4 different types of teeth. These are called:

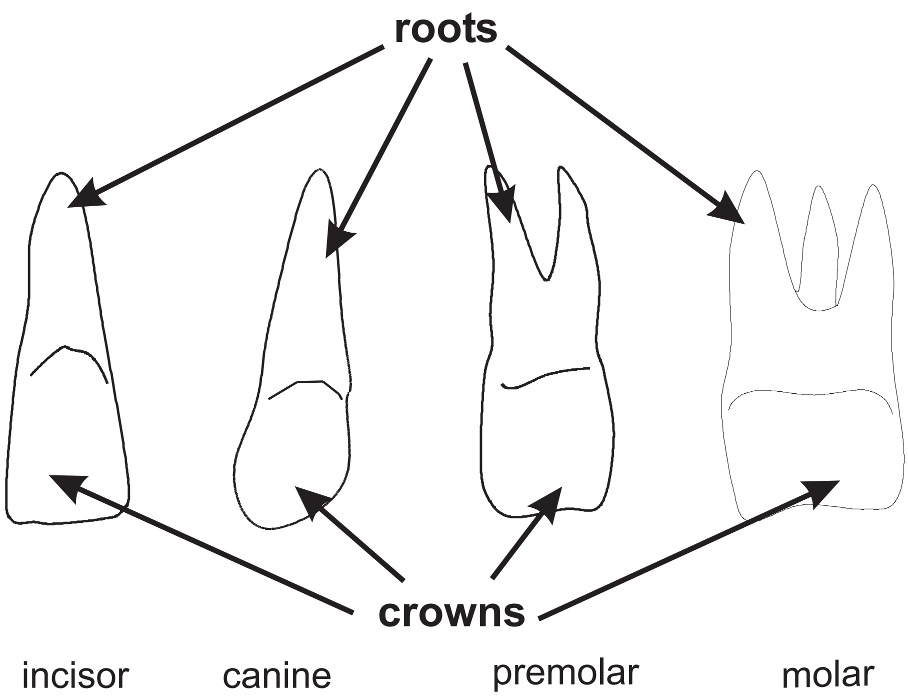
Incisors: They have a sharp cutting edge and they are at the front of the mouth. Humans have 4 incisors in each jaw.

Canines: They have a sharp point and they are next to the incisors. Humans have 2 canines in each jaw. We sometimes call canines "eye-teeth".

Premolars: They are behind the canines and have two bumps or cusps. Adult humans have 4 premolars in each jaw.

Molars: These are behind the premolars and have 4 cusps or bumps. Adult humans have 6 molars in each jaw. The last molars are called "wisdom" teeth. These teeth sometimes cause a lot of pain and have to be removed.

The teeth are anchored in the jaw bones by their roots. The part of the tooth that we see is called the crown.



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To study your teeth you need: yourself, mirror, toothpick.

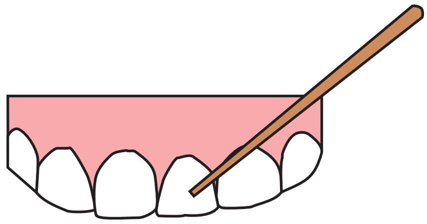
What to do:

STEP 1

Look at your own teeth in the mirror.

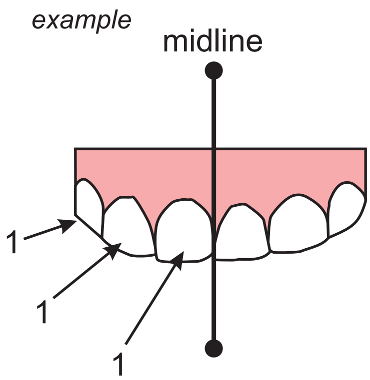
STEP 2

Find the different types of teeth in your mouth.
Use the toothpick to point out each type.



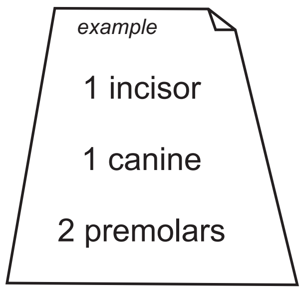
STEP 3

Count how many of each type of tooth you have in the right half of the upper jaw.



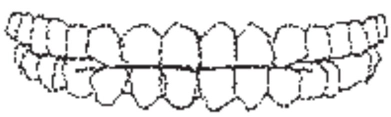
STEP 4

Write down the answer.



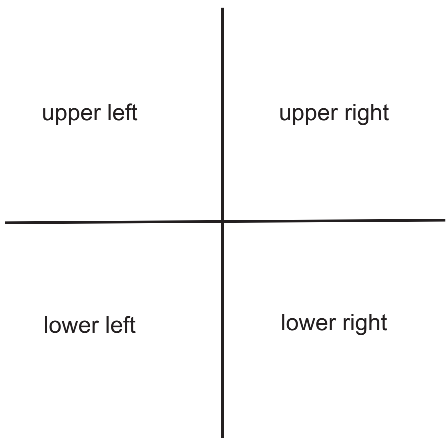
STEP 5

Do the same with the left half of the upper jaw and with both halves of the lower jaw.



STEP 6

Write down all the answers.



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Answer the questions below:

Q1 How many molars do you have altogether?

Q2 How many teeth do you have altogether?

Q3 Are there more teeth in your upper jaw or in your lower jaw?

Compare your answer to question 3 with those of the rest of the class. Summarise the information in a table like the one below.

Name	Upper jaw has more teeth	Lower jaw has more teeth

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