

John Adams®

GLOW IN THE DARK science

WARNING!

ONLY FOR USE BY CHILDREN OVER 8 YEARS OLD. TO BE USED SOLELY UNDER THE STRICT SUPERVISION OF ADULTS THAT HAVE STUDIED THE PRECAUTIONS GIVEN IN THE EXPERIMENTAL SET.

CONTAINS SOME CHEMICALS WHICH ARE CLASSIFIED A SAFETY HAZARD.

READ THE INSTRUCTIONS BEFORE USE, FOLLOW THEM AND KEEP THEM FOR REFERENCE.

DO NOT ALLOW CHEMICALS TO COME INTO CONTACT WITH ANY PART OF THE BODY, PARTICULARLY THE MOUTH AND EYES.

KEEP SMALL CHILDREN AND ANIMALS AWAY FROM EXPERIMENTS.
STORE THE CHEMISTRY SET OUT OF REACH OF SMALL CHILDREN.
EYE PROTECTION FOR SUPERVISING ADULTS IS NOT INCLUDED.

ADVICE FOR SUPERVISING ADULTS:

- Read and follow these instructions, the safety rules and the first aid information and keep them for reference.
- The incorrect use of chemicals can cause injury and damage to health. Only carry out those experiments which are listed in the instructions.
- This chemistry set is for use only by children over 8 years of age.
- Because children's abilities vary so much, even within age groups, supervising adults should exercise discretion as to which experiments are suitable and safe for them. The instructions should enable supervisors to assess any experiment to establish its suitability for a particular child.
- The supervising adult should discuss the warnings and safety information with the child or children before commencing the experiments. Particular attention should be paid to the safe handling of acid, alkalies and flammable liquids.
- The area surrounding the experiment should be kept clear of any obstructions and away from the storage of food. It should be well lit and ventilated and close to a water supply. A solid table with a heat-resistant top should be provided.

FIRST AID INFORMATION:

Most Important: In case of injury, get medical assistance immediately.

- In case of eye contact: Wash out eye with plenty of water, holding eye open if necessary. Seek immediate medical advice.
- If swallowed: Wash out mouth with water, drink some fresh water. Do not induce vomiting. Seek immediate medical advice.
- In case of inhalation: Remove person to fresh air.
- In case of skin contact or burns: Wash affected area with plenty of water for 5 minutes.
- In case of doubt seek medical advice without delay. Take the chemical together with the container with you.
- In case of injury always seek medical advice.

Write in the box below the telephone number of your nearest hospital that can be reached in an emergency.

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SAFETY RULES:

- Do read these instructions before use, follow them and keep them for reference.
- Do keep young children and animals and those not wearing eye protection away from the experimental area.
- Do always wear eye protection.
- Do store experimental sets out of reach of young children.
- Do clean all equipment after use.
- Do make sure that all containers are fully closed and properly stored after use.
- Do wash hands after carrying out experiments.
- Do not use equipment which has not been supplied with this set.
- Do not eat, drink or smoke in the experimental area.
- Do not allow chemicals to come into contact with the eyes or mouth.
- Do not replace foodstuffs in the original container. Dispose of immediately in household waste.
- If any experiment starts growing mould, throw it away in your household waste and wash your hands immediately.

CONTENTS

1. Goggles
2. UV Light – requires 2 x AA batteries, not included
3. Glow In The Dark Liquid – Boiled Water CAS 7732-18-5, Propylene Glyco CAS 57-55-0, Acid Dyes CAS 3844-45-9, 1934-21-0, 17372-87-1, 3734-67-6 and 4129-84-4, Preservatives CAS 52-51-7
4. Flexible Tube
5. Funnel
6. Cornflour – Starch CAS 9005-25-8. Dispose of in household waste
7. Rock Salt – Sodium Chloride NaCl. CAS 7647-14-5. Dispose of in household waste
8. Cone Shaped Lid
9. Loading Tube
10. Double Hole Bung
11. Small Bung x2
12. Straws x 4
13. Bubble Solution – Boiled Water CAS 7732-18-5, Lauramidopropylbetaine CAS 4292-10-8 and Sodium Benzoate CAS 532-32-1. Dispose of in household waste
14. Jelly Mould



INTRODUCTION

Welcome to **GLOW IN THE DARK SCIENCE**, a fun-filled kit that allows you to create amazing luminous science effects. Astound your friends and family as you explore 9 radioactive-like glowing experiments that really shine when the lights go out!

Read all the instructions for each experiment before starting and wear the safety goggles provided. There are some items that you will need to supply yourselves; we have marked them clearly next to each experiment so make sure you have those items before you start. Just to make doubly sure grownups don't give you a hard time, put down plenty of newspaper to protect furniture and carpets and wear some old clothes that you don't mind getting messy. There are some experiments that are really messy and we have marked that these are to be performed outdoors. Please follow our suggestion.

OK ARE YOU READY? IT COULD GET PRETTY MESSY. RIGHT, LET'S GET STARTED...



UV LIGHT BATTERY INFORMATION

The crossed wheellie bin symbol



indicates that the electrical item(s) in this product should not be disposed of in unsorted municipal waste, but collected separately. This is intended to reduce the impact on the environment by minimising the level of waste generated at the end of a product's useful life by increasing the percentage of material recovered and recycled.

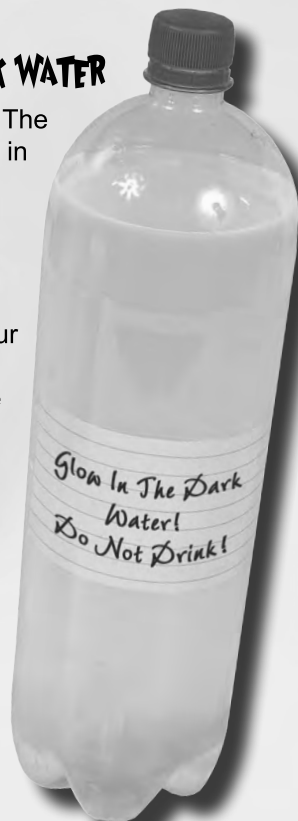
- Use a screwdriver to remove the screw on the battery door on the base of the UV Light. Reverse this operation to secure the battery door.
- This unit uses 2 x AA size batteries (not supplied).
- Use only designated alkaline manganese batteries.
- Read these equipment instructions carefully.
- To avoid leakage, take special care to ensure the batteries are installed correctly, observing the polarity (+, -) signs on the batteries and product.
- Removal and replacement of batteries should be carried out by an adult or under adult supervision.
- It is recommended that you do not use rechargeable or mercury oxide batteries.
- Do not attempt to recharge non-rechargeable batteries.
- Always replace complete sets of batteries at the same time. Do not mix old (used) and new batteries.
- Do not mix battery types (e.g. alkaline and rechargeable).
- Do not dispose of batteries in fire.
- Remove exhausted batteries to avoid leakage.
- Do not short out the battery contacts.
- Remove batteries if unit is not going to be used for a long period of time.
- Do not attempt to power battery products by the introduction of mains supply or separate power supplies and do not attempt to plug any part of this product into the mains supply.
- Periodically examine this product for signs of damage to electrical parts and do not play with it until the damage has been properly examined.
- Please retain this information for future reference.

EXPERIMENT 1 - MAKE UP YOUR GLOW IN THE DARK WATER

Before we begin you will need to make up a batch of Glow In The Dark Water. This will be used in a whole heap of experiments in the kit.

Items required for this experiment not included in the kit: a clean, empty 2 litre drinks bottle with a screw cap.

1. Take the container of Glow In The Dark Liquid (3) and pour half of it into a clean, empty 2 litre drinks bottle. Keep the rest of the Glow In The Dark Liquid safe to make up more water later.
2. Now fill up the bottle with cold tap water.
3. Screw on the lid and give it a little shake – make sure you shake it every time it is used.
4. **IMPORTANT: make sure you tape a big sign onto the bottle saying “Glow In The Dark Water – DO NOT DRINK.”**
5. Your Glow In The Dark Water is now ready for use.



WHY DOES THIS WATER GLOW IN THE DARK?

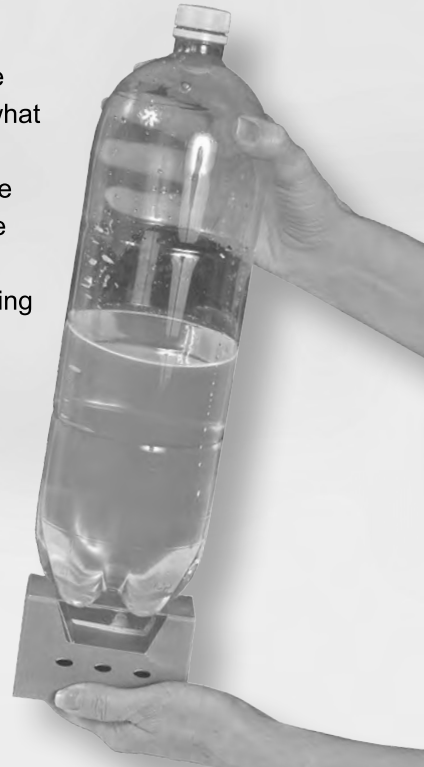
If you turn on the UV Light (2) in a dark room, you will see a purplish glow from the bulb. What you cannot see is the ultraviolet light that the bulb is also producing.

Our eyes can see visible light in a spectrum ranging from red through orange, yellow, green, blue and violet. Above violet is ultraviolet light, which we cannot see.



Long wave length ← Short wave length
Low frequency → High frequency
Low energy → High energy

A UV Light bulb produces UVA light. When you place your UV Light near to the Glow In The Dark Water, what you see glowing are phosphors. A phosphor is any substance that emits visible light in response to some sort of radiation. In other words, the phosphors in the Radioactive Water convert the UVA radiation energy from a UV Light into visible light that we see as glowing brightly.



EXPERIMENT 2 - MAKE YOUR OWN NEON-LIKE TUBE SIGN



Items required for this experiment not included in the kit:
some tape and a piece of strong cardboard.

1. Pour some Glow In The Dark Water (see page 4) into a beaker.
2. Take the Flexible Tube (4) put one end into the beaker of water and raise it higher than the other end of the tubing.
3. Place the lower end of the Flexible Tube into another beaker so you won't have a big mess. Raise the upper beaker until the Flexible Tube is straight and let gravity pull the liquid through the tubing.
4. When the tubing is full of Glow In The Dark Water, put your finger over the end of the lower part of the tubing.
5. Lift the lower end of the Flexible Tube so it is the same height as the higher end and place a Small Bung (11) into each of the ends.
6. Wrap tape around both ends to ensure the Small Bungs do not fall out.
7. Now you can bend your tube into whatever shape you like or even try to spell out a word.
8. To make it more permanent, why not tape your Flexible Tube shape to a backing board like the side of an old cardboard box.
9. Take the Glow In The Dark Water filled tube into a dark room. Turn on the UV Light (2). Now how does the Flexible Tube look?



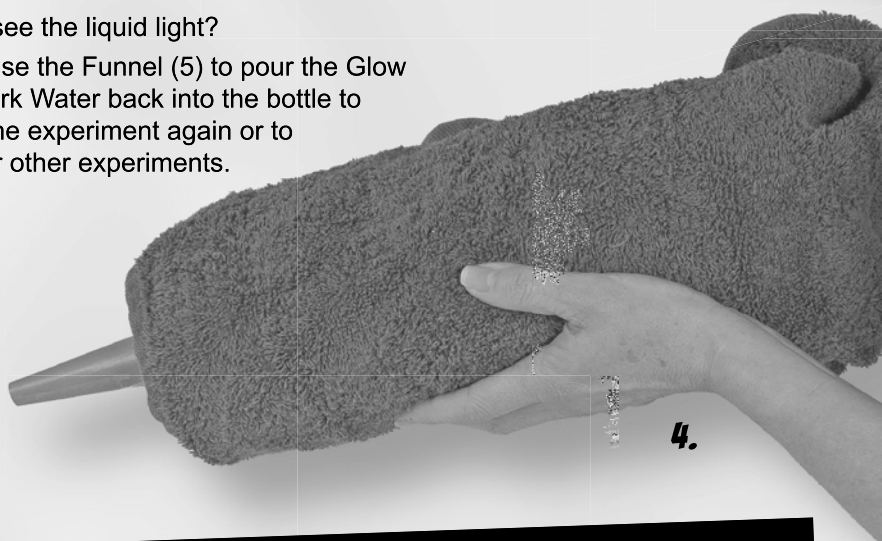
What Makes A Real Neon Sign Work?

Your neon-like sign is glowing because of the phosphors in the Glow In The Dark water (see explanation on page 5). Real neon signs however are produced in a different way by bending glass tubing into shapes. All the air is removed from the tubes and they are filling with neon gas. When a starter button is pressed, an electrical current is sent from an electrode at one end of the tube, through the neon, to a second electrode. This electrical current causes the atoms on the gas to move around really quickly and glow a fiery red. Blue neon lights are made by adding a few drops of mercury to the gas.

EXPERIMENT 3 - POUR LIQUID LIGHT

Items required for this experiment not included in the kit: tape, a towel and a large bowl like a washing up bowl.

1. Take the bottle of Glow In The Dark Water that you made on page 4 and tape the UV Light (2) to the base.
2. Unscrew the bottle lid and replace it with the Cone Shaped Lid (8).
3. Turn on the UV Light.
4. Wrap a towel around the bottle and UV Light so that the end of the Cone Shaped Lid pokes out the end but that everything else is covered.
5. This bit is a little tricky as you need to be in a dark room whilst not making a mess; tip up the bottle and pour the contents into a large bowl.
6. Can you see the liquid light?
7. You can use the Funnel (5) to pour the Glow In The Dark Water back into the bottle to perform the experiment again or to store it for other experiments.



What's happening in this experiment?

Fibre —optic cables are used to send information in the form of light over great distances and this experiment is very similar to how light travels down such a cable. Light is a series of vibrating waves of energy that we can see. In this experiment the light starts at the base of the bottle and illuminates the bottle's contents. When the water is poured out the Cone Shaped Lid, the light travels along the jet by bouncing repeatedly off the edges of the liquid. Each tiny photon (particle of light) bounces down the water jet like a bobsleigh going down an ice run. Now you might expect a beam of light travelling along a liquid simply to leak out of the edges, but if light hits a shiny surface at a really shallow angle (less than 42 degrees), it reflects back in again as though the water's edge were really a mirror. The scientific name for this is total internal reflection.

EXPERIMENT 4 - BUBBLES WITH A RADIOACTIVE-LIKE GLOW

Items required for this experiment not included in the kit: Some washing up liquid and a storage container.

WARNING:

• **MESS WARNING: THE BUBBLE SOLUTION MAY STAIN SO ALWAYS DO THIS EXPERIMENT OUTSIDE.**

• You should be wearing your goggles for all the experiments in this kit, but **MAKE SURE YOU ARE WEARING YOUR GOGGLES FOR THIS EXPERIMENT.**

1. Take the bottle of Bubble Solution (13). Remove the blowing wand and pour half of the bubble solution out into any clean storage container such as an old screw top drinks bottle where it can be put this to one side for later use.
2. Add a small squirt of washing up liquid to the Bubble Solution bottle.
3. Now top up the Bubble Solution bottle with Glow In The Dark Water (see page 4).
4. Screw the lid back on and give the Bubble Solution bottle a quick shake.
5. Go outside when it is dark and dip the bubble wand in the Bubble Solution and blow bubbles.
6. Look at the bubbles with the UV Light (2). Can you see their radioactive-like glow?



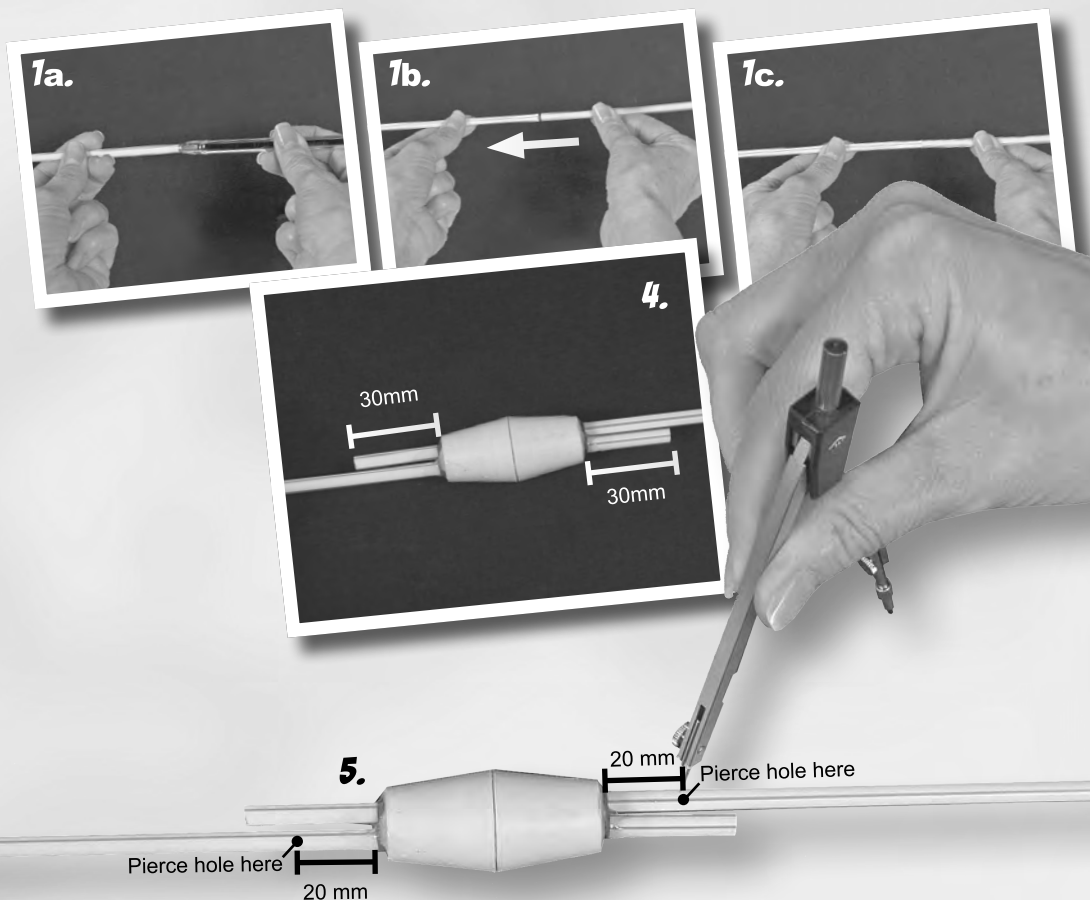
What's happening in this experiment?

A bubble is a thin film of soapy water. When air is blown through a wand full of soapy water, the air is captured inside the water membrane. The slippery texture of the soapy water easily glides around the trapped air creating a bubble. By adding Glow In The Dark Water to the solution, it becomes trapped in the bubble and is what you can see glowing when you shine your UV Light at the bubbles. Eventually, the soapy membrane loses its elasticity and breaks, causing the bubble to pop. No matter what shape a bubble has initially, it will always try to become a sphere. The sphere is the shape that requires the least energy to achieve.

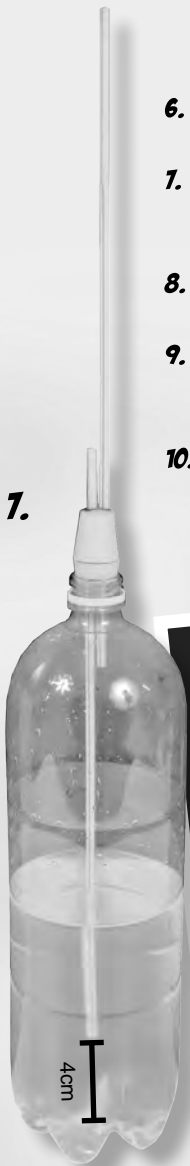
EXPERIMENT 5 - MAKE A NEVER ENDING GLOWING WATER GEYSER

Items required for this experiment not included in the kit: a compass, a ruler, a pen, tape and 2 x 1 litre soft drinks bottles.

1. Take 2 of the Straws (12) and slot them together. Do this by placing a pen into the end of 1 Straw to stretch it open and then slide the other Straw 1cm inside.
2. Wrap some tape around the join to hold it in place.
3. Do the same with other 2 Straws in the kit so that you create 2 long Straws.
4. Place the Straws through the holes in the Double Hole Bung (10). Make sure the measurements are correct.
5. **ASK AN ADULT to take a compass and pierce a small hole through 1 side of each of the Straws in the positions shown.**

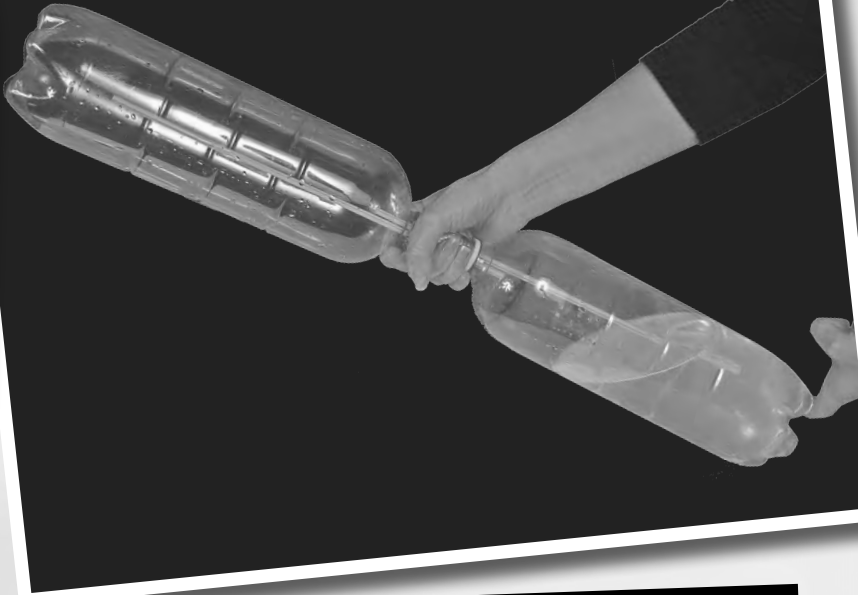


7.



6. Fill one of the soft drink bottle $\frac{1}{2}$ full with Glow In The Dark Water (see page 4).
7. Place the Bung/Straw fitment into the neck of the bottle making a tight fit. Make sure the long Straw is 4cm from the bottom of the bottle. Cut off any excess Straw length with scissors if necessary.
8. Place the second bottle on top ensuring a good tight seal. Tape the join.
9. Take the fountain into a darkened room and holding the unit at the centre of the 2 bottles, turn it over. Look at the fountain created by the Straw in the top bottle with your UV Light.
10. When the water has all run into the bottom bottle, restart the fountain by turning the bottles over again.

9.



What's happening in this experiment?

The Glow In The Dark Water will flow down one of the Straws therefore displacing the air up the other Straw. When the air flows up the Straw, it takes the water that has leaked through the little holes and pushes it upward, creating a fountain.

EXPERIMENT 6 - EDIBLE JELLY WITH A SPOOKY GLOW

Items required for this experiment not included in the kit: A pack of jelly, cellophane and some Indian Tonic Water containing Quinine.

1. Take the Jelly Mould (14), wash it with warm soapy water and dry it thoroughly.
2. Follow the instructions on the packet of jelly, but instead of using regular water, use the Indian Tonic Water instead. The instructions would normally be as follows:
3. Take 1 packet of jelly, break it into pieces, place in a microwavable bowl and add 100ml of Tonic Water.
4. ADULT HELP REQUIRED: Heat in the microwave for 1 minute.
5. Once all the jelly has melted, add more Tonic Water to make the mixture up to 570ml.
6. Line the mould with cellophane, patting it onto the mould's surface. This will help the jelly come out of the mould.
7. Pour the jelly mixture into the mould and place it in the fridge to set.
8. Once the mixture has set you can use the cellophane to lift it from the mould. Take it into a dark room and look at the jelly with your UV Light (2). Do you see that radioactive-like glow? Don't worry, it's perfectly safe to eat.



8.

What's happening in this experiment?

No matter what flavour or colour of Jelly you use, it will glow bright blue under the UV Light. This is caused by the fluorescent qualities of the Quinine in the Tonic Water. When the UV Light's photons are absorbed by the Quinine it triggers the emission of light radiation in the visible spectrum creating the blue glow effect. Quinine also gives tonic water a distinctive bitter flavour which you will also taste in the jelly. If you don't like the taste you can lessen it by using half tonic water and half tap water in the recipe.

EXPERIMENT 7 - MAKE GLOWING ECTOPLASM

Items required for this experiment not included in the kit: a mixing pot like an old margarine tub.

WARNING:

- **DISPOSE OF THE EXPERIMENT IN HOUSEHOLD WASTE.**
- **IF STARTS GROWING MOULD DISPOSE OF IMMEDIATELY AND WASH YOUR HANDS.**

1. Place 4 teaspoons of the Cornflour (6) into your mixing pot.
2. Now take your Glow In The Dark Water (see page 4) and add 3 teaspoons of this liquid to the Cornflour.
3. Stir until the two ingredients are mixed together.
4. Now you can put your hand into the ooze. Squeeze it. What can you feel between your fingers?
5. Squeeze a lump together and place it on your hand. What does it do when you let it sit there?
6. Now take the ectoplasm into a dark room. Play and look at it with your UV Light (2).



What's happening in this experiment?

Why does cornflour react like this? Scientists usually talk about the three types of matter: solids, liquids and gases, but a mixture of cornstarch and water make what is known as a suspension. When you squeeze a cornstarch suspension it really feels like a solid because its molecules line up, however it looks like a liquid and acts like a liquid when no one is pressing on it because the molecules relax. That, combined with glowing Glow In The Dark Water is what gives this goo its ectoplasm-like properties.

EXPERIMENT 8 - A GLOW IN THE DARK DEPTH CHARGE

Items required for this experiment not included in the kit: a bottle of Indian Tonic Water containing Quinine and a piece of thin card.

WARNING:

- **MESS WARNING: DO THIS EXPERIMENT OUTSIDE ON A LEVEL, SOLID SURFACE.**
- **You should be wearing your goggles for all the experiments in this kit, but MAKE SURE YOU ARE WEARING YOUR GOGGLES FOR THIS EXPERIMENT.**

1. Do this experiment outside in the dark. Use the UV Light (2) to see what you are doing.
2. Make sure your Tonic Water is at room temperature - if it comes from the fridge it won't give as good a result as if it is warmer.
3. Gently unscrew the lid so that as little gas escapes as possible.
4. Screw the Cone Shaped Lid (2) onto the top of the bottle.
5. Place the Loading Tube (3) near to the edge of the thin card and pour Rock Salt (7) inside until it is full.
6. Line up the Loading Tube on top of the Cone Shaped Lid keeping the piece of card between the two so the Rock Salt doesn't fall out.

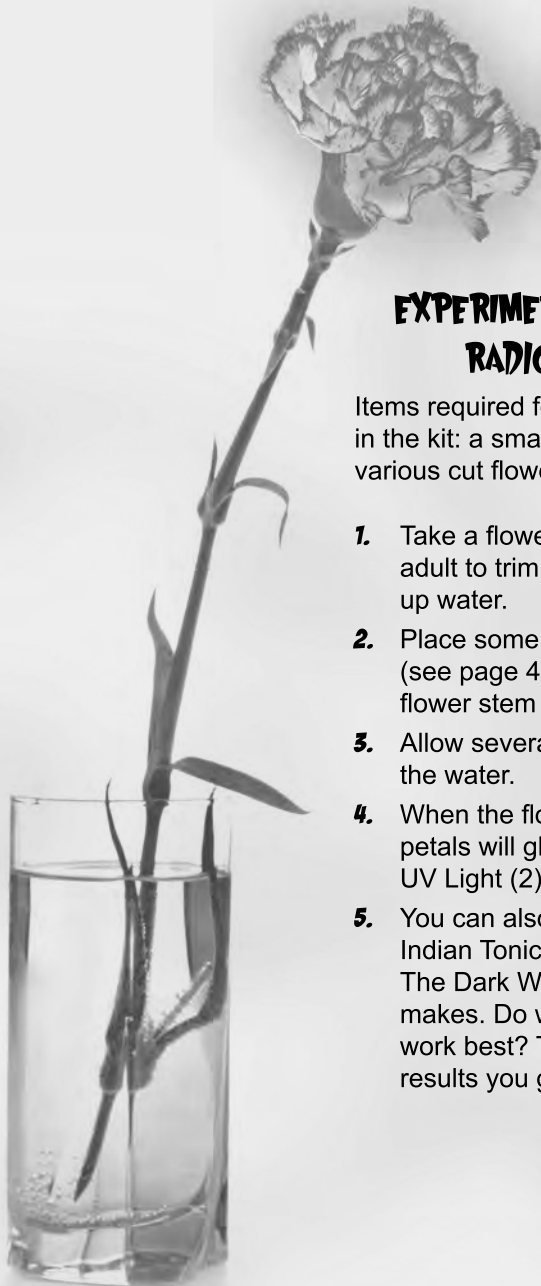


7. This bit is a little tricky: Remove the piece of card quickly and make sure the Cone Shaped Lid and the Loading Tube are still lined up.
8. The Rock Salt will fall into the Tonic Water. As soon as it starts to fizz, back away quickly from the bottle taking the Loading Tube with you.
9. Point the UV Light at the bottle and get ready for a glow in the dark depth charge explosion.

What's happening in this experiment?

Look at a glass of Tonic Water and you'll see streams of bubbles appearing as if by magic from certain spots on the inside of the glass. This is because there are microscopic specks of dust or nicks in the glass that act as seeds for carbon dioxide gas dissolved in the Tonic Water to be released. If you were able to look at the surface of the rock salt with a powerful microscope, you'd see that the surface is very rough. This structure creates tens of thousands of sharp sites on which bubbles can form. This is the reason rock salt causes carbonated drinks to foam so violently: they provide loads and loads of sites to release the carbonation. In addition, the fact that the exit of the Cone Shaped Lid is smaller than the entry hole, concentrates the force of the eruption as it is forced through the small end hole making the height of the eruption even greater. As you have seen before in other experiments in this kit, the Quinine in the Tonic Water fluoresces under the UV Light.





EXPERIMENT 9 - FLOWERS WITH A RADIOACTIVE-LIKE GLOW

Items required for this experiment not included in the kit: a small vase (or a drinking glass) and various cut flowers.

1. Take a flower such as a carnation and ask an adult to trim the end so that it is able to suck up water.
2. Place some of the Glow In The Dark Water (see page 4) into a vase and then place the flower stem into the water.
3. Allow several hours for the flower to take up the water.
4. When the flower has taken up the water, its petals will glow when you view them with the UV Light (2) in a dark room.
5. You can also repeat the experiment using Indian Tonic Water rather than the Glow In The Dark Water. See what difference this makes. Do white or brightly coloured flowers work best? Try different varieties and see what results you get.

What's happening in this experiment?

Plants drink water through a process called capillary action. The molecules of the plants attract the molecules of the liquid. This attraction draws the liquid up through the flower's stem into the leaves. It is the Glow In The Dark Water in the flower's petals that fluoresces when the UV Light shines onto it.



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