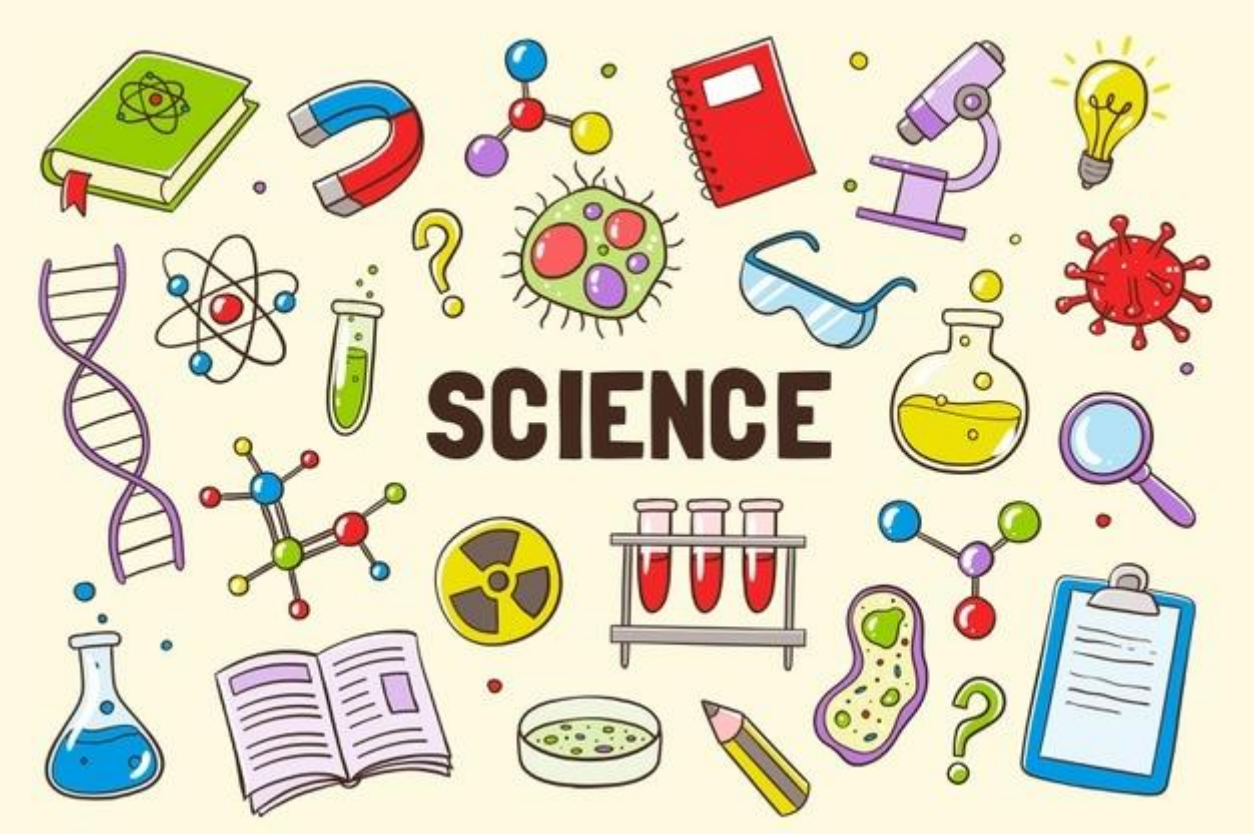
REDISCOVERY CENTRE



Magic of Science

Notes and Activities

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The Rediscovery Centre

The Rediscovery Centre is the National Centre for the Circular Economy in Ireland. A creative movement connecting people, ideas and resources to support greener low-carbon living. As the National Centre for the Circular Economy, we bring together the skills and expertise of artists, scientists, designers and craftspeople united in a common purpose of sustainability. Located in a bespoke demonstration eco-facility, we support four reuse social enterprises; Rediscover Furniture, Rediscover Fashion, Rediscover Paint and Rediscover Cycling. These businesses use unwanted materials for new product development and design demonstrating effective resource efficiency, reuse and low carbon living.

Our operational processes and programmes provide workplace skills training and development for unemployed people, graduates and the community. Our public training courses, demonstrations and educational activities highlight the benefits of effective resource management and encourage everyone to REDISCOVER the value of waste. The Centre's translational research activities support national waste prevention and climate action policy and advocate for a more resilient and equitable society. The Circular Economy Academy is a free mentoring and support programme that assists social enterprises and community organisations in any part of Ireland to move their activities towards sustainability and embrace the circular economy.

Rediscovery Centre Education provides a variety of exciting and interactive workshops that are based on hands-on enquiry and experiential learning. Our programme of education workshops for primary, secondary, and third level covers a wide variety of environmental and STE(A)M topics

The Rediscovery Centre has been an accredited Discover Centre under the Discover Primary Science and Maths Programme since 2006.

Current projects include:

- Rediscover Fashion
- Rediscover Furniture
- Rediscover Cycling
- Rediscover Paint
- Education Programme
- Research Programme
- Circular Economy Academy

Curriculum Links

Strand Links	Skills Development	Learning Objectives
SPHE Curriculum -Myself: Self-identity. -Myself & Others: Relating to others. -Myself & the wider world: Developing citizenship.		• be self-confident and have a positive sense of self-esteem • respect the environment and develop a sense of responsibility for its long-term care • develop and enhance the social skills of communication, co-operation and conflict resolution • develop some of the skills and abilities necessary for participating fully in groups and in society
SESE Curriculum: Science Energy & Forces: Forces; Light; Magnetism. Materials: Materials and change; Properties and characteristics of materials.	**Working scientifically**: Questioning; Observing; Predicting; Investigating and experimenting. **Designing and making:** Exploring; Planning; Making	• Develop an interest in and curiosity about the world through the exploration and study of living and non-living things. • Develop a knowledge and understanding of scientific ideas through the study of living things and the environments in which they live, energy and forces, materials and processes of change. • Observe, ask questions, discern patterns, hypothesise, plan, experiment, design, make, measure, discuss, analyse and evaluate results and so develop a scientific approach to problem solving. • Develop and apply constructive thinking in scientific investigations. • Apply and use scientific knowledge, skills and resources in designing and making tasks. • Explore the environmental repercussions of human actions on physical, natural and human environments. • Become actively involved in the discussion, exploration and resolution of environmental issues. • Communicate and record observations, evidence and results of experiments and investigations using a variety of oral, written and graphical forms and other media.
English Curriculum -Receptiveness to language. -Competence and confidence in using language		• develop the skill of listening actively and appreciate the significance of tone of voice, facial expression and gesture • explore and develop ideas and concepts through talk, directed discussion and writing • identify and evaluate the key points, issues and central meaning of a text or oral presentation and organise efficiently the information gained
Maths Curriculum: Shape & space: Spatial awareness; 3-D shapes; 2-D shapes. Data: Recognising and interpreting data.	Applying and problem-solving, Communicating and expressing, Integrating and connecting, Reasoning, Implementing, Understanding and recalling	Make mathematical connections within mathematics itself, throughout other subjects, and in applications of mathematics in practical everyday contexts.

Science of Magic Investigations

Liquid Density Investigation: Hubble Bubble Boil and Trouble Potion

Aim: To investigate the density properties of different liquids and use science to create a bubbling potion which explores these density differences.

Materials for each group:

- baby oil or vegetable oil, water, food colouring, effervescent/dissolvable vitamin C tablet
- 1 clear plastic bottle or tall container, 4 plastic containers, funnel, sticky labels

***NOTE:** Health and Safety: make sure the children are not allergic to any of the ingredients above before starting this experiment

Method:

- Engage: lead the class in a discussion on the density properties of different liquids, for example:
  - Are some liquids heavier than others (more dense)?
  - What happens when water and oil are put in the same container?
  - Does it make a difference which liquid is added to a container first? What will happen if you add oil first then water?
  - Allow time for the children to explore the different liquids.
- What will happen if an effervescent vitamin C tablet is added to water? Why does this happen? Demonstrate how the effervescent vitamin C tablet dissolves in water, releasing bubbles of carbon dioxide, which are lighter than water, and so rise to the top.
- Divide the class into groups of 4 to 6 students.
- Ask each group to put a label “Hubble Bubble Boil and Trouble” on the plastic bottle or tall clear container. This is where the ingredients will be mixed to create the potion
- Ask each group to put the ingredients in different containers with the labels. To make the science investigation more “magical”, the groups can decide on their own magical names for the ingredients, for example:
  - Jellyfish Venom (Baby Oil / Vegetable Oil)
  - Water taken from a well at Midnight (actually tap water)
  - Toad Slime (actually green food colouring)
  - Wartcap Powder (actually Effervescent/dissolvable vitamin C tablet)

Investigation:

- Fill the ¼ of “Hubble Bubble Boil and Trouble” container with tap water
- Add 4-5 drops of food colouring
- Fill the “Hubble Bubble Boil and Trouble” container with baby/vegetable oil.

- Stir the container and watch what happens! What do you think is causing this?
- Predict what will happen when we add effervescent vitamin C tablet
- Divide the effervescent vitamin C tablet) into four and Drop one quarter of the “Wartcap Powder” into the potion
- Watch what happens! What do you think is causing this?

The Science:

Density refers to how much mass there is in a particular space (or volume). Mass is a measure of how much matter an object is made up of. An object or liquid's density is determined by comparing its mass to its volume. For example, if you compare a rock and a cork that are the same size meaning they have equal volume, which is heavier? The answer is the rock, because it has more mass. Liquids such as oil and water have different densities, water has more mass than oil and so is denser. This means that if you mix water and oil, the water will sink to the bottom and the oil will float on top. The food colouring has the same density as water.

Oil and water do not mix. If you try to stir the container with oil, water, the oil breaks up into small little drops, but the oil does not mix with the water. This is because water molecules are polar molecules - meaning one end of the water molecule has a positive charge and the other end has a negative charge. This allows water molecules to bond together. Oil molecules, on the other hand, are non-polar. Non-polar molecules only mix well with other non-polar molecules. This is why oil doesn’t mix well with water - their molecules aren’t able to bond.

The effervescent dissolvable vitamin C tablet reacts with the water to create carbon dioxide gas, creating a fizz. When the tablet is dropped into the option, the tablet does not dissolve in oil and so does not react with oil layer as it sinks. When the tablet reaches the water, it reacts and creates bubbles of carbon dioxide gas. The gas is lighter, less dense than the water and the oil and so rises to the top of the liquid. These bubbles attach themselves to the coloured water at the bottom of container and cause them to float to the surface. When the bubbles pop and the gas escapes, the coloured water sinks back to the bottom.

Acid and Base Reaction Investigation: Foaming Potion

Aim: To investigate the reaction between an acid and a base and use the science of this reaction to create a foaming potion

Materials for each group:

- Vinegar, bicarbonate of soda, washing up liquid
- 1 clear plastic bottle or tall container, small plastic containers, spoons, sticky labels, litmus paper (pH indicator)

***NOTE:** Health and Safety: make sure the children are not allergic to any of the ingredients above before starting this experiment

Method:

- Engage: lead the class in a discussion on the acids and bases.
- Divide the class into groups of 4 to 6 students.
- Ask each group to put the ingredients in different containers with the labels. To make the science investigation more "magical", the groups can decide on their own magical names for the ingredients.
- Ask each group to put 10ml of vinegar in one container and 10g of bicarbonate of soda in another container. Predict whether each will be an acid or a base. Then test each with the litmus indicator paper to assess is it is an acid or a base.
- Discuss what the children think will happen when the vinegar is added to the bicarbonate of soda and predict what will happen. The groups can then investigate and observe the reaction. Test the resulting liquid with the litmus paper indicator.
- Ask each group to put a label "Foaming Potion" on the plastic bottle or tall clear container. This is where the ingredients will be mixed to create the potion
- Predict what will happen when they combine the vinegar, bicarbonate of sodium, and the liquid soap. The groups can investigate what happens when the ingredients are mixed in their potion container.
- To make the potions more magical, the children can add other ingredients such as food colouring/grass/leaves etc.

The Science:

Scientists often classify materials in order to understand more about them. One way of classifying liquids is whether the material or liquid is an acid or a base. Whether a liquid is an acid or base depends on the type of ions in it.

- What is an **acid**? An acid is a substance that has a low pH (between 0 and 7). Acids have many hydrogen (H) ions. Examples of acids are lemon juice, vinegar, and have a sour taste.

- What is a **base**? A base is a substance that has a high pH (between 7 and 14). Bases have many hydroxide (OH) ions. Examples of bases are bleach, bicarbonate of sodium, and have a bitter taste.
- What is a **neutral**? If a material is neither an acid nor a base, it is a neutral. An example of a neutral is pure water.

Scientists use the **pH scale** to measure how acidic or basic a liquid is. pH is a number from 0 to 14. From 0 to 7 are acids, with 0 being the strongest. From 7 to 14 are bases with 14 being the strongest base. If a liquid has a pH of 7, it's neutral.

An **indicator** is a special type of substance that can tell us whether the item in question is more acidic or basic. Litmus paper an example of an indicator. When it is put into a liquid, it changes colour depending on how acidic or basic the liquid is.

When an acid and a base are mixed together, they react to neutralize the acid and base properties, producing a salt, water and carbon dioxide gas. The chemical reaction between baking soda (sodium bicarbonate) and vinegar (acetic acid) produces carbon dioxide gas, which forms bubbles, causing the mixture to foam. When washing up liquid is added, it helps trap the bubbles so they don’t burst, and form a foaming potion.

Disappearing Coin Investigation

Aim: To investigate the refraction (or bending) of light and use science to make a coin disappear from view.

Materials for each group:

- A coin, clear drinking glass, jug of water, pencil

Method:

- Engage the class in a discussion on light and refraction.
- Divide the class into small groups and give the materials to each group
- Ask each group to place the coin on a flat surface such as their table.
- Place the base of the clear drinking glass over the coin. Can the coin still be seen? Does it look different when seen through the glass?
- Predict what will happen when water is poured into the glass
- Slowly fill the glass with water and continue looking at the coin through the glass. What happens? Why does this happen?
- Investigate the refraction of light further using a pencil put into the glass of water – does the pencil appear to bend where is enters the water? Does the section of pencil in the water appear different to the section above the surface? Move the pencil in the glass and look at it from different angles. Does its appearance change?

The Science:

The trick behind the Disappearing Coin investigation is the refraction of light. Images that we see are all light rays that reach our eyes. When these light rays travel through air, they experience little or no refraction. That's why you can still see the coin through the side of the empty glass.

When light travels from air into water, it slows down, causing it to change direction slightly. This change of direction or bending is called refraction.

When you poured water into the glass, it was as though the coin disappears, but it was really just the bending of light rays. Refraction occurs because of the molecules in the substances that the light rays are passing through. Gas molecules are spread out. This is why little to no refraction occurs. However, when light rays pass through a substance such as water, the refraction is greater because the molecules are closer together.

So when the light rays are traveling from the coin through the water, they are refracted and cannot make it to your eyes. In fact, the glass also refracts the light even more! The image ends up being projected near the top of the glass after the light refraction it has undergone.

Wingardum Leviosa

Aim: To investigate magnetism and magnetic field and to use science to make a feather levitate.

Materials for each group:

- A feather, paperclips, ruler, strong magnets, sticky tape, thread/fishing line, sticks/chopsticks/lollipop sticks (to create "magic wands)

Method:

- Engage the class in a discussion on magnetism
- Divide the class into small groups and give the materials to each group
- Each group can explore the force of magnetism using the magnets and paperclips to investigate how the magnets attract the paperclips, even at a distance.
- The children can then make their “magic wands”. To make the wands, place the magnets between 2 chop/garden sticks and tape into place. Test the strength of the wand by placing it 5cm from a paperclip and if the magnet is strong enough, the paperclip should jump to the magnet. If it is not strong enough, attach another magnet to the wand.
- Prepare the feather: Take a paper clip and tie 15cm fishing line to it, and slide the feather into the paperclip. Anchor the other end of the fishing line by fixing it securely to the table using sticky tape
- Hold the wand near the feather. It should jump up and stick to the wand at first but slowly lift up and the feather will levitate below your wand! Investigate the distance that the wand can still make the feather levitate before it falls.
- To make the investigation more magical, remember the proper wand movement: swish and flick and say the spell “Wingardium Leviosa”
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The Science:

Magnets are objects that produce magnetic fields that attract or repel other objects. Basically, a magnet applies a force over a distance on other magnets or magnetic materials. Some magnets are stronger than others. Strong magnets will create bigger pushing or pulling forces than weak magnets.

A magnet creates an invisible area of magnetism all around it called a magnetic field. This magnetic field is invisible but is responsible for the most notable property of a magnet: a force that pulls on other ferromagnetic materials, such as iron, and attracts or repels other magnets. The fields affect neighbouring objects along things called magnetic field lines. If you place an object in a magnetic field, it will be affected, and the effect will happen along field lines. The strength of the field around a magnet depends on how close you get: it's strongest very near the magnet and falls off quickly as you move away.

By keeping the feather and paperclip anchored, it will try to lift to the magnet but the fishing line will hold it in place allowing you to keep your magnet a short distance away and cause the feather to float or levitate.

Magical Milk Investigation

Aim: To investigate what happens when milk is mixed with soap and cause science to create a colour explosion in milk

Materials for each group:

- Whole milk, 4 different colours of food colouring, washing up liquid / liquid soap, cotton swabs
- Shallow bowl or dish, pipettes

Method:

- Engage the class in a discussion on what milk is made of.
- Divide the class into small groups and give the materials to each group
- Pour some milk into the shallow dish until the milk covers the bottom
- Add 3 to 4 drops of food colouring on the milk, using a variety of different colours. Does anything happen?
- Predict what might happen if you add a bit of washing up liquid into the milk.
- Investigate by adding the washing up liquid onto the cotton swab and put the swab into the centre of the milk. What happens? Why do you think this might happen?
- Move the swab to different sections of the milk. Watch in amazement as the colours dances across the surface of the milk.

You can try this experiment to investigate what happens if these is different fat content in the milk and will that make a difference. For example using whole milk, low fat milk and skimmed milk and comparing the results.

The Science:

The key to the dancing colours in this experiment is soap! Soap molecules consist of a hydrophilic (“water-loving”) end and a hydrophobic (“water-fearing”) end. Water molecules are polar molecules that can dissolve other polar molecules. Fat molecules are nonpolar molecules, so they cannot dissolve in water.

Milk is a mixture of water, fat, vitamins and minerals. When soap is added to the milk, it helps to separate the water and fat in the milk. When soap is mixed in with the fat and water, the hydrophobic end of the soap molecule breaks up the nonpolar fat molecules, and the hydrophilic end of the soap molecule links up with the polar water molecules. Now that the soap is connecting the fat and water, the nonpolar fat molecules can be carried by the polar water molecules.

As the soap molecules connect to the fat molecules, the molecules of the food colouring get pushed around everywhere resulting in an explosion of colour. As the majority of soap molecules attach to the fat molecules and the soap spreads throughout the milk, the colour explosion will slow and eventually stop. Add more soap and see if there are more fat molecules that haven’t attached to soap – if there are unattached fat molecules still, the colour explosion will begin again.