



EXPLORE
EVOLVE
DISCOVER!

YEAR 9 SCIENCE ELP

Curiosity
today,
discoveries
tomorrow!

EXPLORE. CREATE. CHALLENGE YOURSELF!

- Choose one of the two exciting tasks below to show your curiosity, creativity and love of science!

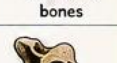
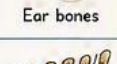
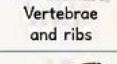
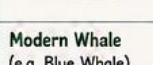
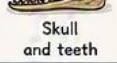


1 CHOOSE A MODERN DAY SPECIES OF YOUR CHOICE.

Create a poster of the timeline of its evolution, including evolutionary ancestors, when each new ancestral species evolved, where each ancestral species was located in the world and fossil evidence to support the timeline. Challenge yourself to go as far back in time as you can!



EXAMPLE: EVOLUTION OF THE WHALE

ANCESTRAL SPECIES	WHEN DID IT EVOLVE?	WHERE WAS IT FOUND?	FOSSIL EVIDENCE
Pakicetus (early whale) 	~50 million years ago (Eocene)	Pakistan 	Partial skeletons 
Ambulocetus 	~49 million years ago (Eocene)	Pakistan 	Skull and bones 
Rodhocetus 	~47 million years ago (Eocene)	Pakistan 	Ear bones 
Basilosaurus 	~40 million years ago (Eocene)	North America 	Vertebrae and ribs 
Dorudon 	~34 million years ago (Oligocene)	Africa 	Skull and teeth 
Modern Whale (e.g. Blue Whale) 	~5 million years ago - present (Pliocene - Holocene)	Worldwide 	Living species - no fossils 

THINGS TO INCLUDE:

- ✓ Clear timeline showing changes over time
- ✓ Where each species lived
- ✓ Fossil evidence (teeth, bones, footprints etc.)
- ✓ How and why the species changed over time

USE MAPS

Show where each ancestor lived.



USE IMAGES

Include drawings or photos of fossils and each species.



EXPLAIN CHANGES

Think about size, habitat, diet, body parts and behaviour.



★ CHALLENGE YOURSELF

Can you go back further than 50 million years?



2 GO ON A BIODIVERSITY WALK.

Take pictures of the different species along the way and identify which species you have seen.

Observe what factors may be affecting biodiversity along your walk, both positively and negatively.

Create a report on your findings including the images you have taken and the information you have collected.



WHAT TO INCLUDE IN YOUR REPORT



PHOTOS OF SPECIES YOU SAW



IDENTIFICATION OF SPECIES (use field guides or apps)



OBSERVATIONS & INFORMATION (where, how many, behaviour, habitat)



POSITIVE FACTORS (what helps biodiversity)



NEGATIVE FACTORS (what harms biodiversity)



CONCLUSIONS & SUGGESTIONS (how biodiversity could improve)

EXAMPLES OF SPECIES YOU MIGHT FIND



Robin



Oxeye Daisy



Bumblebee



Garden Snail



Lichen

POSITIVE FACTORS

- ✓ Lots of plants and flowers
- ✓ Trees and green spaces
- ✓ Clean air and water
- ✓ Wildlife corridors (hedges, rivers, paths)
- ✓ People respecting nature



NEGATIVE FACTORS

- ✗ Litter and pollution
- ✗ Habitat destruction
- ✗ Overuse of pesticides
- ✗ Invasive species
- ✗ Too much noise or light
- ✗ Climate change



TIPS FOR YOUR WALK



Walk slowly and quietly



Look in different places



Take notes and photos



Go at different times or in different weather



Respect wildlife - do not disturb or damage



CHALLENGE YOURSELF

Can you find a species you didn't know before? Are there seasonal changes in what you see?



PLEASE SUBMIT YOUR ELPs TO YOUR SCIENCE TEACHER BY THE **LAST DAY** OF THIS HALF TERM



YEAR 9 SCIENCE ELP

CATALYSTS DRIVE INDUSTRY AND A GREENER FUTURE!

EXPLORE INVESTIGATE INNOVATE MAKE AN IMPACT!

EXPLORE. CREATE. CHALLENGE YOURSELF!

Choose **one** of the two exciting tasks below to show your **curiosity**, **creativity** and **love of science**!

1 RESEARCH THE USE OF CATALYSTS IN LOCAL INDUSTRY.

You may want to start with the following companies:
Essar Energy Transition (Stanlow) and Compact Syngas Solutions (Flintshire).
Create an information leaflet or poster outlining what each company does, the catalysts they use (if this is available) and what the catalysts are used for.

EXAMPLE COMPANIES TO RESEARCH

 Essar Energy Transition (Stanlow) is developing a low-carbon hydrogen and fuel production facility at Stanlow in Cheshire.		
WHAT THEY DO	CATALYSTS (IF AVAILABLE)	WHAT THE CATALYSTS ARE USED FOR
Produce low-carbon hydrogen (via steam methane reforming) and other cleaner fuels for industry and transport.	Nickel-based catalysts (e.g. $\text{Ni}/\text{Al}_2\text{O}_3$) used in steam methane reforming.  Other proprietary catalysts used in fuel upgrading processes.	Convert methane and steam into hydrogen and carbon monoxide. Help make the process faster, more efficient and more selective, reducing energy use and emissions. 

 Compact Syngas Solutions (Flintshire) designs and supplies modular syngas plants for clean fuel and chemical production.		
WHAT THEY DO	CATALYSTS (IF AVAILABLE)	WHAT THE CATALYSTS ARE USED FOR
Produce syngas (a mixture of CO and H_2) from hydrocarbons using partial oxidation technology.	Nickel-based catalysts (proprietary) used in partial oxidation reformers. 	Help convert hydrocarbons into syngas efficiently and reliably at high temperatures. 

THINGS TO INCLUDE IN YOUR POSTER/LEAFLET

- ✓ What the company does
- ✓ Where the company is located
- ✓ The industrial processes they use
- ✓ The catalysts used (if available)
- ✓ What the catalysts are used for
- ✓ Why catalysts are important (e.g. efficiency, cost, lower emissions)



CHALLENGE YOURSELF

Can you find other local companies that use catalysts? How do they help create a more sustainable future?



2 INVESTIGATE THE EFFECT OF CHANGING SURFACE AREA ON REACTION RATES.

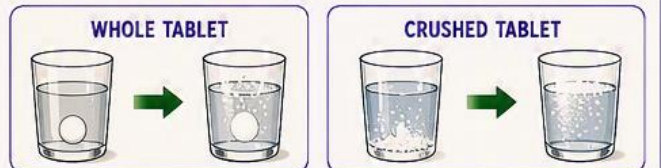
Take pictures of your experiments and write a report of your findings, including explanations of your observations.

METHOD

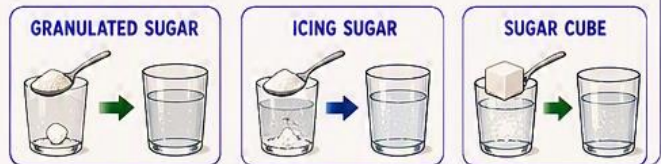
- Place a cube of chocolate/butter on a microwave safe plate. Heat in the microwave at 10 second intervals. Record how long it takes for the chocolate/butter to melt. Repeat with a cube chopped into smaller pieces.



- Add a vitamin C tablet to water and record how long it takes to fully react. Repeat using a crushed vitamin C tablet.



- Add a spoon of granulated sugar to warm water and time how long it takes to dissolve. Repeat using a spoon of icing sugar and a cube of sugar.



WHAT TO INCLUDE IN YOUR REPORT



CHALLENGE YOURSELF

Why does increasing surface area affect the rate of a reaction? Link your results to collision theory and explain your conclusions.



DISCLAIMER: Please seek parental permission before carrying out any at home experiments.



PLEASE SUBMIT YOUR ELPs TO YOUR SCIENCE TEACHER BY THE LAST DAY OF THIS HALF TERM



WAVES
CONNECT
OUR WORLD!




THINK BIG.
EXPLORE MORE.
MAKE AN
IMPACT!

YEAR 9 SCIENCE ELP

EXPLORE. CREATE. CHALLENGE YOURSELF!

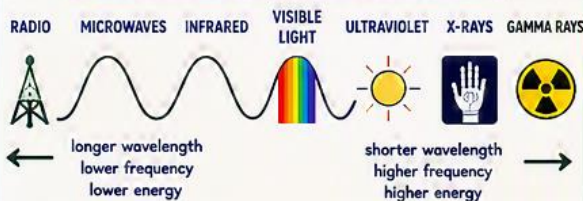
Choose one of the two exciting tasks below to show your curiosity, creativity and love of science!



1 RESEARCH THE TYPES OF ELECTROMAGNETIC WAVES, THEIR PROPERTIES, EVERY DAY USES AND THE DANGERS OF THEM.

Create a poster using the information you find.

THE ELECTROMAGNETIC SPECTRUM



2 NASA HAS USED A RANGE OF DIFFERENT ROBOTS TO FIND OUT MORE INFORMATION ABOUT THE PLANETS IN THE SOLAR SYSTEM.

Research how these different robots have been used and their discoveries. Design a new space robot that can collect rock samples from another planet.

EXAMPLES OF NASA ROBOTS AND THEIR DISCOVERIES

CURIOSITY (MARS ROVER)	PERSEVERANCE (MARS ROVER)	NEW HORIZONS (PLUTO PROBE)	JUNO (JUPITER ORBITER)
 - Landed on Mars in 2012 - Analyses rocks, soil and atmosphere - Found evidence of ancient lakes and organic molecules	 - Landed on Mars in 2021 - Collects rock and soil samples - Searching for signs of ancient life - Storing samples for return to Earth	 - Flew past Pluto in 2015 - Revealed icy mountains and possible oceans - Sent back high quality images	 - Orbiting Jupiter since 2016 - Studies atmosphere, magnetic field and gravity - Helped uncover the planet's formation

DESIGN YOUR OWN SPACE ROBOT!

SAMPLE DRILL

Drills into rocks up to 5 cm deep to collect core samples.

ROBOTIC ARM

Picks up rocks and places them in the container.

SAMPLE CONTAINER

Sealed, labelled container keeps samples safe from contamination.

CAMERAS & SENSORS

High-resolution cameras and spectrometers analyse rock composition.

NAVIGATION SYSTEM

Uses cameras and sensors to avoid obstacles and plan the best route.

SOLAR PANELS

Provides power to move, drill, and communicate.

THINGS TO INCLUDE IN YOUR REPORT & DESIGN



Information about existing robots



Their key discoveries and what they found



How they help scientists learn more



Your robot design with labelled features



How your robot collects, stores and returns samples



Why your design is effective for the planet you choose

THINGS TO INCLUDE IN YOUR POSTER

- ✓ A clear diagram of the electromagnetic spectrum
- ✓ Key properties of each wave (wavelength, frequency, energy)
- ✓ Real-life examples of their uses
- ✓ The potential dangers and how to stay safe
- ✓ How these waves help our lives and technology



CHALLENGE YOURSELF

Can you find how different wavelengths play a role in medicine, communication and space exploration? How do we benefit from them daily?



CHALLENGE YOURSELF

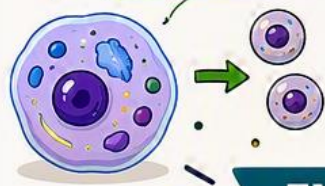
Which planet or moon would be the most interesting to explore next? What challenges would your robot need to overcome?



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**BIG IDEAS
BETTER FUTURES!**



YEAR 9 SCIENCE ELP

**ASK QUESTIONS
BE CURIOUS
MAKE
DISCOVERIES!**



EXPLORE. CREATE. CHALLENGE YOURSELF!

- Choose one of the two exciting tasks below to show your **curiosity**, **creativity** and **love of science**!

1 RESEARCH HOW STEM CELLS ARE BEING USED IN MEDICINE TODAY.

Create an information leaflet outlining their uses, benefits and risks. Include future potential uses of stem cells in medicine.



WHAT ARE STEM CELLS?

Stem cells are special cells that can develop into different types of cells in the body. They can also make more stem cells. This makes them very useful in medicine.

USES OF STEM CELLS IN MEDICINE TODAY



BLOOD DISORDERS
Stem cells from bone marrow or umbilical cord blood are used to treat conditions like leukaemia and lymphoma.



BURN TREATMENT
Stem cells can help regrow skin and heal severe burns.



CORNEAL REPAIR
Stem cells are used to treat damage to the cornea and restore vision.



TISSUE REGENERATION
Research is using stem cells to repair cartilage, heart tissue and even treat spinal cord injuries.

BENEFITS

- Can replace or repair damaged cells and tissues
- Can improve quality of life for many patients
- Umbilical cord stem cells do not require a match
- Potential to treat many diseases and injuries

RISKS & CHALLENGES

- Risk of rejection if not from the patient's own body
- Some stem cells may form tumours
- Ethical issues with using embryonic stem cells
- High cost and complex treatments



FUTURE POTENTIAL USES

TREATING DIABETES



Stem cells may be used to replace insulin-producing cells.

PARKINSON'S DISEASE



Research aims to replace brain cells that are lost.

HEART REPAIR



Stem cells could help regrow damaged heart muscle.

CUSTOM ORGANS



Scientists hope to grow organs for transplants in the future.

THINGS TO INCLUDE IN YOUR LEAFLET

- What are stem cells?
- Where do stem cells come from?
- How are they used in medicine today?
- Benefits of using stem cells
- Risks and ethical considerations
- Future potential uses and current research



CHALLENGE YOURSELF

Can you explain how stem cells could help treat a disease that does not have a cure yet?



2 CREATE STORY BOARD OF THE DIGESTIVE SYSTEM.

This could be images you draw of each stage or photos of a model you have made. Explain what happens at each part of the digestive system.



THE DIGESTIVE SYSTEM JOURNEY

1 MOUTH



Food is chewed by your teeth and mixed with saliva. Saliva contains enzymes that start to break down carbohydrates. The tongue pushes the food back to the throat.

2 OESOPHAGUS



Food travels down the oesophagus in a muscular tube. Waves of muscle contractions called peristalsis push the food towards the stomach.

3 STOMACH



Food is churned and mixed with stomach acid and enzymes. This breaks down proteins and kills harmful bacteria, turning food into a thick liquid called chyme.

4 SMALL INTESTINE



Enzymes from the pancreas and bile from the liver help break down food further. Nutrients are absorbed through the walls into the blood and carried around the body.

5 LARGE INTESTINE



Water and salts are absorbed from the remaining food. The waste becomes more solid.

6 RECTUM & ANUS



Waste is stored in the rectum. When it is ready, it leaves the body through the anus.

THINGS TO INCLUDE IN YOUR STORY BOARD



CLEAR IMAGES
OF EACH STAGE



EXPLANATION OF
WHAT HAPPENS



KEY FUNCTIONS
OF EACH PART



PHOTOS OF YOUR
MODEL (IF MADE)



BE CREATIVE!
USE COLOUR



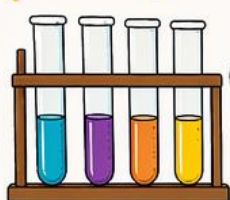
CHALLENGE YOURSELF

Can you explain how the digestive system works together to turn food into energy?



**PLEASE SUBMIT YOUR ELPs TO YOUR
SCIENCE TEACHER BY THE LAST DAY
OF THIS HALF TERM**





SMALL
SEPARATIONS,
BIG DISCOVERIES!

YEAR 9 SCIENCE ELP

EXPLORE
DISCOVER
INNOVATE!



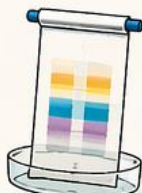
EXPLORE. CREATE. CHALLENGE YOURSELF!

Choose one of the two exciting tasks below to show your curiosity, creativity and love of science!



1 RESEARCH USES OF CHROMATOGRAPHY IN INDUSTRY

Research uses of chromatography in industry e.g. drug, food and forensic testing. Create a poster of the different industries that use chromatography. Challenge yourself to find the most strange or unique industrial use.



INDUSTRIES THAT USE CHROMATOGRAPHY

PHARMACEUTICALS (DRUG TESTING & DEVELOPMENT)



Checks purity of drugs, identifies active ingredients and detects contaminants.

FOOD & DRINK



Tests for food colourings, preservatives, sugars and contaminants. Checks quality and safety.

FORENSIC SCIENCE



Analyses inks, paints, drugs and explosives at crime scenes. Helps match evidence.

ENVIRONMENTAL TESTING



Detects pollutants in air, water and soil. Monitors ecosystems and water quality.

COSMETICS & PERFUMES



Separates scents and ingredients. Ensures product quality, stability and safety.

PETROLEUM INDUSTRY



Analyses complex mixtures of hydrocarbons in oil and gas. Helps improve fuel quality.

BIOTECHNOLOGY



Used to analyse proteins, amino acids and DNA. Important in genetic research and development.

ART & HERITAGE CONSERVATION



Identifies dyes and pigments in ancient artwork and documents without causing damage.

STRANGE BUT TRUE!



Chromatography is used to analyse chameleon pigments, detect doping in sports and even check the authenticity of money!

TYPES OF CHROMATOGRAPHY

PAPER CHROMATOGRAPHY



Simple, cheap and effective. Separates small amounts of coloured compounds.

THIN LAYER CHROMATOGRAPHY (TLC)



Fast and versatile. Used in many labs and industries for testing mixtures.

GAS CHROMATOGRAPHY (GC)



Used for volatile compounds. Common in forensics and petroleum analysis.

LIQUID CHROMATOGRAPHY (LC/HPLC)



Used for non-volatile compounds. Essential in drug testing and biomedical research.

THINGS TO INCLUDE IN YOUR POSTER

- ✓ What chromatography is and how it works
- ✓ Types of chromatography
- ✓ Industries that use it
- ✓ Real-life examples of how it is used
- ✓ Benefits of using chromatography
- ✓ A unique or unusual use you discovered

★ CHALLENGE YOURSELF

Can you find a use of chromatography that surprises your friends and family?



2 CHOOSE 20 OBJECTS AROUND YOUR HOUSE AND FIND OUT THE MAIN ELEMENTS THAT MAKE UP THOSE ITEMS.

Create a table of your findings, including the name of the object, a picture of the object, the type of materials that the object is made from and the main elements that make up the material.



EXAMPLE OF HOW YOUR TABLE COULD LOOK

#	OBJECT	PICTURE	MATERIALS	MAIN ELEMENTS
1	Spoon		Stainless steel (iron, chromium, nickel)	Fe, Cr, Ni, C
2	Pencil		Wood, graphite, metal ferrule, rubber	C, H, O, N, Al, Zn, S
3	Glass cup		Glass (silica)	Si, O, Na, Ca
4	Plastic bottle		Polyethylene terephthalate (PET)	C, H, O
5	Coin		Copper-nickel alloy	Cu, Ni, Zn
6	Aluminium foil		Aluminium	Al
...	...	...	...	...

TIPS FOR YOUR INVESTIGATION



Use trusted websites and periodic tables.



Look at the materials or label.



Take clear photos of each object.



Record your findings in a neat table.



Check more than one source if you can!

★ CHALLENGE YOURSELF

Can you find objects made from unusual materials? Which object contains the most different elements? Do any of your objects contain rare elements?



PLEASE SUBMIT YOUR ELPs TO YOUR SCIENCE TEACHER BY THE **LAST DAY OF THIS HALF TERM**





BIG IDEAS
BETTER
FUTURES!

YEAR 9

EXPLORE
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SCIENCE ELP

EXPLORE. CREATE. CHALLENGE YOURSELF!

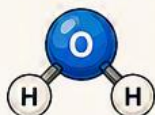
Choose **one** of the two exciting tasks below to show your **curiosity**, creativity and love of science!

1 RESEARCH THE SPECIFIC HEAT CAPACITY OF WATER AND HOW IT CONTROLS EARTH'S TEMPERATURES.

Research the specific heat capacity of water, why water heats up and cools down slowly and how this affects oceans, climate and weather. Use this information to create an infographic or leaflet.



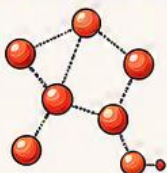
WHAT IS SPECIFIC HEAT CAPACITY?



Specific heat capacity is the amount of energy needed to increase the temperature of 1 kg of a substance by 1°C.

Water has a high specific heat capacity (4.18 kJ/kg°C). This means it can absorb and store a lot of heat energy before its temperature rises. It also releases heat slowly when it cools.

WHY DOES WATER HEAT UP & COOL DOWN SLOWLY?



- Water molecules are attracted to each other by hydrogen bonds.
- A lot of energy is needed to break these bonds, so water changes temperature slowly.
- Water can store and release large amounts of heat without big changes in temperature.

HOW WATER CONTROLS EARTH'S TEMPERATURES

OCEANS AS HEAT STORES



Oceans absorb heat slowly in summer and release it slowly in winter. This keeps coastal areas warmer in winter and cooler in summer.

CLIMATE REGULATION



Water vapour and clouds help trap heat and reduce extreme temperature changes. Evaporation cools the air, helping to balance temperatures.

WEATHER PATTERNS



Warm oceans fuel weather systems. The slow heating of water helps to drive winds, storms and rainfall.



THE BIG IMPACT

- Supports life by keeping Earth's climate stable.
- Reduces extreme temperature changes.
- Helps maintain weather and rainfall patterns.
- Makes Earth a unique planet in our Solar System!

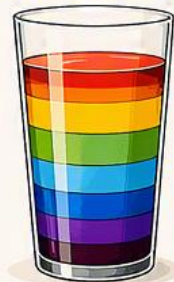
THINGS TO INCLUDE IN YOUR INFOGRAPHIC OR LEAFLET

- What is specific heat capacity? (include the value for water)
- Why water heats up and cools down slowly
- How oceans affect climate and weather
- Real-life examples (e.g. sea breezes, milder coastal climates)
- Diagrams, images and clear explanations



2 INVESTIGATE THE DIFFERENT DENSITIES OF LIQUIDS BY LAYERING LIQUIDS IN A GLASS.

Challenge yourself to see how many different liquids can you layer without them mixing. Start by using water, oil and syrup. How many more can you add? Take a picture of your final result and order the liquids you have used by their densities.



HOW TO DO IT

- Choose your liquids.



- Carefully pour the most dense liquid first.



- Add the next liquid slowly by pouring it down the side of the glass or over the back of a spoon.



- Keep adding liquids – how many layers can you make?



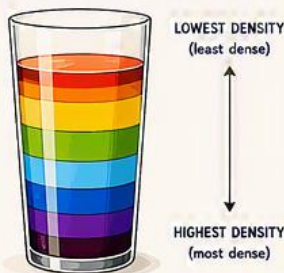
- Take a picture of your final result.



IDEAS FOR LIQUIDS TO TRY

- Honey
- Golden syrup
- Dish soap
- Vegetable oil
- Water
- Milk
- Rubbing alcohol
- Baby oil
- Corn syrup
- Food colouring (in water)

EXAMPLE LAYERED GLASS



EXAMPLE ORDER BY DENSITY (most dense at the bottom)

- Honey
- Golden syrup
- Dish soap
- Vegetable oil
- Water
- Milk
- Rubbing alcohol
- Baby oil
- Corn syrup
- Food colouring (in water)

THINGS TO INCLUDE IN YOUR REPORT



Photo of your layered liquids



List of liquids you used



Table ordering by density



Observations & explanations



What you found out



DISCLAIMER: Please seek parental permission before carrying out any at home experiments.



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