



# SciFest



## Project Ideas



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## Introduction

The most difficult part of doing a STEM fair project is actually coming up with a workable idea. Don't worry; the majority of students have exactly the same problem. What you must avoid doing is getting bogged down by the lists and lists of STEM fair project ideas that are available on the Internet. Remember you will be more passionate about, and interested in, something you have selected yourself.

- ☺ **Meet with your team.** Remember three heads are better than one
- ☺ Appoint a group leader
- ☺ Allow 24 hours for each member of the team to do some independent research and come up with ideas
- ☺ **Meet with your team**
- ☺ Decide on a Project category – Physical Sciences, Life Sciences or Technology
- ☺ Write down each suggestion
- ☺ Shortlist your 3 best ideas
- ☺ Allow 24 hours for each member of the team to do some independent research
- ☺ **Meet with your team**
- ☺ Select one idea and go for it!
- ☺ Design an experimental plan
- ☺ You are now ready to go



If you still have not come up with an idea the following list of project ideas may help. They are just suggestions to get you started. Select your favourite idea from the list and take it from there. Research, research and research some more. You may even come up with a new idea or a new angle on the suggested topic along the way. Design an experimental plan and you are now ready to go.

**Before starting your project make sure it is safe and ethical: Read the Disclaimer and Safety Precautions section of this document [here](#).**

## Boston Scientific Medical Devices Award



### Award Criteria:

The Boston Scientific Medical Devices award will be presented to the project that best demonstrates:

- Understanding of a problem/unanswered question related to science or engineering in the field of medical devices
- Understanding of an area where you have experience or are aware of something to help / improve /change a person's quality of life who may have a medical need - parent / sister / brother / grandparent / classmate
- Provides a contribution to the medical device field through research/experimentation

See website for Research details: [Boston Scientific Medical Devices Award – Project Ideas](#)

## 1. Design a Game that Helps Children with Cystic Fibrosis Improve their Airway Clearance and Breathing

Airway clearance techniques (ACTs) are treatments that help people with cystic fibrosis (CF) stay healthy and breathe easier. ACTs loosen thick, sticky lung mucus so it can be cleared by coughing or huffing. Clearing the airways reduces lung infections and improves lung function. There are many ACTs. Most are easy to do. For infants and toddlers, ACTs can be done by almost anyone. Older kids and adults can do their own ACTs.

**ACTs are often part of daily life for children with CF, so why not make it more fun. Design a game that uses some of the breathing techniques to help kids help themselves.**

### You might like to:

- Read and understand some of the challenges facing kids with CF
- Design a game that uses breathing techniques to help kids to clear their airways
- Work with CF kids to try it out and report back your results
- Think about how they might get the whole family involved

### Research Links:

<https://www.cfireland.ie/>

<http://www.cfri.ie/>

<http://www.ndsu.edu/pubweb/~mcclean/plsc431/students98/senn.htm>

## 2. Design a Device to Assist in 'Drawing Blood' from a Vein

Venipuncture is the collection of blood from a vein. In some patients (for example infants, elderly) it can be difficult to locate the vein and as a result challenging for a nurse or doctor and sometimes painful for the patient, who is getting stuck repeatedly while the nurse / doctor is searching for that vein.

Removal of blood is a daily activity by nurses and doctors. Can you design a better way to find, and remove blood from, a difficult to find vein?

### You might like to:

- Read and understand some of the challenges facing nurses / doctors
- Understand why some people have difficult-to-find veins
- Find out if there are currently devices to assist
- Develop different ideas / solutions
- Develop a prototype

### Research Links:

<http://medical-dictionary.thefreedictionary.com/venipuncture>

[http://www.bbc.co.uk/schools/gcsebitesize/science/21c/keeping\\_healthy/heartdiseaserev2.shtml](http://www.bbc.co.uk/schools/gcsebitesize/science/21c/keeping_healthy/heartdiseaserev2.shtml)

### 3. Off the Ball – Orthotics!

Athletics, Rugby, Camogie, Hurling, Football, Soccer, Basketball, ..... Unfortunately many of the sports we play can cause injury. Many athletes are now wearing orthotics inside boots and runners to help treat and / or prevent injury. Could this have being diagnosed earlier in life?



#### You might like to:

- Read and understand the use of sports orthotics
- Understand some of the basic biomechanics behind the design of orthotics
- Interview people you may know with orthotics
- Find out at what age do children first get detected for orthotics
- Develop different orthotic ideas / solutions
- Develop a prototype

#### Research Links:

<http://www.pamf.org/sports/saxena/orthotics.html>

### 4. Additional Boston Scientific Medical Devices Project Ideas

- Different types of plasters to help wounds to heal, designing a plaster to fit those awkward areas that are always moving, e.g., knees
- A sun-screen protector for a small child
- Crutches that are safe in wet conditions
- A more user- friendly drip for a child who is long term in hospital – portable/disguised
- Colour changing dressing to indicate infections / scar healed
- Stethoscopes
  - ✓ Why are they always so cold – can they be heated?
  - ✓ New heated stethoscopes device!
- Walking Aids
  - ✓ Can we improve – how do we know if someone falls or slips?
  - ✓ Is there an inbuilt alert system / tracker?

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## EirGrid Cleaner Climate Award



### Award Criteria:

This award is presented to the project that best demonstrates the design of a creative, innovative approach which contributes to a cleaner energy future. Projects should focus on at least one of the following:

- Climate Change - these could include social studies, data studies, etc.
- Renewable Energy
- Electricity Transmission
- Existing and alternative energy generation, including wind energy and solar energy
- Carbon Footprint
- Energy Savings
- Air Quality

## 5. Climate Change

Greenhouse gas emissions from burning fossil fuels are one of the primary contributors to climate change. A significant reduction in these emissions will support meeting the targets set out in global agreements such as the Paris Agreement, which will limit the most dangerous and irreversible effects of climate change.

“Climate projections for the next century indicate changes in wind speeds and storm tracks; increased likelihood of river and coastal flooding; changes in distribution of plant and animal species and in the timing of lifecycle events of native species; water stress for crops, pressure on water supply and adverse impacts on water quality and negative impacts on human health and wellbeing” (EPA).

### Have you ever wondered what impact climate change will have on Ireland?

#### You might like to:

- Investigate the potential impacts of exceeding the 1.5 °C target on Ireland
- Research the causes of climate change and design an experiment to demonstrate their effect (e.g. measure temperatures to learn about the greenhouse gas effect or explore how melting ice affects sea levels)
- Design a study to investigate how aware the public is of climate change (e.g. causes, impacts, solutions)
- Design an experiment to report on your school’s carbon footprint and detail actions on how to reduce it: transport, electricity use, food consumption, etc.



## 6. Renewable Energy

One of the leading contributing factors to climate change is power generation from burning fossil fuels such as coal, oil and natural gas (United Nations). Countries have made pledges to become net zero through decarbonisation, in which renewable energy will play a monumental role.

Renewable energy is energy derived from natural sources that are replenished at a higher rate than they are consumed (United Nations). Renewable energy sources come in various forms, but what they have in common is that they are in plentiful supply and can be found all around us such as wind. Governments worldwide are investing in renewable energy infrastructure and funding new projects to support in meeting their respective targets.



### Have you ever wondered how renewable energy works and if it will reverse the damage caused by climate change?

**You might like to:**

- Evaluate the different types of renewable energy generation
- Investigate which type of renewable energy source is the most efficient for Ireland to use
- Investigate how local community groups or schools could develop their own renewable sources of energy and determine the environmental and social benefits of this
- Investigate the impact of the energy crisis on the transition to renewable energy
- Design and create structures that use renewable sources to produce energy to operate common objects (e.g. a fan or charge a phone)

## 7. Electricity Transmission

Electricity transmission is where electricity is transported from the point of generation (e.g. solar or wind farms) to the demand centres (cities, towns and businesses). The electricity is transmitted through a network of high voltage overhead lines and underground cables. These lines and cables then meet at different points called substations. Once the electricity reaches the substation, it is then converted to a lower voltage and distributed to buildings and homes. The large overhead line towers are called pylons, which vary in size depending on the voltage they can carry. You will typically see overhead electricity lines in rural areas as they can cover greater distances, whereas underground cables will be commonly found in built-up towns and cities.

**Have you ever wondered how energy is transported and reaches our homes?****You might like to:**

- Design an experiment to investigate the impact that increasing the voltage has on the efficiency of transmitting electricity
- Investigate which common material is most effective in electricity transmission
- Design an experiment to investigate the effectiveness of wireless electricity transmission



## 8. Wind Energy

Wind energy is a form of renewable energy which is used to generate electricity. This form of generation is a much more sustainable alternative to fossil fuel electricity generation. In Ireland, wind turbines are used both onshore and offshore to generate wind energy. Over the next decade, more and more wind farms will be built offshore as Ireland aims to generate 7 GW of offshore wind power by 2030. This will support Ireland in meeting its Climate Action Plan 2023 target to have 80% of electricity generated from renewable energy sources on the grid by 2030.

**Have you ever wondered why wind energy is so important for Ireland?****You might like to:**

- Investigate what conditions are required for optimum wind generation such as weather, height, location etc.
- Design your own wind turbine, which could be used to power individual homes
- Compare onshore and offshore wind generation and investigate which is more efficient to produce
- Investigate the different types of wind turbines, and determine which is the most effective for wind energy generation e.g. compare size, number of blades, material



## 9. Solar Energy

Solar energy is produced by nuclear fusion that takes place in the sun. It is necessary for life on Earth and can be harvested for human uses such as electricity (National Geographic). An increase in solar energy produced will support in reducing our reliance on fossil fuels. Solar panels that produce electricity are known as solar photovoltaic (PV) modules. These panels generate DC electricity when exposed to light (SEAI). The Government have set out a target for Ireland to generate up to 5 GW of solar by 2025, and 8 GW by 2030. This will support Ireland in meeting its Climate Action Plan 2023 target to have 80% of electricity generated by renewable energy on the grid by 2030.

**Have you ever wondered what role solar energy will have in reducing Ireland's reliance on fossil fuels?**

**You might like to:**

- Design an experiment to investigate the different conditions required for the production of solar energy (e.g. location, angle etc.)
- Research the different types of solar panels, and investigate which are the most effective for solar energy generation in Ireland (e.g. compare size, material etc.)
- Design an experiment that uses solar energy to operate common objects (e.g. charge a phone)



## 10. Energy Storage

As Ireland moves away from conventional fossil fuel generation and towards renewable energy such as wind energy, we will need to start utilising long-term energy storage. Currently, with fossil fuels, we can control when we generate energy, which allows us to ensure we have enough energy to meet demand during peak times. With renewable energy, we cannot control when the wind blows or the sun shines and therefore at windy and sunny times, we can create lots of energy but if there's no demand for that energy, we have to stop the wind turbines or solar panels from generating energy. Storing energy will allow us to keep this energy for use later when it is less windy or sunny. There are several methods to store energy, including pumped hydro and batteries. Looking to the future renewable hydrogen could be used for longer-term energy storage.

**Have you ever wondered about the future of energy storage?**

**You might like to:**

- Develop an experiment demonstrating a method of storing energy
- Investigate how Ireland's pumped hydro storage station at Turlough Hill works and how this technology will work with increased renewable energy production
- Investigate how renewable hydrogen can be used to store energy and how this would be a benefit to Ireland
- Investigate the pros and cons of battery storage and how 'daisy chaining' could help store energy short term
- Design a new system for energy storage in Ireland. You can look at projects such as 'Energy Vault' for inspiration [here](#)



## 11. Carbon Footprint

The energy crisis has put a spotlight on the important role we can all play in saving energy. Energy saving at home will see a reduction in energy bills and the household's carbon footprint. Our carbon footprint is "a measure of the impact your activities have on the amount of carbon dioxide (CO<sub>2</sub>) produced through the burning of fossil fuels and is expressed as a weight of CO<sub>2</sub> emissions produced in tonnes" (WHO). As individuals, we can reduce our personal carbon footprint by rethinking our use of energy, water and transport as well as the food we eat.

The [Carbon Clock](#) feature on EirGrid's Smart Grid Dashboard shows the best and worst time to use electricity throughout the day in terms of carbon intensity.

**Have you ever wondered what impact your household or school's carbon footprint is having on the environment?**

**You might like to:**

- Calculate your personal, household or school's carbon footprint and investigate the impact it has on the environment and how to reduce it
- Compare Ireland's carbon footprint with that of other countries and determine the reasons why Ireland ranks higher or lower per capita (e.g. higher car ownership in Ireland than country X leading to an increase in emissions)
- Design an experiment to test which common materials are most effective in preventing household heat loss or increasing the efficiency of energy use in a home
- Design and implement a creative campaign to highlight awareness of energy savings and monitor how effective it is



## 12. Energy Savings at Home and School

Energy efficiency at home or school has several benefits from saving on energy bills to becoming more environmentally friendly as we reduce our carbon footprint.

When it comes to electricity specifically, being more energy efficient has many advantages. Managing how we use electricity will help to maintain a secure supply of electricity to our homes and schools. A way that individuals can do this is by supporting in managing peak electricity demand. This can be achieved by reducing electricity use at times when the electricity demand is at its peak and the system is tighter. Ways in which we can save energy at home and school are by turning the lights off, layering up and taking public transport, walking, or cycling to school.

**Have you ever wondered how you could encourage people to reduce their energy use at home and school?**

**You might like to:**

- Investigate how your community (school, home, town etc.) could reduce its energy demand
- Design a survey to investigate the public's perception of energy saving at home and determine the reasons why people will reduce their consumption (e.g. cost, reduced carbon footprint etc.)
- Investigate Ireland's energy consumption patterns and determine the causes of either an increase or decrease in energy use compared to previous years
- Design and implement a campaign to spread awareness of how individuals can reduce their energy consumption (e.g. walk, cycle or take public transport to school or work) and monitor its progress

**13. Air Quality**

One of the main benefits of decarbonisation is less air pollution as a result of an increase in renewable energy and investment in green technologies. Air pollution is the contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere. Common causes of air pollution are household combustion devices, motor vehicles, industrial facilities, and forest fires. An increase in electric vehicles on our roads will see air quality improve. However, this electrification of society will increase demand on the electricity grid which will have to be managed and planned for.

**Have you ever wondered how different forms of energy use impact air quality?****You might like to:**

- Design an experiment to test air quality in the area surrounding your school or local community
- Investigate conditions which lead to greater air pollution, e.g. traffic congestion
- Investigate the impact that the electrification of the heat or transport sector will have on energy demand
- Design a study to investigate how aware the public is of air pollution (e.g. causes, impacts, solutions)



## 14. Alternative Energy Generation

The energy crisis has reinforced the need to transition to renewable energy. In response to this, the events and performance industry have had to look to alternative sources of energy generation to reduce demand on the grid and reduce their carbon footprint.

Coldplay in their recent tour, *'Music of the Spheres'*, have pledged to cut their emissions by 50%. It is proposed this will be done by "supporting new green technologies and developing new sustainable, super-low carbon touring methods". Coldplay has begun to use kinetic energy to support powering their shows by installing kinetic floors which converts the energy from fans' dancing into energy to power the show. Kinetic energy is energy that a body possesses by being in motion.

For more information on Coldplay's pledge visit their website [here](#).

**Have you ever wondered what alternative energy generation solutions exist and how they can be harnessed to support decarbonisation?**

**You might like to:**

- Design an experiment to test how effective kinetic energy is at powering common objects
- Design a device to collect kinetic energy which can be used by individuals as they go about their day-to-day tasks
- Research piezoelectric materials and determine whether they can produce electrical energy when squeezed or stretched



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## Sustainability Projects (Courtesy of Smurfit Kappa)

### 15. SafeShield – COVID-19 Safety Desk Dividers

In response to the need to protect office workers, children and students during the COVID-19 pandemic, we created SafeShield desk dividers designed to support social distancing in offices, schools, colleges and universities. SafeShield desk dividers are made of corrugated board and can be used, replaced and recycled, easily and quickly. They are both a hygienic and cost-effective solution for our customers.

#### You might like to:

- Think of another way where sustainable paper-based alternatives could be used to promote hygiene and social distancing and/or used more in healthcare settings
- Decide which paper-based alternatives would work best
- Research if any paper-based materials have any antimicrobial properties
- Demonstrate the value and benefits



### 16. KarTent and Smurfit Kappa Eco-friendly Cardboard Tents

KarTent was invented by two young Dutch entrepreneurs who spotted a growing tendency by festival goers to abandon their tents at the end of the event, creating an enormous waste pile of mostly unrecyclable material. Smurfit Kappa was able to help the pair turn their vision into reality by creating a 100% cardboard tent that is both eco-friendly and convenient for festival goers.

#### You might like to:

- Think of another plastic material or product that is easily abandoned
- Decide which paper-based alternatives would work best
- Research other forms of temporary accommodation where this approach may apply
- Design it to be recyclable and, if littered biodegrades naturally without leaving a trace



### 17. Fashion Packaging - Rollor eCommerce

Rollor packaging is a worldwide to ship garments crease-free and offer customers a unique unpacking experience. Breaking with traditional packaging, the box can be rolled up without the clothing being distorted. Crease free fashion items can result in up to 50% fewer returns, according to existing clients. All Rollor packaging is FSC® certified, 100% recyclable and made from a renewable resource. The packs are also 100% plastic free as no coat hangers or plastic bags are needed.

#### You might like to:

- Think of another plastic material or product used in eCommerce that a paper-based alternative could replace
- Brainstorm other problems have you experienced when receiving a package? Could a change to paper-based packaging help improve the customer experience?
- Demonstrate the value and benefits of this alternative



## 18. Bag-in-the-Box - Detergents

Bag-in-Box is a sustainable choice of packaging for many industries such as juice, eggs and dairy. Bag-in-Box is an efficient and environmentally friendly packaging solution for detergents. Composed of 75% corrugated box and only 25% of plastics, it reduces plastics used up to 70% compared to the traditional bottles. In addition, it substantially cuts transport costs and optimises storage space. Firstly, because it is shipped to our customers in flat. Secondly, even when filled, its rectangular form allows 65% more of the products shipped in a truck than the traditional plastic bottle



### You might like to:

- Think of another rigid plastic container where a Bag-in-Box solution could be used to promote sustainable packaging
- Create a design that significantly minimises the carbon footprint impact
- Demonstrate how the Bag-in-Box solution can enhance the customer experience

**Cardboard is stronger and more durable than you have ever imagined. With the right amount of imagination and creativity, combined with science and engineering, you can create almost anything.**

## 19. AgroPaper™ - Paper Alternative for Mulching

Smurfit Kappa have developed a revolutionary new paper to replace Polythene. Made from long pine fibres from sustainably managed forests in Northern Spain, AgroPaper enables efficient and eco-friendly mulching. It prevents weed growth but does not need to be removed after harvest as it is fully compostable and can be laid with existing machinery. The material that farmers currently use for mulching is plastic (Polythene) which causes multiple problems including significant handling costs due to the lengthy manual process and pollution as fragments of plastic are left behind after the harvest.



### You might like to:

- Think of another plastic material or product that is used in farming or industry. Could a paper-based alternative do the same job?
- Decide which paper-based alternatives would work best
- Demonstrate the value and benefits of how they would compare to plastics

## 20. Packing Retail - Fruit Punnets

Paper-based punnets, trays and baskets offer a replacement to polystyrene or plastic trays. Made from corrugated cardboard or solid board, our punnets are 100% recyclable and made from a renewable resource. Fruit punnets are also designed to meet the physical requirements of the supply chain to ensure fruit arrives in optimal condition, protect fruit in transit while offering consumers excellent visibility of the product.



### You might like to:

- Keep a single use plastic diary over the period of two weeks
- Choose one of these products and think about how it could be replaced with a paper-based alternative
- Investigate which paper-based materials can carry the most weight and are strongest
- Demonstrate the value and benefits of how they would compare to plastics

**Cardboard is stronger and more durable than you have ever imagined. With the right amount of imagination and creativity, combined with science and engineering, you can create almost anything.**

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## ESERO Ireland Discover Space Award – Sample Projects

The European Space Education Resource Office Ireland (ESERO Ireland) is a project co-funded by SFI and the European Space Agency. The aim of the project is to use space as a theme to support the teaching of science and maths through the provision of resources, inspirational materials and training for teachers.



Criteria: The award is presented to the project which best uses Space as a theme in science, technology or maths. Space education information and resources are available from [www.esero.ie](http://www.esero.ie).

### 21. Light Pollution

Light pollution is a big issue for people (including observatories) trying to view faint objects in the night sky. The stray light from streetlights, houses, cars, etc. has the effect of lighting up the night sky which limits the amount of objects we can observe in the sky. This means that people living in cities rarely see the stars in the sky. The best observatories in the world are placed in remote locations in order to minimise the effect of light pollution. Light pollution has also been shown to have an effect on the health of humans and animals. As the world becomes ever more populated it is important that we manage the issue of light pollution.

#### You might like to:

- Research effects of light pollution – both positive and negative
- Study the effect of night lighting on nearby trees and plants
- Monitoring/Measuring
  - Use commercial light meters
  - Build a custom Arduino/ raspberry pi sensor
- Develop a mobile phone app
- Campaign to raise awareness
  - Local media
  - Social media
  - Citizen science



#### Research Links:

<http://www.globeatnight.org/light-pollution.php>  
<http://www.lightpollutionmap.info/>  
<http://www.darkskiesawareness.org/faq-what-is-lp.php>  
<http://physics.fau.edu/observatory/lightpol-Plants.html>



## 22. Collect and Analyse Meteorite Dust

Cosmic space dust regularly enters Earth's atmosphere, from asteroids and other moving space objects. Lots of this material burns up in the atmosphere, but some of it finishes up on the ground here on the Earth. A small asteroid is called a meteoroid. Meteoroid material that makes it to the ground on Earth is called a meteorite.

### You might like to:

- Devise a way to collect and analyse meteorite dust or design a collection system
- Determine which places are best to collect the dust, compared to others
- Think about ways to tell the difference between real space dust and dust from terrestrial materials such as iron and other industrial metals
- Compare the amount of dust you find on different nights – does it increase when there's been a meteor shower (for example, the Lyrid Shower on 22-23 April)?

### Research Links:

<https://icecube.wisc.edu/outreach/activity/micrometeorites>

<http://www.planetary.org/blogs/bruce-betts/20140815-Stardust-home-dust-found.html>

<http://earthsky.org/astronomy-essentials/everything-you-need-to-know-lyrid-meteor-shower#how>

## 23. Evaluation of Citizen Science Space Projects

Citizen Science, where ordinary people are encouraged to take part in scientific research, is growing in popularity. To broaden astronomical knowledge, people who have backyard telescopes can contribute to the understanding of space, by recording supernovae or movement of near-Earth objects, for example. How much does citizen science actually contribute to new scientific knowledge or understanding?

### You might like to:

- Report on the use of Citizen Science in space projects
- Find out whether the results found by people who aren't funded scientists contribute to understanding of space, by region or country
- Come up with your own astronomy citizen science project idea, and collect some data

### Research Links:

<https://www.planetary.org/kids>

[http://hubblesite.org/get\\_involved/citizen\\_science/](http://hubblesite.org/get_involved/citizen_science/)

[Lessons Learned from Citizen Science Projects](#)

### Other topics to consider:

- Robotic telescopes
- Measuring the temperature of stars
- Variable stars
- Our atmosphere's effect on observatories
- The moon
- Planets in our solar system
- Planets not in our solar system

## 24. Solar Activity

Our nearest star, our Sun, has a very significant effect on life on earth. While on larger time scales our Sun is very stable, on shorter time scales we know that there are events which happen quite quickly and can affect life here on Earth. Sunspots, coronal mass ejections and solar flares are events which take place regularly. Understanding and monitoring these events is very important for life on Earth. A notable example of the impact of solar activity on life on Earth came in 1989 when a large solar flare disabled the Canadian power grid, leaving the country in darkness.



### You might like to:

- Understand solar activity
- Understand why monitoring solar activity is important
- Research the effects on people on Earth – positive + negative
- Monitoring
  - Develop an instrument which monitors the radioactivity of our closest star – the Sun.
  - Correlate the data with other data available – SOHO
- Campaign
  - Inform the public about the Sun's activity
  - Develop a mobile app
  - Set up a twitter feed

### Research Links:

[http://www.nasa.gov/topics/earth/features/sun\\_darkness.html](http://www.nasa.gov/topics/earth/features/sun_darkness.html)  
<http://backyardastronomer.com/sid/sindex.html>

## 25. NEO Monitoring

A near-Earth object (NEO) is a Solar System object whose orbit brings it into proximity with Earth. These include more than ten thousand asteroids, comets and spacecraft. Should a NEO impact the Earth the implications could be huge for our survival on this planet. Early detection and data relating to these objects arm us with the tools to avoid disaster. Understanding and monitoring these objects is a very important task for life on our planet.

### You might like to:

- Research NEOs
- What can we do if one is on a collision course with Earth?
- What systems are already in place to deal with NEOs?
- Study NEOs using the CIT BCO TARA telescope
- Campaign
  - Inform public
  - Promote awareness

### Research Links:

<http://neo.jpl.nasa.gov/>  
<http://www.minorplanetcenter.net/iau/NEO/TheNEOPage.html>



## Physical Sciences Category

### 26. What's the Best Colour and Fabric to Wear in the Summer?

Traditionally light/pastel-coloured fabrics have been used to make summer clothing but in recent years black has become very popular, worn in both winter and summer even though everybody knows that wearing dark coloured clothing on a hot sunny day makes you feel warmer. But maybe there's a plus side to wearing dark colours in the summer? Black and more vivid colours are said to provide greater protection against the sun's ultraviolet radiation (UVR). What's also interesting is that some synthetic fibres such as polyester and nylon are said to provide more protection than bleached cottons.



**Have you ever wondered if there is a 'safest' colour or type of fabric to wear to protect yourself from UV radiation?**

**You might like to:**

- Design an experiment to investigate which colour fabric provides the most protection against UV radiation
- Design an experiment to investigate which fabric provides the most protection against UV radiation. (Natural vs manmade fabrics, shiny vs matte fabrics, light sheer fabric such as silk vs heavy cotton denim)
- Find out if washing a material in detergent makes it less able to prevent UV radiation from passing through

**N.B. Ultraviolet-sensitive plastic beads can be used to detect UV radiation. The beads are generally white but turn colours when exposed to UV radiation.**

*Research Links:*

[https://www.cancer.ie/reduce-your-risk/sunsmart/skin-cancer?gclid=EAIaIQobChMIoammguqx4wIVR7TtCh35AQQzEAAYASAAEgIuC\\_D\\_BwE#sthash.vcJyYMwx.dpbs](https://www.cancer.ie/reduce-your-risk/sunsmart/skin-cancer?gclid=EAIaIQobChMIoammguqx4wIVR7TtCh35AQQzEAAYASAAEgIuC_D_BwE#sthash.vcJyYMwx.dpbs)

<https://www.skincancer.org/prevention/sun-protection/clothing/protection>

<https://www.sciencefocus.com/future-technology/nanope-the-material-of-the-future-keeping-you-cool/>

<https://www.stevespanglerscience.com/lab/experiments/uv-reactive-beads/>

### 27. What is the Best Shampoo for Your Hair Type?

There are so many different types of shampoo on the market that it is often difficult to choose which is best for your hair type. On the shelves of any supermarket or pharmacy you will find shampoos for dry hair, greasy hair, coloured or damaged hair, anti-dandruff shampoos, baby shampoos, shampoos with built-in conditioner, etc. The price also varies. Some brands are expensive whilst others cost very little.

**Have you ever wondered if there is a big difference between the brands and, if there is, what makes them different?**

**You might like to:**

- Collect as many different types of shampoo as possible (Ask the students in your class to bring in samples of shampoo in the original bottles with the cost written on the bottle label.)
- Design experiments to investigate each shampoo for:
  - ✓ Lather producing properties
  - ✓ Emulsification
  - ✓ Viscosity
  - ✓ Dirt removal
  - ✓ pH
- Compare the more expensive shampoos to the less expensive ones, e.g. do the more expensive shampoos produce more lather, do you have to use less to produce a lather, etc.
- Check out the ingredients in each shampoo
- Make your own shampoo from a recipe on the internet and compare its properties to the shop bought ones

**N.B. Before using a natural product or a shop bought product be sure to use a small amount for a skin test to make sure you are not allergic to any of the ingredients.**

*Research Links:*

<https://www.hoddereducation.co.uk/media/Documents/Magazines/Sample%20Articles/CR-V22.pdf>

<https://s3.eu-west-2.amazonaws.com/edulabdocumentsandimages/documents/library/manuals/200-015%20Student%20Guide.pdf>

## 28. Investigating Time

We do strange things like changing our clocks during the summer months to move an hour of daylight from the morning to the evening. This practice is common in many countries and different countries have different change dates! The original idea was that it would be more energy efficient, saving electricity, etc. if we started work and school during daylight rather than in darkness.

Did you know that in certain months of the year, days can be up to 20 seconds longer or shorter than 24 hours and that there are three different ways of measuring time: sidereal time (based on positions of distant stars in the sky) and solar time (based on position of the sun in the local sky), mean time (time normally kept by clocks – assumes Sun appears to move at a constant speed).



**Have you ever wondered why we could have almost 17 hours of daylight in June yet only around 7.5 hours in December?**

**You might like to:**

- Design and make a sundial to investigate how the revolution of the earth affects what time the sundial shows
- Design an experiment to investigate if changing the clocks actually saves energy
- Investigate whether the difference in mean and local time vary more depending upon the location. Try choosing locations in Northern/Southern, Equatorial and Eastern/Western Hemispheres. How does the location change the results? Are some regions more standard than others?

**Research Links:**

[https://www.eurekalert.org/pub\\_releases/2015-08/uov-rew081015.php](https://www.eurekalert.org/pub_releases/2015-08/uov-rew081015.php)  
[https://in-the-sky.org/article.php?term=equation\\_of\\_time](https://in-the-sky.org/article.php?term=equation_of_time)  
<https://www.rmg.co.uk/discover/explore/greenwich-mean-time-gmt>  
[https://www.sciencebuddies.org/science-fair-projects/project-ideas/Astro\\_p015/astronomy/standard-solar-and-sidereal-time#summary](https://www.sciencebuddies.org/science-fair-projects/project-ideas/Astro_p015/astronomy/standard-solar-and-sidereal-time#summary)  
<http://www.planetary.org/explore/projects/earth-dial/how-to-read-a-sundial.html>  
<https://explorable.com/sundials>  
<https://www.shadowspro.com/en/sundials.html>  
<https://www.timeanddate.com/sun/>

## 29. Cosmetic Chemistry

‘Revenue in the cosmetics segment amounts to €128.1m in 2019. The market is expected to grow annually by 2.9% (CAGR 2019 – 2023).’ (STATISTA 2019)  
 Cosmetics have been used since ancient times to enhance beauty. Egyptians used cosmetics made of lead ore and copper. As early as 3000 BC Grecian women painted their faces with white lead and applied crushed mulberries as rouge. Women discovered that they could use burnt matches as eyeshadow and berries as lipstick. And so the cosmetic industry grew and grew!

In recent times consumers have become more conscious of the ingredients in cosmetics and questions have been asked about products containing parabens, aluminium, solvents, silicates and artificial preservatives, colours and fragrances. There is a definite shift towards natural, herbal and organic beauty products.

**Have you ever wondered if it’s possible to create your own makeup? Could you make your product cheaper, more environmentally friendly and longer lasting than existing products?**

**You might like to:**

- Make an avocado face pack using ¼ of an avocado, clear honey, natural yoghurt and fine oatmeal or using 100 g strawberries, natural yoghurt, chopped fennel leaves and fine oatmeal
- Make your own cleanser using a lemon and one egg white
- Make your own lip balm, see Science Buddies website for more ideas and recipes – [Link](#)
- Carry out some consumer research to compare your product with similar products on the market
- Investigate how temperature affects how your balm works

**N.B. Before using a natural product or a shop bought product be sure to use a small amount for a skin test to make sure you are not allergic to any of the ingredients.**

**Research Links:**

<https://thephysicsteacher.ie/Transition%20Year/Lisa%20Darley/Cosmetic%20Science/cosmetics%20module2.pdf>  
<http://www.catie.org.uk/barefacts/ks3/default.aspx>  
<http://www.chemistryexplained.com/Co-Di/Cosmetic-Chemistry.html>  
<https://www.sciencenewsforstudents.org/article/makeup-science>  
<http://chemistscorner.com/cosmetic-formulation-basics-whats-in-a-lip-balm-and-why/>

## 30. Noise Pollution

'Noise pollution is linked to a range of **health problems**, yet the number of Europeans exposed to high levels of noise is on the rise. Noise also has **harmful impacts on wildlife**. EU Member States are required to map noise levels in large towns and cities, roads, railways and airports, and to come up with plans to tackle the problem.

Noise from traffic, industry and recreational activities is a **growing problem**. Road traffic is a leading source in towns and cities – each day nearly **70 million Europeans** in towns and cities are exposed to noise levels in excess of 55 decibels just from traffic. According to the World Health Organisation, long-term exposure to such levels can trigger elevated blood pressure and heart attacks.

Around **50 million people** living in urban areas suffer from **excessively high levels** of traffic noise at night, and for 20 million of them night-time traffic noise actually has a damaging effect on health.



The **biggest problem is loss of sleep**. The World Health Organisation recommends that for a good night's sleep, continuous background noise should stay below 30 decibels and individual noises should not exceed 45 decibels.

Other issues include hearing problems such as tinnitus, mental health problems and stress. It can also affect performance at work and cause children problems with schoolwork. Birds and animals also suffer. While some creatures are able to adapt to an urban existence, there is concern that noise pollution may drive some away from their usual breeding and feeding sites.

**EU laws oblige authorities to inform the public about the impacts of noise pollution and consult them on the measures they are planning to tackle noise pollution.** That way, citizens can see how noise management measures are bringing real improvements and approach their elected representatives if necessary.'

Ref: [http://ec.europa.eu/environment/basics/health-wellbeing/noise/index\\_en.htm](http://ec.europa.eu/environment/basics/health-wellbeing/noise/index_en.htm)

**Have you ever wondered if the noise levels where you live or go to school are above allowable levels?**

**Note: Did you know that if you have a smartphone you can investigate noise levels in your environment using Google's [Science Journal](#) app.**

See <https://sciencejournal.withgoogle.com/experiments/getting-started-with-sound/>

### You might like to:

- draw up a noise map of the area around your home or school if your home or school is in the city, near an airport or a motorway
- investigate which common material is most effective for soundproofing
- compare how different road surfaces affect traffic noise

### Research Links:

[http://ec.europa.eu/environment/noise/index\\_en.htm](http://ec.europa.eu/environment/noise/index_en.htm)

<http://www.euro.who.int/en/health-topics/environment-and-health/noise>

<https://www.eea.europa.eu/themes/noise>

<http://www.epa.ie/monitoringassessment/noisemapping/>

[http://www.citizensinformation.ie/en/environment/environmental\\_protection/noise\\_regulations.html](http://www.citizensinformation.ie/en/environment/environmental_protection/noise_regulations.html)

<https://sciencing.com/soundproofing-science-projects-6452623.html>

## 31. Cloud Formations and the Weather

Different types and amounts of clouds often follow one another in sequence and recording the amount of cloud cover and sequence should enable one to predict the weather. Cirrus clouds, for example, are high and feathery and indicate good weather. Other types of clouds, such as stratus and cumulus, can be indicators of rain or snow.

**Have you ever wondered if it is possible to predict the weather by studying the clouds in the sky?**

**You might like to:**

- keep a weather diary over a period of 6 weeks
- record the cloud types and your predictions twice a day (photograph the clouds if possible)
- note other weather factors like temperature, humidity and precipitation
- check the actual weather forecast each day online

*Research Links:*

<http://www.met.ie/>

<http://www.infoplease.com/cig/science-fair-projects/clouds-tell-us-weather-coming.html>

<http://sectionhiker.com/predicting-the-weather-using-clouds>

<http://www.weatherwizkids.com/weather-clouds.htm>

<https://www.sciencelearn.org.nz/resources/628-observing-clouds-and-weather>

## 32. The Solubility of Painkillers and Speed of their Effectiveness

A painkiller is a medicine to relieve pain. Solubility is the chemical property of a substance which refers to the ability of the substance (solute) to dissolve in a particular substance (solvent). The amount of time it takes for a medicine to pass from the digestive system into the bloodstream after being swallowed is dependent on its solubility. The more soluble it is the faster it passes into the bloodstream. It is therefore important that a painkiller dissolves quickly.

**Have you ever wondered which painkiller is the most effective and works the fastest?**

**You might like to:**

- compare the solubility of different painkillers
- compare different brands of a drug to find out which brands dissolve the quickest
- investigate if the pH of the stomach (which is usually between 1 and 2) affects the solubility rate
- compare uncoated pills to coated pills
- compare traditional pills to gel capsules and coated tablets
- compare generic drugs to branded equivalents



*Research Links:*

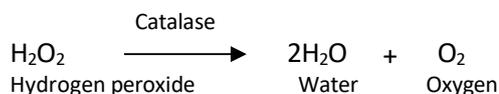
<http://www.rsc.org/learn-chemistry/content/filerepository/CMP/00/000/045/Aspirin.pdf>

[http://www.rsc.org/learn-chemistry/content/filerepository/CMP/00/000/047/Paracetamol\\_web.pdf](http://www.rsc.org/learn-chemistry/content/filerepository/CMP/00/000/047/Paracetamol_web.pdf)

<https://www.sciencebuddies.org/science-fair-projects/ask-an-expert/viewtopic.php?t=16837>

### 33. Enzyme Controlled Reactions – Catalase and Hydrogen Peroxide

Some chemical reactions in living cells can release toxic by-products such as hydrogen peroxide. This chemical is produced, for example, during respiration and by white blood cells during phagocytosis to kill microorganisms. To quickly convert the harmful hydrogen peroxide into safer products, water and oxygen, living cells produce the enzyme catalase.



Enzymes are protein in nature and their function is to speed up the rate at which metabolic processes and reactions occur in living organisms without being destroyed or altered during the process. They are extremely efficient and may be used over and over again. Catalase is one of the fastest known enzymes and is often used with hydrogen peroxide in schools to show enzyme activity. Textbooks often recommend the use of liver, potato or celery as sources of catalase. Other sources include kiwi, peaches, cherries, apricots, bananas, watermelon and pineapple.

**Have you ever wondered which fruit/vegetable is the best source of catalase?**

#### You might like to:

- investigate if the rate of the reaction varies depending on the source of catalase
- determine which is the best source of catalase
- if the efficiency of the enzyme deteriorates as the source ages

#### Research Links:

Laboratory Handbook for Teachers, SUPPORT MATERIALS, BIOLOGY, Leaving Certificate, Ordinary Level and Higher Level, NCCA, DES – Prescribed Activities

8. Investigate the effect of pH on the rate of one of the following: amylase, pepsin or catalase activity
9. Investigate the effect of temperature on the rate of one of the following: amylase, pepsin or catalase activity
14. Investigate the effect of heat denaturation on the activity of one enzyme

[http://www.ehow.com/info\\_8552996\\_vegetable-fruit-sources-catalase.html#ixzz2ZrCzHAai](http://www.ehow.com/info_8552996_vegetable-fruit-sources-catalase.html#ixzz2ZrCzHAai)

**SAFETY:** Wear eye protection and protect clothing from hydrogen peroxide. Rinse splashes of peroxide and pureed potato off the skin as quickly as possible.

### 34. The Need for Speed

The fastest one-mile land speed record, in a car, is 763 miles per hour (1228 km/h). That's quick! The record was set by Andy Green in Thrust SSC (Super Sonic Car) in the Black Rock Desert, Nevada, USA on October 15, 1997. The car's one-mile run was – obviously – over in seconds, yet it took six-years to design and build the lightning-quick car. I wonder if they bothered fitting a speedometer.

**Have you ever wondered how a speedometer works?**

#### You might like to:

- devise a way of testing speedometers
  - devise a way of measuring traffic speed without using radar
  - design a speedometer for pedestrians or cyclists to use
  - compare the accuracy of different pedometers
- (British Association for the Advancement of Science)

#### Research Links:

<http://www.thrustssc.com/>

[https://ec.europa.eu/transport/road\\_safety/specialist/knowledge/speed/speed\\_is\\_a\\_central\\_issue\\_in\\_road\\_safety/speed\\_and\\_accident\\_risk\\_en](https://ec.europa.eu/transport/road_safety/specialist/knowledge/speed/speed_is_a_central_issue_in_road_safety/speed_and_accident_risk_en)

[https://ec.europa.eu/transport/road\\_safety/specialist/knowledge/speed/speed\\_is\\_a\\_central\\_issue\\_in\\_road\\_safety\\_en](https://ec.europa.eu/transport/road_safety/specialist/knowledge/speed/speed_is_a_central_issue_in_road_safety_en)



## 35. Bone Shakers

In the 1870s one of the most popular types of bicycle was the penny farthing. You've probably seen pictures of them – they have an enormous front wheel attached directly to the pedals, and a very small back wheel to keep it steady. The seat is directly above the large front wheel. In those days, they didn't have suspensions and the roads were very uneven. So a ride on a penny farthing really shook your bones! Nowadays bike design has changed considerably; the two wheels are the same size. But the wheels are still pretty big compared to, say, a car.



**Have you ever wondered why bikes usually have such large wheels?**

**You might like to:**

- compare effort with speed for bikes with different wheel sizes
- test the rolling efficiency of bikes, trikes, scooters, roller skates
- compare different folding bikes; what comparisons could you make?
- find out what injuries people usually suffer when they fall off a bike
- look at the design of helmets over the years – how has it changed?

*(British Association for the Advancement of Science)*

## 36. Tell-tale Splashes

Are you a messy eater or painter, always spilling and splashing? Have you noticed how thick liquids, like tomato sauce or paint make different splash patterns from thinner liquids like tea or cola? Because thick liquids don't flow so easily the splashes spread out less when they hit the surface. Blood behaves similarly. The pattern gives forensic scientists clues about what happened.

**Have you ever wondered what can be deduced from a splash pattern?**

**You might like to:**

- investigate which liquids make good substitutes for blood (tomato sauce is too thick)
- devise experiments to compare splash patterns of substitute blood falling onto a horizontal surface under controlled conditions
- investigate the effects of height, direction and speed of the 'blood'; in other words, whether it drips under gravity or is squirted out under pressure

*Research Links:*

[http://hemospat.com/terminology/index.php?org=SWGSTAIN&term=drip\\_pattern](http://hemospat.com/terminology/index.php?org=SWGSTAIN&term=drip_pattern)

## 37. Strangely Shaped Bags

Square, round, pyramid-shaped? Does the shape of your tea bag make much difference? Some adverts claim that pyramid shaped tea bags are definitely better. Others insist that round bags make all the difference. Perhaps we're all missing a trick and some form of three-dimensional, heptagonal construction is what we really need for tasty tea.

**Have you ever wondered if differently shaped tea bags make any difference to the way your tea brews?**

**You might like to:**

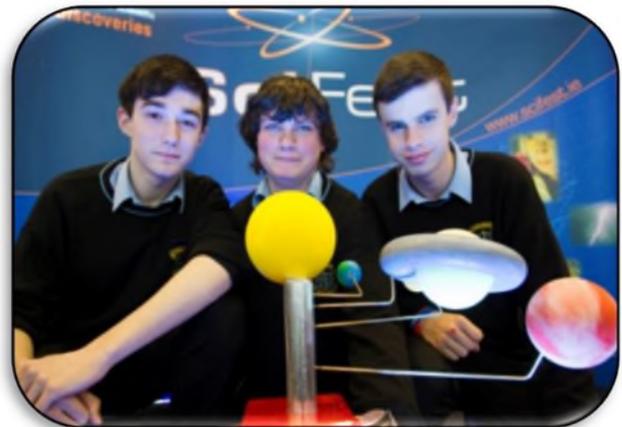
- investigate how many differently shaped tea bags there are available, and note the varying costs
- work out how much tea is in each type of tea bag (see if there's really any less in bags that claim to be 'one cup' bags)
- conduct an experiment to see if tea brews quicker using different types of tea bag and loose tea
- design (and make) the ultimate 'quick-brew' tea bag

*Research Links:*

<http://www.teacouncil.co.uk/>

## 38. Earthquake Victims

When buildings collapse and bodies are trapped under rubble, rescue workers are under pressure of time to locate the victims. You may have seen television scenes of rescuers using heat-detecting equipment. They often use infrared detectors to locate where the bodies are. A simulation experiment might use bottles of hot water to simulate the heat from a live 'person'. Temperature sensors connected to the bottles could record the falling body temperature as time passes. The bottles could be buried under rubble at various depths and infrared sensors used to detect them. The Austrian scientist Josef Stefan found there was a relationship between the amount of radiant energy emitted from a body and its temperature. The depth of the rubble will also affect the level of radiation detected.



**Have you ever wondered at what point the search would be called off?**

**You might like to:**

- move infrared sensors over the 'disaster area' slowly and in a logical search pattern to find the 'hot spots'
- investigate the issues of time, depth and falling body temperature on the levels of infrared radiation detected

*Research Links:*

<https://earthquake.usgs.gov/learn/kids/eqscience.php>

<https://www.usgs.gov/natural-hazards/earthquake-hazards/earthquakes>

## 39. How Safe is your Water?

According to the European Commission 38 towns in Ireland have inadequate water treatment to prevent serious risks to human health and the environment, see Irish Times <http://www.irishtimes.com/news/environment/state-being-taken-to-european-court-over-waste-water-1.2976507>:

“Inspectors have identified inadequate sewage treatment plants in Clonakilty, Cobh, Cork city, Fermoy, Mallow, Middleton, Ringaskiddy, Youghal, Rathcormac, Passage/Monkstown and Ballincollig, all of which are in Cork. In Donegal, Gaoth Dobhair, Killybegs and the Ballybofey/Stranorlar area are similarly classed.

In the Midlands and the east of the country issues were identified in Arklow, Castlecomer in Kilkenny, Dundalk, Enniscorthy, Oberstown and Ringsend in Dublin, Navan, Athlone, Monksland, Enfield, Longford and Portarlington. Elsewhere, treatment plants are not suitable for the populations of Nenagh, Thurles, Roscrea in Tipperary, Killarney and Tralee in Kerry, Cavan, Clifden, Roscommon town, Shannon town, Tubbercurry in Co Sligo and Waterford city.”

- Is your town listed?

### You might like to:

- To learn how to collect water samples aseptically for quality testing
- To analyse water samples for common chemical contaminants and learn what their presence means
- To use a microscope to look for and identify invertebrates in water samples
- To make a homemade filtration system and test how well it can remove contaminants from your water samples.



### Research Links:

<https://www.epa.ie/irelandsenvironment/>

<http://www.epa.ie/water/dw/>

<http://www.irishexaminer.com/ireland/drinking-water-for-400000-people-is-contaminated-382387.html>

[http://www.citizensinformation.ie/en/environment/water\\_services/water\\_quality.html](http://www.citizensinformation.ie/en/environment/water_services/water_quality.html)

## 40. Testing the Claims of Washing Ball Manufacturers

Manufacturers of washing balls claim that they are an effective and eco-friendly alternative to washing detergent. You simply place them into the washing machine instead of detergent to clean laundry. They can be used up to 2000 times before being replaced.

### You might like to:

- Research how detergents work to clean clothes
- Compare this to how it is claimed washing balls work
- Carry out an investigation to compare detergents and washing balls

### Research Links:

<https://www.ecohome.net/guides/3621/do-laundry-balls-work/>

<https://www.choice.com.au/home-and-living/laundry-and-cleaning/laundry-detergents/review-and-compare/laundry-balls>

<https://www.goodhousekeeping.com/uk/product-reviews/house-garden/g36815448/best-eco-friendly-laundry-detergents/ff>

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## 41. Energy Efficient Heating and Cooling

In Ireland, approximately 60% of household energy is used to heat the home and 20% is used to heat water. This means that any improvement in heating efficiency or home insulation can have a significant impact on energy bills and the environment. In other countries significant amounts of energy is used to cool down homes using air conditioning.

### You might like to:

- Research the various ways of heating a home or heating water in the home.
- Investigate the energy released from various fuels (oil, different types of wood)
- Investigate and compare methods of heating and cooling (different fuels, controlled evaporation, heat pumps).
- Investigate and compare various forms of insulation and the impact this can have on home energy use

### Research Links:

<https://www.electricireland.ie/residential/help/efficiency/energy-efficient-water-heating>

<https://www.seai.ie/home-energy/take-climate-action/save-energy-at-home/>

<https://www.ovoenergy.com/guides/energy-guides/heating-costs-gas-vs-oil-vs-electric-storage-heaters>

## 42. Homemade glue

Adhesives (or glues) have a global market value of approximately 50 billion US dollars. In addition to everyday use, they are used in medicine, engineering, construction, and electronics. Some are made from naturally occurring material and some are synthetic. There is a growing demand for bio-based adhesives and adhesives that are non-toxic.

### You might like to:

- Make your own adhesive using household materials and investigate how the adhesive properties can be changed
- Design an experiment to investigate the strength of a number of different brands of glue
- Investigate the environmental impact of producing some common adhesives
- Investigate how different surfaces affect the adhesion of several brands of glue

### Research Links:

<https://www.nps.gov/articles/ink-activity.htm>

<https://www.compoundchem.com/2015/10/15/superglue/>

<https://www.chemistryislife.com/the-chemistry-of-super>

<https://www.thoughtco.com/homemade-glue-recipes-607826>



## 43. Water Desalination

Approximately one litre of seawater typically contains 32 to 37.5 grams of salt. Water desalination is the process of removing salt from water. This process is important in the production of drinking water and purified water for industrial use. It will become increasingly important as the availability of drinking water decreases due to the effects of climate change. The two main methods of industrial desalination are reverse osmosis (RO) and distillation.

### You might like to:

- Investigate the various methods of removing salt from water  
Design a method to reduce the salt content in water
- Learn about solar-powered water desalination.
- Design and build a solar-powered desalination device for desalinating water. Design a number of experiments to measure the performance of your desalination device
- Investigate the uses of the 'salty' waste of this process to make it more environmentally sustainable



### Research Links:

<https://www.usgs.gov/special-topics/water-science-school/science/desalination>

<https://greensborosciencecenter.wordpress.com/2020/08/18/diy-science-desalination-experiment/>

## 44. Making Better Soap

Soap is a lifesaver. It is cheap and readily available – and it kills disease causing bacteria. There is evidence of soap manufacture as much as 5000 years ago. Soap is a mixture of fat or oil, water, and an alkali, or basic salt. When those ingredients combine in the proper proportions, they go through a chemical process called saponification, which results in soap.

Did you know you can make great soap using some common household ingredients?

### You might like to:

- Research the different methods of making soap throughout history
- Make your own soap and change the recipe to suit different skin types and have different smells. **(Warning: Take precautions when making soap – some of the ingredients, while found in many households, can be dangerous to the skin and eyes)**
- Test the effect of changing the soap ingredients on the cleansing power.
- Investigate how soap works to kill bacteria



### Research Links:

<https://www.zmescience.com/other/feature-post/making-soap-home/>

<https://www.scitech.org.au/experiment/the-science-of-soap/>

<https://www.pfizer.com/news/articles/how-soap-works-the-science-behind-handwashing>

<https://www.midlandsscience.ie/the-science-of-soap/>

## 45. Eco Friendly Insulation – a Hot Topic!

A massive 60% of household energy is used to warm our homes. In many homes, much of this heat is lost through the roof, walls, windows and doors. By adding insulation to our homes, we can reduce this heat loss, making our homes more comfortable and cheaper to run.

### You might like to:

- Learn about insulation and how it works
- Design and carry out experiments to test different types of insulation at home or in a school laboratory
- Compare the effectiveness of different natural materials as insulators. You might include leaves, soil, grass, horsehair, sheep's wool, etc.
- Compare the effectiveness of a selection of ecofriendly insulators with a number of synthetic insulators



### Research Links:

[https://www.roundtowerlime.com/category/natural-insulations?gclid=CjwKCAiAy\\_CcBhBeEiwAcoMRHJkB\\_dW8wdxeFrZFYqdn8pu0GjbWPhArWR3XV4WYkSG7Awxu3pL04RoCOXMQAuD\\_BwE](https://www.roundtowerlime.com/category/natural-insulations?gclid=CjwKCAiAy_CcBhBeEiwAcoMRHJkB_dW8wdxeFrZFYqdn8pu0GjbWPhArWR3XV4WYkSG7Awxu3pL04RoCOXMQAuD_BwE)  
<https://passivehouseplus.ie/news/product-news/researchers-develop-plant-based-foam-insulation>  
<https://www.homelogic.co.uk/vegetable-based-foam-insulation-an-eco-alternative>

## 46. Reducing the Energy Demand of Data Centres

Data centres use a lot of energy. Much of this energy is used to keep the equipment cool because if it overheats it can stop working. In 2021, data centres used 14% of all the electricity produced in Ireland so any method of cooling data centres core efficiently would have a huge impact on energy use.

### You might like to:

- Learn about why there has been a huge increase in the number of data centres in Ireland
- Research current methods that are used to reduce energy consumption in data centres. Design a method of cooling down data centres in an efficient way
- Look at possible uses for the excess heat produced in data centres



### Research Links

<https://www.siliconrepublic.com/enterprise/data-centres-ireland-energy-sustainability>  
<https://enterprise.gov.ie/en/news-and-events/department-news/2022/july/new-statement-on-the-role-of-data-centres-in-irelands-enterprise-strategy-published.html>  
[https://www.seai.ie/publications/Energy-in-Ireland-2021\\_Final.pdf](https://www.seai.ie/publications/Energy-in-Ireland-2021_Final.pdf)

## 47. To Infinity and Beyond – the Lifecycle of a Plastic Toy

80% of children’s toys are made of plastic. This plastic is mostly made from petrochemicals found in crude oil. The recycling of toys is challenging and, even if reused many times, they often end up in landfill or in the oceans. They can then persist in the environment for hundreds of years. Recycling toys and choosing new ones that are sustainable will not only benefit the environment but teach a child a valuable lesson on caring for the earth.

### You might like to:

- Investigate methods to reduce the amount of non-biodegradable plastic in toys
- Research alternative uses for plastic after a toy is discarded
- Develop a method to prevent plastic from ending up in landfill or the ocean

#### Research Links:

<https://www.acrossthegreen.com/going-green-with-kids-the-environmental-impacts-of-toys/>

<https://www.hennepin.us/choose-to-reuse/tips/2022-can-you-recycle-plastic-toys>

<https://www.treehugger.com/sustainable-solutions-old-toys-4858454>

<https://happyplanettoys.com.au/blogs/blog/how-do-you-recycle-toys>

## 48. Walking on Water

Water striders (aka pond skaters) can walk on water. They can do this because of a combination of their highly adapted legs and the surface tension on the water.

### You might like to:

- Design a buoyancy device inspired by the morphology of the legs of water striders
- Investigate different ways to change and measure the surface tension of water. (You will find one way to measure surface tension here: <https://www.scientificamerican.com/article/measure-surface-tension-with-a-penny/>)
- Design an experiment to compare the surface tension of various liquids
- Design and carry out experiments to investigate the effect of temperature, surfactants (such as soap and detergents)



#### Research Links:

<https://study.com/academy/lesson/surface-tension-experiments.html>

<https://www.brighton-science.com/blog/what-is-surfactant-and-how-does-it-impact-surface-tension>

## Life Sciences Category

### 49. Which Washing Powder?

Washing powders contain detergents, but biological washing powders also contain enzymes which break down larger molecules such as starch and protein into smaller molecules which can then be dissolved in water. The enzymes used are amylases used to break down starch, proteases used to break down protein and lipase used to break down grease and fats. The presence of these enzymes can be demonstrated by their action on starch, milk protein (casein) and fat.

Have you ever wondered how biological detergents work and if there is any difference between the different brands available in the supermarket?



#### You might like to:

Design an experiment to investigate the effectiveness of a number of biological detergents and their ability to break down:

- Starch
- Protein
- Fat

Investigate if their effectiveness decreases:

- Over time
- With the temperature of the water

#### Possible Technique:

Use a no. 6 cork borer to cut wells in starch/iodine agar, milk agar and mayonnaise agar in agar plates. Add 1% <sup>w/v</sup> of detergent and measure areas of clear zones.

**Starch agar:** Mix 2 g soluble starch with cold water. Add to 100 cm<sup>3</sup> boiling water. Mix 2 g agar powder with cold water. Add to boiling starch solution stirring continuously.

**Milk agar:** Mix 2 g milk powder with 100 cm<sup>3</sup> cold water. Heat until boiling. Mix 2 g agar powder with cold water. Add to boiling milk powder stirring continuously until dissolved.

**Mayonnaise agar:** Mix heaped spoonful of mayonnaise with 100 cm<sup>3</sup> cold water. Heat until boiling. Mix 2 g agar powder with cold water. Add to boiling mayonnaise stirring continuously until dissolved.

#### Research Links:

<https://cd1.edb.hkedcity.net/cd/science/biology/resources/l&t2/practical/Practical-16.pdf>

<https://www.thoughtco.com/how-do-detergents-clean-607866>

<https://www.persil.com/uk/laundry/laundry-tips/washing-tips/difference-bio-non-bio-detergent.html>

## 50. What Price High Heels

For many teenagers fashion is an important part of their lives. Fashion trends tend to come and go but high heels remain popular for women of all ages. Numerous studies have shown that wearing high heels can be costly in more ways than one, taking their toll on the wearer's spine, hips, knees, ankles and feet, while altering their posture and gait.

"If you keep your core tight, and exercise your core, that will help stabilise your pelvis and spine. Wearing high heels tilts the pelvis forward; if the core is weak then it's going to tilt even further."

Dr Tony Accardi, [President of Chiropractic Association of Ireland](#)



**Have you ever wondered if wearing high heels might cause back problems in later life?**

**You might like to:**

- calculate the percentage of girls in your school who wear shoes with a heel height of above 5 cm
- study the effects of heel height in shoes on posture of girls while walking at a steady pace in high heels and in heels of less than 5 cm (Hint: Use a treadmill, reflective markers on shoulder, hip, knee, ankle and forefoot. Record video.)
- find the pressure under the heels of a range of high heeled shoes compared to the pressure under the heels of a range of flat heeled shoes

*Research Links:*

<http://www.thespinehealthinstitute.com/news-room/health-blog/how-high-heels-affect-your-body>

<https://www.rte.ie/lifestyle/living/2017/0320/861166-the-health-risks-of-your-killer-high-heels/>

## 51. All about Sand Dunes

Did you know that the sand dunes in Ireland have developed over the last 5,000 years? They are formed when sand deposited on the beaches by the sea is blown by the wind beyond the high-water mark. The sand builds up into dunes sometimes many metres high held together and stabilised by vegetation such as marram grass and sand sedge. Sand dunes form a natural barrier to the destructive forces of wind and waves and are important in helping prevent beach erosion. In recent times some of these important dune systems have come under threat not only from natural causes such as shoreline erosion due to storms and high tides but also from humans. With the growth in tourism, family days out to the seaside, beach parking and the increase in leisure activities such as windsurfing, the protective vegetation which covers the dunes and binds the sandy soil is in danger of being worn away leading to erosion.

**Have you ever wondered how a sand dune ecosystem develops and why both the percentage cover and the variety of plants increase the further you move away from the sea?**

**You might like to:**

- investigate the changes in colour, acidity and infiltration rate of the sand to soil on a line transect
- identify the vegetation and how the vegetation varies as you move inland
- identify the adaptations of the plants you find which enable them to survive in this environment
- evaluate the positive and negative aspects of human activities on sand dunes
- draw up a list of actions which might help to protect and preserve beaches and sand dunes

*Research Links:*

[http://www.coastalwiki.org/wiki/Sand\\_dune\\_-\\_Country\\_Report,\\_Ireland](http://www.coastalwiki.org/wiki/Sand_dune_-_Country_Report,_Ireland)

[http://www.fingal biodiversity.ie/resources/fingal\\_coast/2007%20Dune%20Protection.pdf](http://www.fingal biodiversity.ie/resources/fingal_coast/2007%20Dune%20Protection.pdf)

<http://www.dnrec.delaware.gov/swc/shoreline/pages/duneprotection.aspx>

<http://www.countrysideinfo.co.uk/successn/primary2.htm>

<https://www.biology-fieldwork.org/a-level/succession/sand-dunes/>

## 52. Antidandruff Shampoos and Asthma

'Parents of asthma sufferers should try washing their children's hair with an anti-dandruff shampoo. Researchers in Brazil have found that the skin flakes on children's scalps provide a comfortable and overlooked refuge for house-dust mites, which trigger allergic responses that can cause asthma attacks.

Charles Naspitz and his colleagues in the paediatrics department of the Federal University of São Paulo studied children from middle-class households whose general standards of hygiene were "satisfactory". Using a hand-held vacuum cleaner with a fine nozzle they collected fine dust from the children's scalps, just hours after they washed their hair with an ordinary shampoo.



The researchers found two common species of mite, *Dermatophagoides pteronyssinus* and *Blomia tropicalis*, in the scalp dust. The children had similar numbers of mites on their scalps whether or not they had asthma. But blood tests showed that while the asthmatic children made antibodies to them, the non-asthmatic children did ...'

Ref: *New Scientist*, Magazine issue 2069, 15 February 1997 by Phyllida Brown

**Have you ever wondered if there is a link between asthma and dandruff?**

### You might like to:

- find out all you can about asthma and dandruff
- investigate the possibility of a relationship between asthma and dandruff
- investigate if the use of an antidandruff shampoo for a controlled period of time reduces the common symptoms in asthma sufferers

The management of asthma relies on a patient's ability to monitor their asthma regularly. Self-monitoring includes assessing the frequency and severity of symptoms (such as wheezing and shortness of breath) and measurement of lung function with a peak flow meter. A control group of volunteers could keep an asthma diary and record daily peak flow meter readings. Peak flow meters are used to measure peak expiratory flow rate (PEFR) to monitor lung function. They are small, inexpensive and easy to use. You could contact a manufacturer for free samples.

### Research Links:

<http://www.asthma.ie/>

<http://www.irishhealth.com/article.html?id=560>

<http://www.newscientist.com/article/mg15320690.600-vacuum-cleaner-gets-to-the-roots-of-asthma.html>

<https://www.oxhp.com/secure/materials/member/asthma.pdf>

## 53. The Circular Garden – Managing an Urban Garden with no Waste

Grass needs cutting and hedges need trimming. This generates a lot of garden waste. However, there are nutrients in this waste and by throwing it out plants can miss out on important chemicals that they need to survive. This garden waste can also provide an excellent habitat for small animals. By keeping the waste in the garden, future plant growth can be supported, and soil quality can increase.



### You might like to:

- Research the life cycle of a selection plants and animals found in Irish gardens
- Learn about the nutrients in plant cuttings and how they can be best used
- Test soil quality (pH, water quantity etc.) over a number of months to test the effect of keeping garden waste in the garden
- Make some compost samples using different mixtures of garden and kitchen waste. Design experiments to test the fertility of your compost samples. Soil test kits can be purchased online or at garden centres. Test for pH, nitrogen, phosphorus, and potassium

### Research Links:

<https://www.zerowasteweek.co.uk/4-tips-for-zero-waste-gardening/>

<https://www.rhs.org.uk/soil-composts-mulches/composting>

<https://www.education.com/science-fair/article/what-makes-best-compost-pile/>

## 54. Enzyme Inhibition by Drugs

Enzymes are protein in nature and their function is to speed up the rate at which metabolic processes and reactions occur in living organisms without being destroyed or altered during the process. Without enzymes, these reactions would take place too slowly to keep you alive. Some substances such as alcohol (ethanol) and aspirin (salicylic acid) can reduce the activity of enzymes or prevent them from working. Such substances are referred to as enzyme inhibitors. Therefore, if we take these drugs (and others such as tobacco) over a period of time our health may be damaged. Note that some drugs such as alcohol can cause excessive production of some enzymes.

**Have you ever wondered if your body's enzymes are affected by drugs such as alcohol, caffeine, aspirin, etc.?**

### You might like to:

- investigate if common drugs such as alcohol and aspirin can affect the rate of enzyme reaction
- determine the presence of starch quantitatively using the iodine test with a colorimeter fitted with a red filter
- investigate if the presence of metal ions in solution inhibits the activity of enzymes (use a solution of copper(II) sulfate) for  $\text{Cu}^{2+}$  ions}

### Research Links:

<http://books.google.ie/books?id=oAFiCHdrEAYC&pg=PA23&lpg=PA23&dq=use+a+colorimeter+to+measure+starch+breakdown&source=bl&ots=mL9ApnJ60h&sig=zPTNyU46xjRDtYNiHuhEL2i45rg&hl=en&sa=X&ei=jZXvUfeHPOew7AbPmlGoAg&ved=0CC0Q6AEwAA#v=onepage&q=use%20a%20colorimeter%20to%20measure%20starch%20reakdown&f=false>

## 55. Low-fat Crisps

There's a woman in Chicago who has a collection of more than 4,000 crisps – each one resembling a celebrity. Crisp-a-like lover Nadine Lumford has a wide variety of crisps including an Elvis Presley crisp, a Princess Diana crisp and a Communist Karl Marx crisp. According to Nadine, there's a celebrity crisp in every packet; you just have to look hard. I assume she didn't find her Elvis crisp in a low-fat packet. I also assume she has a vivid imagination.

BBC News - Amazing tales from Planet Tabloid Friday, 12 January, 2001, 16:43 GMT

### Have you ever wondered just how much fat there is in a low-fat crisp?

#### You might like to:

- look at the labels of different brands of crisps; rank them in order of high to low fat
- decide which brand of crisp you would recommend to someone wanting to follow a low-fat diet (remember: crisps contain other types of food as well)
- calculate your body mass index (BMI), a measure of body fat worked out from your height and weight. Go to this [website](#) to find out how

*(British Association for the Advancement of Science)*

#### Research Links:

<https://www.sciencebuddies.org/stem-activities/spot-the-fat-in-your-snack>

<https://www.scientificamerican.com/article/spot-the-fat-in-your-snack/>

## 56. Salt

There are lots of crisp flavours on the market, from pickled onion to crispy bacon. There was even a time back in the 1980s when you could get your hands-on hedgehog flavour crisps. Having never eaten a hedgehog I can't vouch for their authenticity, but there they were, lining the corner-shop shelves. Yet despite this myriad of flavours, crisp manufacturers Walkers say their top three most popular snacks are the good-old-fashioned cheese and onion, salt and vinegar, and ready salted.

### Have you ever wondered why some crisps taste saltier than others?

#### You might like to:

- compare the salt content of different types of crisp or different flavours of the same brand of crisp
- find out how to carry out a chloride titration or use flame photometry to determine the sodium content of your crisp samples
- devise a simple experiment to find out if the crisps with higher salt content stay fresh for longer (salt can be used as a preservative)

*(British Association for the Advancement of Science)*

Research has shown that reducing average salt intake to 6 grammes a day would prevent 70,000 strokes and heart attacks a year. Some labels do give you the salt content of food per serving, but this currently only applies to a small number of foods; other labels on foods give the amount of sodium in grams per 100 g of food. To convert sodium to salt, you need to multiply the amount of sodium by 2.5: 1 g of sodium per 100 g = 2.5 g salt – <http://news.bbc.co.uk/2/low/programmes/newsnight/3816735.stm>.

## 57. Crisp Packets

All types of packaged food have labels which give us essential information. Some of the information given is strictly regulated by the law. For example, anything that claims to be 'alcohol-free' must have less than 0.05% alcohol in it. Another important piece of information is the 'use-by' or 'sell-by' date. These are there to make sure we eat the food before it goes off.

**Have you ever wondered how to keep your snacks fresh at the p**

**You might like to:**

- investigate the range of materials used to make crisp packets; find out why manufacturers have chosen them; find out what their key properties are
- design an experiment to find out which material keeps your crisps fresh for the longest period of time
- investigate the effect of temperature on the shelf-life of your crisps; see if some packaging responds differently to changes in temperature compared to others



*(British Association for the Advancement of Science)*

## 58. Soil

Soil is made up of mineral particles, organic matter, water, air and living organisms and forms the top layer of the earth's crust. Together with air and water soil makes up the three natural resources on which all animal and plant life depends.

**Have you ever wondered what's in soil?**

**You might like to:**

- compare different soils and investigate the types of plant that grow in them
- investigate the humus content, texture, pH
- use a soil test kit to estimate the nitrate, phosphate and potassium content
- look at the number of organisms, for example earthworms, living in different types of soil
- see how the moisture content of a soil affects how well a plant will grow in it
- make your own soil, designed for growing a particular plant, and see how well the plant grows

*(British Association for the Advancement of Science)*

*Research Links:*

[http://ec.europa.eu/environment/soil/index\\_en.htm](http://ec.europa.eu/environment/soil/index_en.htm)

<http://home.howstuffworks.com/composting.htm>

<http://www.ucd.ie/sssi>

## 59. Computers and Dry Eye Syndrome

It is a proven fact that working at a computer for long periods of time is one of the main causes of Dry Eye Syndrome.

What is dry eye syndrome?

'The eye depends on the flow of tears to provide constant moisture and lubrication to maintain vision and comfort. Tears are a combination of water, for moisture; oils, for lubrication; mucus, for even spreading; and antibodies and special proteins, for resistance to infection. These components are secreted by special glands located around the eye. When there is an imbalance in this tear system, a person may experience dry eyes.'

When tears do not adequately lubricate the eye, a person may experience:

- pain
- light sensitivity
- a gritty sensation
- a feeling of a foreign body or sand in the eye
- itching
- redness
- blurring of vision



Sometimes, a person with a dry eye will have excess tears running down the cheeks, which may seem confusing. This happens when the eye isn't getting enough lubrication. The eye sends a distress signal through the nervous system for more lubrication. In response, the eye is flooded with tears to try to compensate for the underlying dryness. However, these tears are mostly water and do not have the lubricating qualities or the rich composition of normal tears. They will wash debris away, but they will not coat the eye surface properly. In addition, because these emergency tears tend to arrive too late, the eye needs to regenerate and treatment is necessary.'

(Ref: [http://www.medicinenet.com/dry\\_eyes/article.htm](http://www.medicinenet.com/dry_eyes/article.htm))

Why does working on a computer cause dry eye syndrome?

For some people, working on a computer can lead to dry eyes. This could be because people blink less while using a computer. If computer users don't blink they don't moisten the eyeball surface and this causes the eye surface to dry out. Stopping to blink or rest the eyes can reduce this effect.

### You might like to:

- Set up a control group of students
- Monitor the amount of times each subject blinks per minute while using the computer
- Estimate the gaze angle and roughly estimate the eye opening while using a computer
- Repeat the experiment with the test subjects, first while reading and then while relaxing

Research Links:

<https://www2.hse.ie/conditions/dry-eyes/>

## 60. A Local Ecosystem

Undertake a field study of a local terrestrial or aquatic ecosystem to measure abiotic variables using appropriate sensors. Many **environmental factors affect living organisms. One such factor is climate. Measurements could be taken of such** quantities as humidity, temperature (air and ground or aquatic), oxygen content, incident light, etc. These could be measured using sensors and datalogging equipment which offers the opportunity for measurement over relatively long periods of time in the open field. The results could then be brought back to the laboratory for analysis. This data might then be related to the distribution of organisms or an investigation could be undertaken to assess the extent to which one factor (e.g. light) might affect another (e.g. oxygen levels). Soil type or water quality might also be investigated using a pH sensor.

**Have you ever wondered why mist develops near ground level in the early morning?**

**You might like to:**

- compare a seashore habitat to a grassland habitat
- compare a hedgerow habitat to a woodland habitat
- compare the same habitat in two different seasons of the year
- investigate if the seasonal variation in temperature is linked to light intensity



Seashore



Grassland



Woodland



Bog

## 61. Immobilised Enzymes, Bead Size and Reaction Rates

**Enzymes** are proteins that play an important role in speeding up chemical reactions in living organisms. They are referred to as biological catalysts. They are used in research and industry to catalyse chemical reactions or to synthesise products, e.g., in the manufacture of medicines, vaccines, perfumes, etc. Nowadays many enzymes are immobilized or fixed. They become insoluble, attached to a bead or embedded in a gel and they can be used again and again. Also, there are no traces of the enzymes in the product. This has many benefits, e.g., in the manufacture of drugs. There are fewer side effects as the product is more pure. The enzyme invertase which catalyses the production of glucose from fructose can be trapped in alginate beads using calcium chloride and sodium alginate.

**Have you ever wondered if the rate of a reaction using an immobilised enzyme would depend on the size of the bead?**

**You might like to:**

- immobilise the enzyme invertase using the procedure described in Prescribed Activity 10: 'Prepare one enzyme immobilisation and examine its application', Leaving Certificate Biology
- use a selection of syringes to make beads of different sizes
- use *Clinistix strips* to test for the presence of glucose



**Research Links:**

Laboratory Handbook for Teachers, SUPPORT MATERIALS, BIOLOGY, Leaving Certificate, Ordinary Level and Higher Level, NCCA, DES

Prescribed Activities

10. Prepare one enzyme immobilisation and examine its application.

[http://www.abpschools.org.uk/page/modules/enzymes/enzymes8.cfm?coSiteNavigation\\_allTopic=1](http://www.abpschools.org.uk/page/modules/enzymes/enzymes8.cfm?coSiteNavigation_allTopic=1)

<http://www.nuffieldfoundation.org/practical-biology/working-immobilised-enzymes-or-microscopic-organisms>

The following projects, 62 – 64, are provided courtesy of **NatPro**  Trinity College Dublin  
Coláiste na Tríonóide, Baile Átha Cliath  
The University of Dublin

## 62. Plant Medicine and Wellbeing

Plants have been used as health remedies for thousands of years. Across Ireland in the 1930s school children collected and recorded local cultural information about Irish traditional medicinal remedies. The information they collected is now stored and available to view on the The Dúchas website under The Schools Manuscript Collection. However, this precious information is no longer common knowledge and practices are disappearing.



**You might like to:**

- Investigate the decline of cultural knowledge in relation to medicinal plants in your community and identify new potentials.
- Investigate traditional local remedies, its ethnopharmacology use to create therapeutics or cosmetics. Make a plant derived cream, soap or essential oil using traditional knowledge and investigate its antimicrobial activity. Compare its antimicrobial activity to commercially available essential oils or creams. Do the findings correlate with traditional remedies? Would people today be interested in traditionally made products?
- Create a project to investigate the current knowledge of medicinal and wellbeing remedies in relation to traditional use. For example, identify a specific plant in your area and investigate a scientific approach to retain its valuable healing and natural properties in the modern area. Could you revitalise its power and usage for the future?

**Research Links:**

<https://www.duchas.ie>

<https://fieldnotes.nationalgeographic.org/expedition/irishbogs>

<https://www.clarabognaturereserve.ie/article-about/article-how-bogs-form/>

## 63. Carry Out a Bog Study

Vegetation and rainwater are a critical part of bog formation and function.

### You might like to:

- Select a cubic foot of bog and identify the soil wet weight and dry weight, wildlife, insects and plants growing. This can be done over a few weeks, photographed and compared. What factors do you think are affecting the bog habitat and what could make the habitat more diverse?
- Research and understand the role of sphagnum moss, peat formation and carbon dioxide emissions. Could moss be used as a filter to give cleaner water? Could this be demonstrated in a fish tank time-lapse? What could moss be used for in everyday life?



Bogbean was used for indigestion

### Research Links:

<https://www.bordnamona.ie/peatlands/biodiversity/>

<https://www.tcd.ie/natpro/>

## 64. Additional Bog Study Ideas

- **Choose a bog plant:**
  - Identify it taxonomically
  - Carry out a picture time-lapse of its growth throughout the seasons
  - What insects are attracted to and repelled by it?
  - What chemicals does the plant manufacture and why?
  - What is known locally about the plant - any medicinal uses?
  - What does the plant add to the bog's habitat?
  - Could you draw it and include its identifying structures e.g. leaf shape, unusual flower, stem or seeds?
- **Bog season survey**
  - Carry out a survey of growth and change of a bog throughout the seasons
  - What plants grow leaves, flowers and fruit in each season?
  - What impact have trees on their bog environment?
  - What bacteria and fungi grow in bogs?
  - What impact have bacteria and fungi on bogs and plants?
- **Agricultural science**
  - Do agricultural animals that graze on wasteland bog fields have a higher nutritional intake than animals that graze on cultivated pasture? Could dairy cows' nutritional/ fat content or yield be compared?



## 65. The Maths of Pine Cones

The main function of a pine cone is to keep a pine tree's seeds safe. The cones can close their scales, or bracts, to protect the seeds from wind, low temperatures and even animals that might try to eat them. They open the bracts to release the seeds when it is warm, and conditions are suitable for germination. If you look very carefully at the arrangement of the bracts in a pine cone you will notice that they circle the pine cone in spirals. Did you know that the number of spirals found on a pine cone is almost always a Fibonacci number?

### You might like to:

- Find out more about **Fibonacci numbers** and the **golden ratio**
- Investigate the relationship between Fibonacci numbers and the bracts on pine cones



### Research Links:

[https://www.canr.msu.edu/news/fun\\_facts\\_about\\_pine\\_cones](https://www.canr.msu.edu/news/fun_facts_about_pine_cones)  
<https://www.cfireland.ie/>  
<https://faculty.math.illinois.edu/~delcour2/LessonPlanSunflowerWorksheets.pdf>  
<https://awkwardbotany.com/2019/12/25/pine-cones-and-the-fibonacci-sequence/>  
<https://phys.org/news/2013-02-nature-pattern-fibonacci.html>  
<https://plus.maths.org/content/life-and-numbers-fibonacci>

## 66. To Investigate Dispersal in Trees Possessing Winged Fruits, e.g. Sycamore and Ash

Seed dispersal is the mechanism by which a plant ensures that its seeds are scattered as far away from the parent plant as possible so that the seeds can colonise new territory. One of the ways plants disperse their seeds is by wind. Some trees produce seeds embedded in papery wings of varying structures to provide aerodynamic lift. Sycamore trees have distinctive helicopter seeds that fly on the wind. They twirl, float and spin through the air, crossing fields and mountains, hopefully landing somewhere where conditions are favourable for survival.



### You might like to:

- Study seed dispersal in trees such as the ash and sycamore (Hint: Take 100 seeds. Paint them red. Release them from a height in various strengths of wind which you can measure with an anemometer.)
- Collect sycamore seeds and study the factors that affect germination of the seeds by planting them in early February
- Investigate the distribution of seeds around a tree
- Seeds of some trees such as oak and horse chestnut have no special features that assist their dispersal by wind. Investigate if wind affects the direction in which these seeds are distributed or if they are just distributed evenly around the tree

### Research Links:

<https://www.rhs.org.uk/advice/profile?pid=675>  
[https://forest.jrc.ec.europa.eu/media/atlas/Acer\\_pseudoplatanus.pdf](https://forest.jrc.ec.europa.eu/media/atlas/Acer_pseudoplatanus.pdf)

## 67. Forests and their Effects on Health

There are around 20 forest parks in Ireland providing opportunities for people of all ages and walking abilities to escape from the stresses of modern life and to connect with nature. A number of studies have been carried out linking both physical and mental wellness to walking in forests. Studies have shown that being close to nature in a forest environment can improve physical fitness, reduce high blood pressure and obesity and help relieve symptoms of stress and depression.



### You might like to:

- Investigate the footfall in a forest park near you
- Carry out some research on forest walking and its effect on both physical and mental health
- Identify and map out areas covered by forests in Ireland. Calculate the total land area covered by forests. Compare your findings to e.g. Finland. (Finland was named as the happiest country in the world by the 2019 World Happiness Report. This is the second year in a row which has seen Finland take number one place. 71% of total land area in Finland is forest area.)

### Research Links:

<https://www.coillte.ie/our-forests/public-goods/health-and-well-being/>

<https://ec.europa.eu/eurostat/web/products-eurostat-news/-/EDN-20180321-1>

## 68. A Woodland Study

Forests are vital and not just for human life. Among other things they provide watershed protection, reduce global warming, provide habitats for animals, prevent soil erosion and are the source of many medicines not to mention chocolate! Conservation of our forests is one of the most important environmental issues we are facing today. Studying forests and understanding how human activities affect ecological processes within forests is essential in order to protect this invaluable resource.



### You might like to:

- Investigate the properties of woodland soils (drainage and water retention, acidity and particle size)
- Investigate how shade cast by trees affects the ground flora in a woodland
- Investigating the characteristics of a population of trees (select e.g. oak trees or beech trees in a section of woodland) by recording size composition. This may be found by measuring the circumference (girth of the tree trunks at 1.3 m). Trees may be grouped according to their circumference and a histogram plotted. Are your results affected by the position of the tree within the woodland?
- Investigate the link between deforestation and agriculture
- Use satellite mapping resources to investigate the link between urbanisation, population growth and deforestation

### Research Links:

<https://www.societyofirishforesters.ie/>

<https://www.treecouncil.ie/>

<http://www.coillte.ie/>

<https://www.teagasc.ie/crops/forestry/advice/general-topics/environmental-benefits-of-farm-forestry/>

<http://www.woodlandsofireland.com/>

<https://www.pefc.org/what-we-do/why-forests-are-important/the-benefits-of-forests>

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## Technology Category



### 69. Learning to Play the String Bass

When people start to play the string bass, most beginners cannot hold their hand correctly and keep their fingers in place and this prevents them from being able to play properly.

**Could you solve this problem?**

*Research Links:*

Design and Discovery, A Transition Year Module, Intel Ireland Corporate Affairs

### 70. Wind Generated Electricity

Windmills have been in use for thousands of years. The type of windmill still seen in Holland was once more widespread. A typical windmill could do the work of 200 people. They have been used for many purposes, including grinding corn, pumping water and operating machinery. Windmills lost favour about a hundred years ago when other forms of energy became cheaper and more reliable. Rising fuel costs and the fear of global warming are making alternative energy sources like windmills increasingly popular again.



Windmills that generate electricity are properly called wind turbines. They are made of a set of blades (sails) tilted at a slight angle and attached to a central shaft. The amount of electricity generated depends on several factors apart from the wind speed and wind availability.

**Have you ever wondered how the wind could best be harvested to generate electricity?**

**You might like to:**

- investigate the effectiveness of different types of wind turbine; how many blades to use....what pitch (or angle) for the blade...what area of blade
- investigate the relationship between power generated and wind speed
- monitor the amount of Research wind in a day on hill-tops or by the sea, etc.

The wind speed is variable and so datalogging could be used over an extended period and from the graph of voltage and current against time, an average power output could be obtained for a given turbine design or wind environment.

*Research Links:*

<https://www.seai.ie/technologies/wind-energy/>

### 71. Develop an App that Solves a Problem in your Local Community, such as a Health Problem, a Social Concern, or a Lack of Resources

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## Suitable for SciFest@School

### Coursework B Investigation Titles 2008 – 2018

Coursework B investigations are suitable first-time projects for first and second-year students who wish to take part in a SciFest@School STEM fair. While it is preferably that the student selects a topic of his/her own choice this may not always be possible and the list below may come in Research.

**The projects may also provide a starting point for SciFest@College projects.**

#### Investigation Titles 2008

##### **Biology**

Florists often supply a sachet of flower food/preservative with bunches of cut flowers. Carry out an investigation to compare the effectiveness of using a commercially supplied flower food/preservative with two other household substances as additives to prolong the life of cut flowers in a container of water.

##### **Chemistry**

Marble chips react with a dilute hydrochloric acid solution. Carbon dioxide gas is released. Investigate how particle size affects the speed at which mass is lost from the reaction mixture as the gas is released.

##### **Physics**

Clothes made from certain fabrics, e.g. denim, are not suitable for hill walking or mountain climbing. Carry out an investigation to compare the thermal insulating properties of three different fabrics when they are dry and when they are wet. Denim must be included as one of the three fabrics.

#### Investigation Titles 2009

##### **Biology**

Investigate the relationship between reaction temperature and the effectiveness of action of the enzyme amylase on starch.

##### **Chemistry**

Qualitatively investigate the effectiveness of three methods of preventing an object containing iron from corrosion.

##### **Physics**

Investigate the relationship between the size of the electric current passing through a length of wire and its heating effect.

#### Investigation Titles 2010

##### **Biology**

Qualitatively investigate two factors that affect the uptake of water by a plant.

##### **Chemistry**

Compare by way of investigation the abilities of different indigestion remedies to neutralise excess stomach acid.

##### **Physics**

Investigate two factors that affect the distance taken for a toy car to stop after rolling down a ramp.

## Investigation Titles 2011

### Biology

Carry out an investigation to **study the** anaerobic respiration of yeast with particular reference to (i) the change of temperature with time, (ii) the evolution of carbon dioxide with time and (iii) the change of density with time.

### Chemistry

Carry out an investigation to study the pH changes that take place when neutralisation reactions occur between two named acids and a named base.

### Physics

Investigate the factors that determine the force of friction between a wooden block and the surface on which it is resting.

## Investigation Titles 2012

### Biology

Investigate named seeds, chosen by you, to examine the effects of (a) placing the seeds in a fridge for a few days before sowing, (b) placing the seeds in a hot press for a few days before sowing on (i) the percentage of seeds that germinate, (ii) the speed of germination of the seeds.

### Chemistry

Investigate the effects on the amount of carbon dioxide dissolved in a fizzy drink when it is stored in (a) an open container, (b) a closed container, at different conditions of (i) temperature, (ii) stirring or shaking, (iii) time elapsed.

### Physics

Investigate the factors that determine the rate at which heat is lost from different types of drinking cups that contain hot liquid.

## Investigation Titles 2013

### Biology

Compare by means of investigation the vitamin C content of a number of commercial and fresh fruit juices.

### Chemistry

Compare by means of investigation methanol, propan-1-ol and candle wax in terms of their effectiveness as fuels.

### Physics

Investigate any two factors that affect the output from a solar cell when light is shone on it

## Investigation Titles 2014

### Biology

Investigate and compare the effects of pH on the catalytic effect of the enzyme catalase, found in (a) celery and (b) animal liver, on the rate of breakdown of hydrogen peroxide.

### Chemistry

Investigate and compare how the solubility, in water, of (a) potassium chloride and bisodium carbonate (anhydrous) change with temperature.

### Physics

Investigate and compare how the rates of powdered or granulated solids through a funnel are affected by (a) the size of the solids particles and (b) any one of the funnel dimensions.

## Investigation Titles 2015

### Biology

Investigate and compare the quantitative effects of changing (a) wavelength of illumination and (b) either intensity or duration of illumination on the phototropic growth response of recently germinated plant shoots/seedlings.

### Chemistry

Investigate and compare the quantitative effects of changing (a) metal types and (b) fruit/vegetable type on the emf (voltage) produced across two different metals, when the electrolytes take the form of fruits and/or vegetables.

### Physics

Investigate and compare the quantitative effects of changing (a) material type and (b) material thickness on the level of sound insulation provided by a range of materials

## Investigation Titles 2016

### Biology

Investigate and compare the quantitative effects of changing (a) the duration of light physical exercise and (b) the time elapsed since the exercise stopped on the pulse rate of a person.

### Chemistry

Investigate and compare the quantitative effects of changing (a) the rhubarb surface area and (b) the temperature of solution on the rate of reaction (measured by noting time for decolorisation of solution) between The oxalic acid in rhubarb and dilute potassium permanganate solution (acidified with sulfuric acid).

### Physics

Investigate and compare the quantitative effects of changing (a) the pendulum length and (b) the mass of the pendulum bob on the period (time of oscillation) of a simple pendulum oscillating through a small angle.

## Investigation Titles 2017

### Biology

Investigate quantitatively, to determine the impact of each additive, the effects on samples of a garden soil of adding 20% by mass of (a) sand, (b) potting compost, and (c) clay\* on

- (i) the soil's ability to retain water,
- (ii) the rate of drainage of water through the soil.

\*Some readily available cat litter is composed of dry clay.

### Chemistry

Investigate quantitatively, at room temperature, the effect of dilution on the pH of

- (i) vinegar,
- (ii) a solution containing 5 g washing soda per litre of water,
- (iii) a solution containing 5 g sucrose per litre of water.

### Physics

Using conductors made of children's play (modelling) dough, investigate quantitatively the effect on resistance, calculated from measurements of voltage across and current through the conductors, of changing the conductor length and obtain data to establish whether dough colour has an effect on its resistance.

## Investigation Titles 2018

### Biology

Investigate and compare the quantitative effects of changing

- (a) concentration of solution,
- (b) type of solute used

on the change in mass of a sample of potato placed in distilled water, salt solution and sugar solution.

### Chemistry

Investigate and compare the quantitative effects of changing

- (a) applied voltage,
- (b) concentration of sulfuric acid on the rate of production of either hydrogen or oxygen gas during the electrolysis of acidified water.

### Physics

Investigate and compare the quantitative effects of changing

- (a) hair colour,
- (b) the usage of shampoo or similar commercial hair treatments on the tensile strength of hair taken from the human head.

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## SciFest National Final Project Abstracts 2011 - 2023

See SciFest website: <https://scifest.ie/Page/National-Final-Award-Winners/3675/Index.html>

### Help Tools

#### Your Mobile Phone!

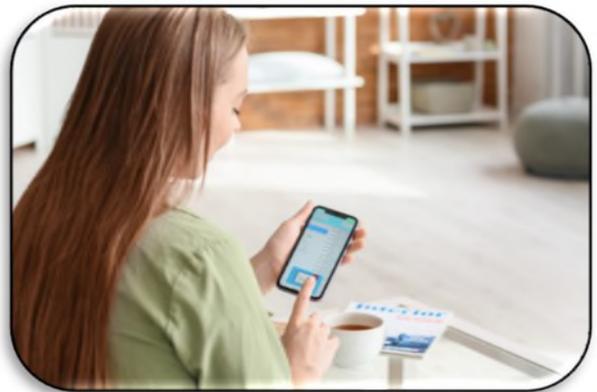
If you have a smartphone, you have a multi-faceted tool that can be converted into for example, a decibel meter to measure sound intensity, a light meter to measure light intensity, a slow-motion camera to record movement, all with various free apps. Many of you could have a smart watch, which is often able to measure important physiological data such as pulse, heart rate, sleep, etc.

A free app called Arduino Science Journal alone contains:

- An accelerometer (measures acceleration)
- Barometer (measures atmospheric pressure)
- Light intensity meter

Compass

- Magnetometer (measures properties of a magnetic field)
- Pitch meter (measures frequency)
- Decibel meter (measures sound intensity/loudness)



#### Your Computer!

Many computer science projects need little more than access to a computer. Reputable public datasets can be a good starting point for data analysis projects.

Examples include:

- [Eurostat](#) - the statistical office of the European Union
- [Google Public Data](#)
- [EPA Climate Calculators](#)
- [EPA Environmental Protection Agency](#)
- [Central Statistics Office](#)
- [The Department of Education](#)
- [The Food and Agriculture Organization \(FAO\) of the United Nations](#) – a specialised agency of the United Nations that leads international efforts to defeat hunger.
- [The American Astronomical Society \(AAS\) Worldwide Telescope](#)
- [Calculate your climate footprint https://climate-calculator.climatehero.me/?source=GoogleAdwords&gclid=Cj0KCQjw3f6HBhDHARIsAD\\_i3D\\_M9Q\\_SHBW2FW4S\\_BBZDFkAzS35lZrj7aLK\\_oUYGkPTI-2OIhnmSPOaApXIEALw\\_wcB](https://climate-calculator.climatehero.me/?source=GoogleAdwords&gclid=Cj0KCQjw3f6HBhDHARIsAD_i3D_M9Q_SHBW2FW4S_BBZDFkAzS35lZrj7aLK_oUYGkPTI-2OIhnmSPOaApXIEALw_wcB)



## Research Websites!

- Junior Cycle – Features of an Investigation <https://www.ict.ie/perch/resources/science/features-of-an-investigation-poster.pdf>
- Science Buddies [http://www.sciencebuddies.org/science-fair-projects/project\\_ideas.shtml](http://www.sciencebuddies.org/science-fair-projects/project_ideas.shtml)
- Education.com <http://www.education.com/science-fair/high-school/>
- Home Science Tools <http://www.hometrainingtools.com/a/high-school-science-projects>
- Live Science <http://www.livescience.com/38126-high-school-science-fair-projects.html>
- Bright Hub Education <http://www.brighthubeducation.com/science-fair-projects/>
- National Council for Special Education <https://ncse.ie/summer-programme-2021-academic-core-skills>
- Society for Science Research at Home <https://www.societyforscience.org/research-at-home/>
- SciFest Resources [www.scifest.ie](http://www.scifest.ie)



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<https://www.education.ie/en/Publications/Education-Reports/Safety-in-School-Science.pdf>

For additional information, including on safety and ethical issues, please see [Guidelines for Teachers and Students](#).



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