



# THE LAB REPORT

Christmas edition



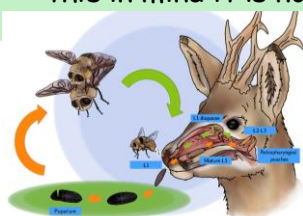
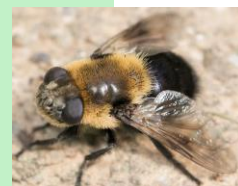
Today's joke  
What does Santa drink at Christmas ?...

## The gruesome science behind Rudolph's red nose

Rudolph is a well-loved Christmas character and him and his red nose are the stars of many Christmas songs and stories. But what is the reason behind our favourite Reindeer's Scarlett snout? Many scientists have had conflicting theories on the reasoning behind Rudolph's characteristic red nose-one such theory being that he suffered from an infestation of Reindeer nose Botfly. Reindeer nose Botfly (also lovingly known as Snotbots) are parasitic flies that infect the nostrils of deer- these flies are scientifically known as *Cephenemyia trompe*. Whilst in flight, Female Botfly deposit larvae from their abdomen (which already hatched from eggs while still inside the fly) into the nostrils or mouth of an unfortunate reindeer. From there, the larvae are able to work their way through the nasal cavity - burrowing deep into spaces either side of the throat called retropharyngeal pouches. These larvae then feed off the reindeer and grow until about 25-36 mm long. Once the fly larvae have reached this point and are ready to leave their unwilling host, they make their way back into the nasal cavity prompting the Reindeer to expel them through sneezing, coughing or spluttering. Once expelled, the larvae burrow into the soil where they pupate (mature) for 2- 3 weeks before emerging as flies. These newly matured flies then only have a short time to find a mate and repeat this process to complete their life cycle. These Larvae can cause the Reindeer a range of different problems - such as inflammation, breathing difficulties and damage to blood vessels. With all this in mind it is no surprise that Rudolph has a red nose!



BIOLOGY



Samuel Johnson & Hermione Redwood

**Did you know** You produce about 40,000 litres of spit in your life. That's enough spit to fill around five hundred bathtubs!

## All I want for Christmas is a diamond

Technology is an integral part of today's modernising world, so when our phones, laptops, iPads, headphones etc. die on us, it can be frustrating. However, science is here to save the day with a carbon-14 diamond battery which has the potential to power devices for 1000s of years 😊.

The alkaline batteries in TV remotes, or the lithium-ion batteries in our smartphones are examples of conventional chemical batteries. While they can put out a lot of power for short periods of time, you may have noticed that after a few years battery life begins to worsen rapidly either by eventually running out, or charge capacity declining over time. This is not (only) a marketing scam used by certain fruit-related technological giants, but is a real issue that emerges within the use of conventional chemical batteries and something that the new Carbon-14 diamond batteries (created by Scientists and engineers from the UK Atomic Energy Authority (UKAEA) and the University of Bristol) could transform in the future. The carbon-14 diamond batteries work by using the radioactive decay of carbon-14 to generate low levels of power and the fast-moving electrons are converted into electricity within the diamond structure. With Carbon-14's half-life being 5700 years, they are a long-lasting energy source.

Luckily the potential uses for this revolutionary battery goes beyond our phones 😊. They could be used in medical devices like hearing aids/pacemakers or places where it's inconvenient to change batteries- e.g. satellites in space.

While there have been worries about the potential risk posed by harmful radiation from these batteries, Dr Neil Fox from the School of Chemistry clarifies, "Carbon-14 was chosen as a source material because it emits a short-range radiation, which is quickly absorbed by any solid material [but it is] safely held within diamond, no short-range radiation can escape. In fact, diamond is the hardest substance ...there is literally nothing we could use that could offer more protection."

With that being said, I know what I am putting on my Xmas wish-list 😊 How about you? 😊

Delaena Debre & Eloise Martin

CHEMISTRY



### Fun Fact

The only letter not appearing on the periodic table is J.



# The power of Stars

In the cores of the stars, there is a process called nuclear fusion. In this process, nuclei are fused into larger nuclei, creating the elements we find on Earth today. Fusion releases lots of energy, making them shine brightly in the sky and in the case of our Sun, give us heat to make our planet liveable. For decades, scientists and engineers have endlessly tried to replicate this process for a new renewable energy source but have come to no efficient results.

The problem with using nuclear fusion is the conditions required to start it. A star's core is one of the hottest and densest places in the universe, so as you can imagine, it can be quite expensive to make it on Earth. The fuel would need to reach roughly 100 million degrees C before fusion starts, so not easy to do. As the fuel reaches this temperature, we need a way to contain it as it would just destroy any container it is put in. To prevent this, the fuel plasma is suspended away from the wall of the vessel by very strong magnetic fields (also very expensive to maintain). An advantage of nuclear fusion over fission, which is used in nuclear reactors, is that they are much safer. Fusion reactors are almost incapable of having a meltdown. As, if anything went wrong, the plasma would just cool down and return to a safe state. The fuel required for nuclear fusion is often deuterium or tritium, which are heavier isotopes of hydrogen than what we normally find. Deuterium, while being in trace amounts, can be found in seawater, allowing for an essentially limitless amount of fuel-making fusion a mainly renewable source of energy with no carbon emissions.

Earlier this year, the UK's JET facility set a record for energy generation from fusion of 69 MJ, roughly enough energy to power 80 kettles, showing progress towards a fusion powered future, but there is still a long way to go before commercial use.

Henry Cleverdon



PHYSICS



## The End of Coal: A Christmas Future Powered by Renewables

We all know coal to be the gift you get from Santa Claus if you've misbehaved. But what is it? And will Santa find a new resource as the world moves away from using coal?

Coal has been a vital means of powering the world for centuries - the first coal mine opened around 3,000 years ago in China. In 2022, eight billion tons of coal was combusted worldwide for electricity, steel plants, and cement works. But it is running out. Coal is a natural resource, forming when plants die and sink to the bottom of the swamp, becoming buried and turning into peat. The pressure and depth heats and compacts the plants, causing them to undergo a process called diagenesis, where they become lignite. Over time, as the lignite is heated and compacted more, it becomes bituminous coal and then the best type of coal, anthracite. Because of what it is made of and how long it takes to form, coal is a fossil fuel and a finite resource. The stores we have of coal in the world are hugely depleted, so some governments are looking for other ways to power their country. The United Kingdom very recently closed its last coal plant, situated in Ratcliffe-on-Soar, on the 30th of September 2024, joining 11 other countries such as Iceland and Norway in becoming coal-free. We now aim for clean power by 2030, using only renewables such as wind power, solar power, or even bioenergy. Over the last 12 years in the UK, coal has gone from powering 40% of the country to nothing, whereas renewables rose by 28%.

So, when you open your stocking on Christmas day this year, you might find a solar panel or a collection of fresh leaves to power your house in place of some lumps of coal.

Clove Gater

GEOLOGY



FUN FACT

The Great Sphinx of Giza was carved from natural limestone, making it an example of a rock-cut monument.







## CAREERS



## Marine Biologist

Do you love the ocean? This job may be for you! Marine biology is the study of organisms and ecosystems in the oceans and other saltwater environments. This includes marine plants, animals (both vertebrate and invertebrate) and other organisms, in deep oceans, shallow seas, coastal habitats and the laboratory. Marine Biologists study marine organisms in their natural habitats, and there are many areas of study that you can specialise in. They investigate the behaviour and physiological processes of marine species and often assess impacts that us as humans are (unfortunately) having on wildlife. Marine Biology is such an important job as it ensures the safety of our ocean animals and allows us to understand more about what goes on under the water.

To study at University, you will need 2 related A-levels. Biology is the best subject to take, as well as chemistry. Some universities recommend Maths, Geography or computing. You don't need to specifically study Marine Biology, as many courses can open you to the career:

- Marine Biology
- Marine Science
- Ocean and earth science
- Oceanography

There is a range of salaries available, from £14,000 (Apprentice lab technicians) up to £90,000 (high level research positions)

If you see future in Marine Biology, it's never too early to get started! We have a wonderful coast right on our doorsteps with many beaches perfect for rock pooling and learning about the native wildlife. It's important to care for our environment, so even if you weren't considering this field of study for your future, think about taking part in a beach clean or local wildlife project as every little contribution counts!

**Freya Windle**

*This section of the magazine will be for students with a passion for science who want to pursue a career in STEM but aren't sure on the jobs available to them. In Each edition there will be an overview of a different career, including a description of what it entails, as well as the qualifications needed to get the job.*

## Flashcards

Hopefully, you know what flashcards are (obviously not cards that flash). Because people underestimate the true power of these things. This is the BEST way to remember things, especially for subjects with a lot of content such as biology and English literature. Just follow these steps and I guarantee you will absolutely bulldoze the living daylights out of exams.

**Step 1:** Choose if you want to make physical or online flashcards. Online is more convenient because you can access them on your phone wherever you are, but some prefer physical paper ones cos they "feel better". For online, use apps like Quizlet or Anki.

**Step 2:** Grab your notes or a revision guide and make sure you have got the information clearly laid out in front of you.

**Step 3:** Now, on one side of the flashcard put a question. EG- 'Describe the adaptations of the small intestine'

**Step 4:** Now here is where a lot of people go wrong. DON'T ADD TONS OF INFO. Your brain will just get annoyed and give up when you try to memorise it. Instead, try to minimise the information as much as possible, so it's easier to remember.

**Step 5:** To actually remember it- look at the flashcard and keep repeating the answer in your head/out loud, then flip it over to and try and recall the answer. repeat until you have memorised it perfectly. Then move on.

**Step 6:** To ensure it stays in your long-term memory, test yourself again the day after. Then test yourself again and keep increasing the time between tests. EG leave a day between tests, then 3 days, then a week, then two weeks, then a month.

Extra tips: For physical flashcards- although adding colour is maybe a waste of time, always add some tanginess to them once in a while just to cheer yourself up. And last of all RELAX everything will be fine in the end!!! **Ron Zaki**



## REVISION TIPS

Find out about 👁️👁️  
The Lab Report Competition on the next page



Today's joke  
... H2 HO HO  
HO 🐱 🤔

**Want to get involved in The Lab Report?  
Now's your chance!**

We're challenging you to write a science-based article in an area that interests you, and we'll pick the best two to publish next issue. The article must be around 200 words, complete with a picture, and sent to [TheLabReport@ccgrammarschool.onmicrosoft.com](mailto:TheLabReport@ccgrammarschool.onmicrosoft.com) by Monday the 6th January. Please make sure you credit yourself with your name and form group.  
Good luck!

**Merry Christmas from everyone at The Lab Report**

April McGowan, Clove Gater, Emily Ford, Freya Windle, Samuel Johnson, Eloise Martin, Hermione Redwood, Ron Zaki, Delaena Debre, Henry Cleverdon



Edited by April McGowan