

TYNDALL SCIENCE AT HOME

TYNDALL EFFECT: LIGHT IN A JAR OF MILK

AGES: 5+

#Tyndall200

A national celebration to mark the bicentenary of John Tyndall, one of Ireland's most imaginative and influential scientists.

Take part by conducting this experiment at home. Take photos or make a video, and share it on social media using the hashtag **#Tyndall200**. You can also share photos or a 30-second video using our [online entry form](#). Either way you'll be entered to win a #Tyndall200 prize pack for science lovers!

BACKGROUND

John Tyndall was the first person to suggest why the sky is blue. White light is made up of all of the colours of the rainbow – red, orange, yellow, green, blue and indigo. When white light bounces off an object it can break up into the different colours. As light from the sun goes through the atmosphere it is scattered around. Blue light is scattered more than other colours and is bounced back to our eyes, which is why the sky is blue.

John Tyndall thought that the light bounced off dust or water vapour in the air. This idea is known as the 'Tyndall Effect'. We now know that the light from the sun scatters off of the air itself and the molecules in the air, for example nitrogen (N₂), oxygen (O₂) and carbon dioxide (CO₂). This is known as 'Rayleigh Scattering' as the theory to explain how the scattering occurs was developed by Lord Rayleigh, based on John Tyndall's research.

THE EXPERIMENT

In this experiment you will test out the Tyndall Effect for yourself.

YOU WILL NEED:

- 2 clean glass jars or 2 glasses, straight-sided
- Milk (dairy, oat, almond, etc)
- Water
- Small torch
- Teaspoon

WHAT TO DO:

- 1 Fill both jars with water and let it settle, so the air bubbles disappear.
- 2 Add half a teaspoon of milk to **one** of the jars and stir, so it's just uniformly cloudy.
- 3 Darken the room.
- 4 Put the torch next to each of the jars and look from the side to see how the light travels through the liquid.

WHAT YOU WILL SEE:

The beam path of the light should not be visible inside the jar with clear water – light travels through water freely. Inside the jar with milky water, the milk particles suspended in the water scatter the light and you can see the beam now!

Take a look!





EXPERIMENT NOTEBOOK



SCIENTIST NAME: _____

AGE: _____ EXPERIMENT DATE: _____ TIME: _____

One thing I learned was:

If I was doing this experiment again, I would try/use....

ADDITIONAL EXPERIMENT: AGES 8 - 18

Add a little more milk to the jar, so it's cloudier. Put the torch in front of the jar with milky water, and then behind. Observe the colour of the light.

The white light of the torch is made of multiple colours – blue, green, yellow, red – which combined, appear white. Placing the torch in front of the jar with milky water shows slightly blue colour of the jar contents – the blue light is scattered more than the red, and the red passes through. Blue is bounced back and you can observe it. This similar to why the sky is blue – light from the Sun goes through atmosphere and is scattered around, and we see it as blue sky.

Watching from the other side of the jar, the opposite happens – you can see the warm light that passes through, while the blue is scattered. Similar thing happens during the sunset – light from the Sun goes through denser parts of the atmosphere so the blue is scattered even more, and red goes through, and we can see it as red Sun at sunset.



DID YOU KNOW?

Human eyes can have only two colours of dye – brown and amber.

Melanin is responsible for brown eye colour (black eyes are just very dark brown) and **lipochrome** for amber. Other eye colours are dye-free and the observed colour is due to Tyndall effect. Small particles suspended in the eye scatter the light and result in blue/grey irises. Green eyes have just a bit of dye but the end result is due to Tyndall effect as well: mixed together, yellow + blue = green.



John Tyndall (1820 - 1893) was one of Ireland's most successful scientists and educators. Born in Leighlinbridge, County Carlow, he reached the pinnacle of 19th century science. His major scientific interest was the interaction of light with matter, and he is most widely known for the explanation of why the sky is blue. Tyndall National Institute, Ireland's leading ICT research institute, is named in recognition of his work.