

● ○ ○ EASY

👩👧 5 – 11 YRS

🕒 ½ HR



1 Discover how titanium dioxide coatings on windows and solar panels can help them to stay clean

2 Create your own self-cleaning glass using sunscreen

3 Explore how plants and animals use different water attracting and repelling coatings

INNOVATION IN CHEMISTRY

SURPRISING SELF-CLEANING SUNCREAM



ENCOURAGING TOMORROW'S CHEMISTS TODAY
DISCOVER MORE ACTIVITIES AT [SALTERSINSTITUTE.ORG/RESOURCES](https://www.saltersinstitute.org/resources)



INTRODUCTION

What is the safest way to clean the window on a skyscraper? Scientists have invented a self-cleaning glass. Self-cleaning glass is coated in a very thin layer of a chemical called titanium dioxide.

When sunlight falls on titanium dioxide, a special chemical reaction takes place that breaks down dirt and mud into small pieces that are easily washed away. Normally when water falls on glass, the water forms droplets. However, in glass coated with titanium dioxide, the titanium dioxide coating becomes hydrophilic (this means it attracts water) when the sun shines on it and the water spreads out to form a layer on the surface. On windows coated in titanium dioxide the water forms a continuous sheet which washes away the dirt. The same titanium dioxide self-cleaning technology has recently been used in solar panels and outdoor paints.

Titanium dioxide powder is often added to suncreams because it also absorbs and reflects the harmful ultraviolet rays in sunlight, preventing sunburn.



SAFETY

- Take care with glass jars
- Broken glass should always be cleared up by an adult, using a dustpan and brush
- Always wash your hands after handling soil
- This activity should always be supervised by an adult



DID YOU KNOW?

Self-cleaning technologies can be found in the natural world. Pitcher plants have hydrophilic surfaces on their leaves – a thin coating of water forms over their leaves making them very slippery. This means that insects are more likely to fall into the pitcher shaped leaves on these carnivorous plants.

Most fish secrete a self-cleaning slippery hydrophilic slime that help them swim faster, prevents algal growth on their scales and allows them to escape predators. Lotus leaves are extremely hydrophobic (they repel water), which means water droplets form streams of water which run off the leaves, carrying away any dirt, so their leaves are always beautifully clean.



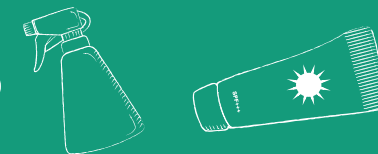
ACTIVITY



INSTRUCTIONS

1. Make sure the glass jars are clean and dry before you start and have their lids firmly on.
2. Using the marker pen, label the 3 jars 'suncream', 'cream' and 'nothing'.
3. Paint the outside of one jar with the suncream or SPF moisturiser, paint the outside of the second jar with the moisturising cream without titanium dioxide and leave the third jar unpainted.
4. Fill the plant spray bottle with cold water. Holding the jars over a sink, spray each jar with water. What do you notice happens to the water? Does it run off in droplets and streams of water or does it run off in sheets?
5. Fill a washing up basin with about 5cm depth of warm water. Now add a handful of soil to the water. Mix with your hands to make muddy water. Splash this all over the outside of the three jars to make them dirty.
6. Hold the jars over the washing up basin and sprinkle a little flour onto the outside of each of the muddy jars. The flour acts like household dust.
7. Place the muddy, dusty jam jars outdoors in a sunny spot where they won't be disturbed. Make sure they are not under cover as they need rainwater to wash them. Wash your hands. Leave the jars outside until it has rained for a few days. Now examine the jars, which jar looks the cleanest and which jar looks the most dirty?

YOU WILL NEED



- Suncream or SPF moisturiser containing titanium dioxide. Check the ingredients list as this might be labelled as Titanium (iv) oxide, Titania, Titanium White, Pigment White (PW6), or CI77891
- Suncream / moisturiser that doesn't contain titanium dioxide
- 3 clean glass jam jars
- 2 paintbrushes
- Plant mister/spray bottle
- Washing up basin and access to a sink
- Marker pen
- Handful of flour
- Handful of soil / compost
- Access to a sunny outdoor area where the jam jars won't be disturbed

WHAT'S HAPPENING?

When the jam jars are sprayed with water, water droplets form on the surface of the jar covered in moisturising cream and also on the unpainted jar because they lack the hydrophilic titanium dioxide coating. The 'suncream' jar remains see-through and without droplets due to the hydrophilic chemical reaction from the titanium dioxide in the suncream.

After a few days outside in the rain, an almost invisible film of cream can still be seen on the 'suncream' and 'moisturiser' jars. The jars marked 'moisturiser' and 'nothing' are covered in specks of mud and flour. The sunlight falling on the titanium dioxide in the suncream helps to break down the dirt. After rainfall, the hydrophilic coating on the 'suncream' jar allows a continuous sheet of water which washes away the broken-down particles of dirt like a cloth, leaving it cleanest.