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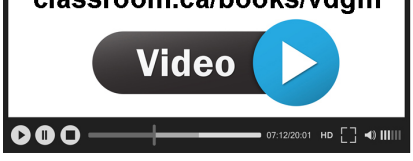

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SPACE

The Vera Rubin Observatory

In the mountains of northern Chile, a brand-new telescope is about to change the way we see the universe. The Vera C. Rubin **Observatory** will soon begin its mission of scanning the entire southern sky every few nights. Scientists have dreamed of this project for decades, and now it is nearly ready to start collecting data.

The observatory was first imagined in the 1990s by astronomer Tony Tyson. It was named after Vera Rubin, the astronomer who provided some of the best evidence for the existence of **dark matter** back in the 1970s. She discovered that galaxies were rotating in a way that suggested some invisible matter was holding them together.

What makes the Rubin Observatory different from other telescopes is its enormous camera and unusual design. The camera is the largest digital camera ever built, weighing about 3000 kilograms and fitted with 189 sensors. Each image it takes is so large that it contains more detail than 260 smartphone cameras combined. The giant mirrors make sure the images stay sharp across a huge field of view. The telescope will be able to capture an area of sky as wide as 45 full moons at once.

The purpose of the Rubin Observatory is to study both the slow and fast changes happening in the universe. Over its planned 10-year **survey**, it will create a map of about 20 billion galaxies and 20 billion stars, giving scientists an unmatched view of how the universe is structured. It will also track objects closer to home, such as asteroids and comets, and maybe even help locate a hidden ninth planet in our solar system.

Perhaps the most exciting part is that Rubin's data will be shared openly with the world. Anyone will be able to explore its discoveries online.

DID YOU KNOW

The Vera C. Rubin Observatory features the world's largest digital camera.

To view videos, go to: http://resources.dynamic-classroom.ca/books/vdgm

WORD POWER

OBSERVATORY: A building or place equipped for observing the sky and studying space

DARK MATTER: Material that some scientists believe exists in space but does not reflect any light

SURVEY: A systematic study or mapping of a large area or group to collect information

SPACE

The Vera Rubin Observatory

1. Who was the observatory named after?

2. Describe the observatory's camera.

3. What do the observatory's mirrors do?

4. What will the Rubin Observatory be doing?

5. What is the most exciting part of the Rubin Observatory?

CRITICAL THINKING

1. Why is the Rubin Observatory important for studying space?

Gazing at the Stars

You have been given a telescope to study the night sky. You can look at the moon, planets, stars, asteroids, and comets. Describe below what you would look at and explain why you would choose that.

INNOVATION

Pickleballs Help Cut Vehicle Drag

Sometimes, a good idea comes from the most unexpected place. For engineer Anchal Sareen, a pickleball was more than just a sports ball. It inspired a new way to make vehicles move more easily through air and water.

Drag is a force that acts against moving objects, like wind pushing back on a car. It makes vehicles work harder and use more fuel or power. Engineers have tried many ways to reduce drag. One common trick is to make surfaces smooth and sleek. There is another way that is based on the **dimples** on sport balls like golf balls or pickleballs.

The team led by Sareen covered a pickleball with a balloon to create a surface with tiny dimples that can change depth by pumping air in or out. These adjustable dimples can be made deeper or shallower when needed. This smart surface helps reduce drag by almost half compared to a smooth, dimple-free surface.

To test the idea, the researchers 3-D printed ball-shaped models and placed them in wind tunnels. They controlled the dimple depth using a **vacuum pump** and found that even a small change made a big difference in slowing down drag. By changing the dimples on one side of the ball, the surface also can push the vehicle sideways or upward. This means vehicles could be steered in new ways.

This technology could help make airplanes fly more smoothly, help underwater robots explore the ocean more efficiently, and even save fuel by reducing resistance. The research team is still refining the design to create skins that quickly respond to changing air or water conditions. One day, this smart dimpled skin could make vehicles lighter, faster, and easier to control.

DID YOU KNOW

Pickleball was invented in 1965 by three friends on Bainbridge Island, Washington, using a mix of badminton and ping-pong paddles.

To view videos, go to: http://resources.dynamic-classroom.ca/books/vdgm

WORD POWER

DRAG: A force that slows down objects moving through air or water by pushing against them, like wind pushing back on a car

DIMPLE: A small hollow or indentation on the surface of something

VACUUM PUMP: A device that removes air or gas from a space to create a vacuum

INNOVATION

Pickleballs Help Cut Vehicle Drag

1. What is drag?

2. What did Sareen's team do with a pickleball?

3. How did the researchers test whether these balls could reduce drag?

4. How did changing the dimples on one side of the ball affect things?

5. How could this technology be used?

CRITICAL THINKING

1. What problems could happen if this technology does not work as planned?

Forces of Flight

There are four forces that affect things that fly.

1. Weight is the force of gravity. It acts in a downward direction.
2. Lift is the force that acts at a right angle to the direction of motion through the air. Lift is created by differences in air pressure.
3. Thrust is the force that propels a flying machine in the direction of motion. Engines produce thrust.
4. Drag is the force that acts opposite to the direction of motion. Drag is caused by friction and differences in air pressure.

When an airplane flies, the wings are designed to provide enough lift to overcome the airplane's weight, while the engine provides enough thrust to overcome drag and move the airplane forward.

When an airplane is flying straight and level at a constant speed, the lift it produces balances its weight, and the thrust it produces balances its drag. However, this balance of forces changes as the airplane rises and descends, as it speeds up and slows down, and as it turns.

Increasing the weight of an aircraft affects the amount of lift needed. In turn, larger wings would provide more lift, but that would increase the amount of drag and therefore increase the amount of thrust needed. The forces of flight are connected, and a change in one affects the others.

What is a force?

A force is basically a push or a pull that causes an object to undergo a change in speed, a change in direction, or a change in shape. A force has both magnitude (size) and direction.

On the diagram below, use labels and arrows to show how each force (gravity, thrust, lift, and drag) acts on an airplane.

Answer the following multiple choice questions to show that you understand the forces of flight.

1. How does thrust help an airplane fly?

   A. It lifts the airplane up.
   C. It slows the airplane down.
   B. It gives the airplane speed.
   D. It pulls everything down.

2. What will happen to an airplane if drag is greater than thrust?

   A. It will go faster.
   C. It will go faster and higher.
   B. It will go slower and higher.
   D. It will go slower and be unable to fly.

3. What will happen to an airplane if lift is greater than gravity?

   A. It will fly upward.
   C. There will be no change.
   B. It will fly downward.
   D. It will not be able to fly.

4. Where does an airplane get its thrust?

   A. Wings
   C. Wheels
   B. Weight
   D. Engine or propeller

CHEMISTRY

Anti-Spice Compounds in Chili Peppers

Chili peppers are known for their spicy heat. The heat in chili peppers comes from special chemical compounds called capsaicinoids, with **capsaicin** being the most famous. Capsaicin is mostly found in the white, spongy part of the pepper where the seeds attach.

When people eat chili peppers, capsaicin binds to **receptors** in the mouth that sense heat and pain. This sends signals to the brain that cause the burning feeling we call "spice." The level of heat in peppers is measured on the Scoville scale, where the hottest peppers score millions of heat units and sweet peppers have none.

Scientists recently discovered that even though many chili peppers have the potential to be very spicy, they sometimes are not as hot as expected. This happens because of five newly found "anti-spice" compounds inside some peppers. These compounds act like natural coolers that reduce the peppers' heat. They work by blocking or changing how the spicy molecules behave. This discovery helps explain why some peppers contain capsaicin but still don't taste very hot.

These anti-spice compounds are part of an interesting chemical balance inside chili peppers. Capsaicin helps protect the pepper plants from animals that might eat them, since the heat is unpleasant for many creatures. The anti-spice compounds offer a gentler protection, possibly helping peppers survive better in different environments and attracting certain animals like birds that can spread their seeds without being hurt by the spice.

Knowing about these compounds could help farmers and food makers create new kinds of peppers with just the right amount of heat. For example, people who want some spice but not too much could enjoy milder peppers that still taste flavourful.

DID YOU KNOW

Chili peppers have been around for over 7000 years and were first **cultivated** in Mexico.

To view videos, go to: http://resources.dynamic-classroom.ca/books/vdgm

WORD POWER

CAPSAICIN: A chemical in chili peppers that makes them spicy and causes a burning feeling in your mouth

RECEPTOR: A tiny part in your body that detects signals, like heat or pain, and tells your brain about them

CULTIVATED: To grow plants or crops

CHEMISTRY

Anti-Spice Compounds in Chili Peppers

1. Where does the heat in chili peppers come from?

2. What happens when people eat chili peppers?

3. What did scientists recently discover?

4. What do these anti-spice compounds do?

5. How could knowing about these compounds help farmers and food makers?

CRITICAL THINKING

1. How could understanding "anti-spice" compounds help people who don't like spicy food?

ENVIRONMENT

The Fight Against Tan Spot

Wheat farmers face many challenges, but one stubborn disease called tan spot quietly damages crops every year and threatens harvests across Canada.

Tan spot is a disease that affects wheat plants and is caused by a fungus called Pyrenophora tritici-repentis. This fungus is not the most dangerous wheat disease, but it is very persistent and can cause serious damage to crops.

Tan spot shows up on wheat leaves as small tan or brown spots that grow into diamond-shaped patches surrounded by yellow halos. These spots can join together to cover large parts of the leaf. The infected leaves often wither and die, which weakens the plant and makes it harder for the wheat to grow properly.

One problem is that tan spot damages the leaves where **photosynthesis** happens. When tan spot damages the leaves, the plant can't make enough food, which slows down growth and reduces the amount of wheat that farmers can harvest.

Tan spot survives through the winter on leftover wheat stalks and straw in the fields. In the spring, it produces **spores** that are spread by wind and rain, infecting new wheat plants. The disease grows quickly during wet and humid weather. Farmers who plant wheat in fields with a lot of leftovers from previous crops are more likely to face tan spot problems.

Canadian researchers and farmers are trying to control tan spot through different methods. These include changing the type of plants grown in a field to break the disease cycle. Farmers also use wheat varieties that are more resistant to tan spot and apply **fungicides**.

Tan spot is not the deadliest wheat disease, but it can cause major losses over time if not managed well. Research continues to find better ways to fight this persistent threat, helping Canadian farmers protect their wheat crops for the future.

? DID YOU KNOW

Farmers rotate crops to keep soil healthy, replenish nutrients, control pests and diseases, and reduce the need for chemical fertilizers and pesticides. This improves long-term crop yields.

To view videos, go to: http://resources.dynamic-classroom.ca/books/vdgm

WORD POWER

PHOTOSYNTHESIS: The process in which plants use sunlight, water, and carbon dioxide to make their own food and grow

SPORES: Tiny cells produced by fungi or plants that can spread and grow into new plants or organisms

FUNGICIDE: A chemical that kills fungus

ENVIRONMENT

The Fight Against Tan Spot

1. What is tan spot?

2. What does tan spot look like?

3. What is one problem caused by tan spot?

4. What happens to tan spot in the winter and spring?

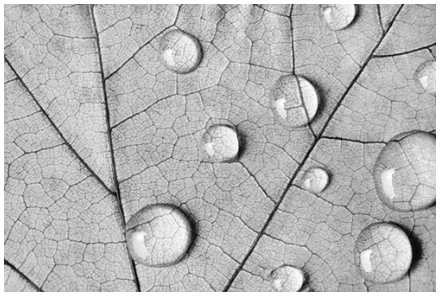
5. How are Canadian researchers and farmers trying to control tan spot?

CRITICAL THINKING

1. What might happen if tan spot spreads without any control?

BIG IDEAS

The Water Cycle



Water on Earth is always moving in a cycle that never ends. This cycle is called the water cycle.

The water cycle is how water travels from the ground to the sky and back again. The Sun plays a big role in this cycle because its heat causes water to change from liquid into a gas called water vapour. This happens mainly in oceans, lakes, and rivers. The process of water changing to vapour is called evaporation.

Plants help the water cycle too. They release water vapour through tiny holes in their leaves in a process called transpiration. Together, evaporation and transpiration move water into the atmosphere, where it cools down and changes back into tiny water droplets. This change from gas back to liquid is called condensation, and it forms clouds in the sky. When the clouds get full of water droplets, the water falls back to Earth as rain, snow, sleet, or hail. This is called precipitation.

Once water reaches the ground, it can flow over the surface into lakes, rivers, and oceans, or soak into the soil to become **groundwater**. Plants and animals use this water to survive, and the cycle begins again.

The water cycle can be disrupted. Human activities, like cutting down forests or building cities, can change how water moves. For example, when trees are removed, less water is released into the air through transpiration. Pollution can also harm the water cycle by **contaminating** water sources.

The water cycle is easy to see in our everyday life. When it rains, water falls from clouds and lands in rivers or lakes, or on soil. Some of this water travels through streams back to oceans, where it can evaporate again with the heat of the Sun. This movement of water supports all living things and keeps our environment healthy.

DID YOU KNOW

The water you drink today might have been part of a dinosaur's world millions of years ago, because Earth's water has been recycling for over 4 billion years.

To view videos, go to: http://resources.dynamic-classroom.ca/books/vdgm

WORD POWER

GROUNDWATER: Water that is found under the ground in soil or rocks

CONTAMINATING: Making a substance or place dirty or no longer pure by adding a substance that is dangerous or carries disease

BIG IDEAS

The Water Cycle

1. What is the water cycle?

2. What role does the Sun play in the water cycle?

3. What happens after evaporation and transpiration move water into the atmosphere?

4. What happens once water reaches the ground?

5. How can the water cycle be disrupted?

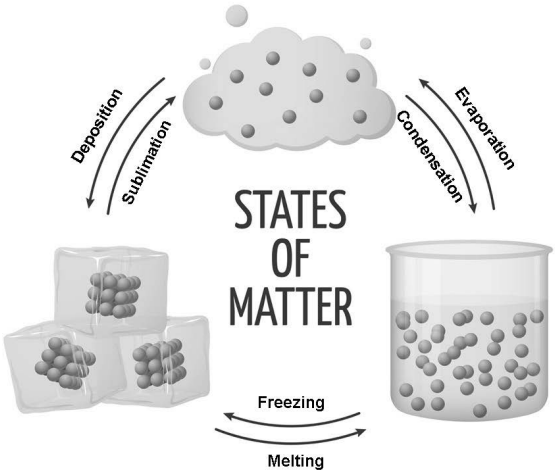
CRITICAL THINKING

1. Why is the water cycle important for life on Earth?

States of Water

Water is found in three common states: solid (ice), liquid (water), and gas (water vapour).

Below is a diagram that shows the processes that change water from one state to another.



Condensation: The process by which water vapour changes into liquid

Deposition: The process by which a gas turns into a solid, without becoming a liquid first

Evaporation: The process of liquid water changing into water vapor

Freezing: The process by which liquid water becomes ice

Melting: The process by which ice becomes liquid water

Sublimation: The process by which ice changes directly into water vapour, without becoming a liquid first

Match each word with the correct definition.

Condensation	The process by which liquid water becomes ice
Deposition	The process by which ice changes directly into water vapour, without becoming a liquid first
Evaporation	The process of water changing into water vapor
Freezing	The process by which ice becomes liquid water
Melting	The process by which water vapour changes into liquid
Sublimation	The process by which a gas turns into a solid, without becoming a liquid first

Science News Quiz

THE VERA RUBIN OBSERVATORY

1. What will the observatory soon begin scanning?

   A. The surface of the Moon B. The entire southern sky C. The entire northern sky

2. The observatory will create a map of about 20 billion _____ and 20 billion stars.

PICKLEBALLS HELP CUT VEHICLE DRAG

1. Drag is a _____ that acts against moving objects, like wind pushing back on a car.

2. The team led by Sareen covered a pickleball with a balloon to create a surface with tiny dimples that have a set depth.

   True False

ANTI-SPICE COMPOUNDS IN CHILI PEPPERS

1. Capsaicin is mostly found in the outer skin of the pepper.

   True False

2. The anti-spice compounds act like natural coolers that reduce the peppers' _____.

THE FIGHT AGAINST TAN SPOT

1. Tan spot is caused by what?

   A. A fungus B. A bacteria C. A virus

2. In the spring, tan spot produces spores that are _____ by wind and rain.

THE WATER CYCLE

1. Heat from the Sun causes water to change from liquid into a gas called water _____.

2. Once water reaches the ground, it can flow over the surface into lakes, rivers, and oceans.

   True False

Science News Answer Key

The Vera Rubin Observatory

1. **Who was the observatory named after?**
   It was named after Vera Rubin, the astronomer who provided some of the best evidence for the existence of dark matter back in the 1970s. She discovered that galaxies were rotating in a way that suggested some invisible matter was holding them together.
2. **Describe the observatory's camera.**
   The camera is the largest digital camera ever built, weighing about 3000 kilograms and fitted with 189 sensors. Each image it takes is so large that it contains more detail than 260 smartphone cameras combined.
3. **What do the observatory's mirrors do?**
   The giant mirrors make sure the images stay sharp across a huge field of view.
4. **What will the Rubin Observatory be doing?**
   Over its planned 10-year survey, it will create a map of about 20 billion galaxies and 20 billion stars, giving scientists an unmatched view of how the universe is structured. It will also track objects closer to home, such as asteroids and comets, and maybe even help locate a hidden ninth planet in our solar system.
5. **What is the most exciting part of the Rubin Observatory?**
   Perhaps the most exciting part is that Rubin's data will be shared openly with the world. Anyone will be able to explore its discoveries online.

Pickleballs Help Cut Vehicle Drag

1. **What is drag?**
   Drag is a force that acts against moving objects, like wind pushing back on a car. It makes vehicles work harder and use more fuel or power.
2. **What did Sareen's team do with a pickleball?**
   The team led by Sareen covered a pickleball with a balloon to create a surface with tiny dimples that can change depth by pumping air in or out. These adjustable dimples can be made deeper or shallower when needed.
3. **How did the researchers test whether these balls could reduce drag?**
   The researchers 3-D printed ball-shaped models and placed them in wind tunnels. They controlled the dimple depth using a vacuum pump and found that even a small change made a big difference in slowing down drag.
4. **How did changing the dimples on one side of the ball affect things?**
   By changing the dimples on one side of the ball, the surface also can push the vehicle sideways or upward. This means vehicles could be steered in new ways.
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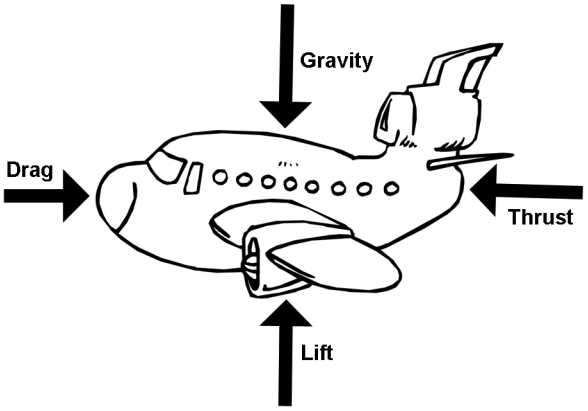
   This technology could help make airplanes fly more smoothly, help underwater robots explore the ocean more efficiently, and even save fuel by reducing resistance.

Forces of Flight



1. B 2. D 3. A 4. D

Anti-Spice Compounds in Chili Peppers

1. **Where does the heat in chili peppers come from?**
   The heat in chili peppers comes from special chemical compounds called capsaicinoids, with capsaicin being the most famous.
2. **What happens when people eat chili peppers?**
   When people eat chili peppers, capsaicin binds to receptors in the mouth that sense heat and pain. This sends signals to the brain that cause the burning feeling we call "spice."
3. **What did scientists recently discover?**
   Scientists recently discovered that even though many chili peppers have the potential to be very spicy, they sometimes are not as hot as expected. This happens because of five newly found "anti-spice" compounds inside some peppers.
4. **What do these anti-spice compounds do?**
   These compounds act like natural coolers that reduce the peppers' heat. They work by blocking or changing how the spicy molecules behave.
5. **How could knowing about these compounds help farmers and food makers?**
   Knowing about these compounds could help farmers and food makers create new kinds of peppers with just the right amount of heat. For example, people who want some spice but not too much could enjoy milder peppers that still taste flavourful.

The Fight Against Tan Spot

1. **What is tan spot?**
   Tan spot is a disease that affects wheat plants and is caused by a fungus called Pyrenophora tritici-repentis. This fungus is not the most dangerous wheat disease, but it is very persistent and can cause serious damage to crops.
2. **What does tan spot look like?**
   Tan spot shows up on wheat leaves as small tan or brown spots that grow into diamond-shaped patches surrounded by yellow halos. These spots can join together to cover large parts of the leaf.
3. **What is one problem caused by tan spot?**
   One problem is that tan spot damages the leaves where photosynthesis happens. When tan spot damages the leaves, the plant can't make enough food, which slows down growth and reduces the amount of wheat that farmers can harvest.
4. **What happens to tan spot in the winter and spring?**
   Tan spot survives through the winter on leftover wheat stalks and straw in the fields. In the spring, it produces spores that are spread by wind and rain, infecting new wheat plants. The disease grows quickly during wet and humid weather
5. **How are Canadian researchers and farmers trying to control tan spot?**
   Canadian researchers and farmers are trying to control tan spot through different methods. These include changing the type of plants grown in a field to break the disease cycle. Farmers also use

wheat varieties that are more resistant to tan spot and apply fungicides.

The Water Cycle

1. **What is the water cycle?**
   The water cycle is how water travels from the ground to the sky and back again.
2. **What role does the Sun play in the water cycle?**
   The Sun plays a big role in this cycle because its heat causes water to change from liquid into a gas called water vapour. This happens mainly in oceans, lakes, and rivers.
3. **What happens after evaporation and transpiration move water into the atmosphere?**
   Together, evaporation and transpiration move water into the atmosphere, where it cools down and changes back into tiny water droplets and it forms clouds in the sky. When the clouds get full of water droplets, the water falls back to Earth as rain, snow, sleet, or hail.
4. **What happens once water reaches the ground?**
   Once water reaches the ground, it can flow over the surface into lakes, rivers, and oceans, or soak into the soil to become groundwater. Plants and animals use this water to survive, and the cycle begins again.
5. **How can the water cycle be disrupted?**
   Human activities, like cutting down forests or building cities, can change how water moves. For example, when trees are removed, less water is released into the air through transpiration. Pollution can also harm the water cycle by contaminating water sources.

Science News Quiz

THE VERA RUBIN OBSERVATORY

1. **What will the observatory soon begin scanning?**
   B. The entire southern sky
2. The observatory will create a map of about 20 billion **GALAXIES** and 20 billion stars.

PICKLEBALLS HELP CUT VEHICLE DRAG

1. Drag is a **FORCE** that acts against moving objects, like wind pushing back on a car.
2. **The team led by Sareen covered a pickleball with a balloon to create a surface with tiny dimples that have a set depth.**
   False – That can change depth by pumping air in or out

ANTI-SPICE COMPOUNDS IN CHILI PEPPERS

1. **Capsaicin is mostly found in the outer skin of the pepper.**
   False – In the white, spongy part of the pepper where the seeds attach
2. The anti-spice compounds act like natural coolers that reduce the peppers' **HEAT**.

THE FIGHT AGAINST TAN SPOT

1. **Tan spot is caused by what?**
   A. A fungus
2. In the spring, tan spot produces spores that are **SPREAD** by wind and rain.

THE WATER CYCLE

1. Heat from the Sun causes water to change from liquid into a gas called water **VAPOUR**.
2. **Once water reaches the ground, it can flow over the surface into lakes, rivers, and oceans.**
   True