

## Unit 1 Light Travels

Light travels in a straight line. How do we know this? Turn on a flashlight. The light moves away from the flashlight. It moves in a straight line.

When light hits a mirror, what happens to it?

Does it keep going? Does it change direction?

Let's find out.

You need a mirror, a flashlight, and a target.

Step 1. Put the target on the wall and shine the flashlight at it.

Step 2. Use the mirror to change the direction of the light. Make the light go toward the target.

When light hits a mirror, it changes direction. This is called reflection.

We can change the direction of the light by moving the mirror.

Look around you.

A bus driver uses her rearview mirror to see who is getting off the bus. She doesn't need to turn her head.

Where else can you see reflections every day?

## Unit 2 The Bus Driver

Tom and Jenny got on the bus. It was 7 p.m. and the bus was full of people.

Tom said, "Wow, this bus is crowded!"

"Yes, it is," said Jenny.

After a while, Tom said, "Jenny, do you think we can get off? I don't think the bus driver can see us! There're too many people!"

Then Jenny said, "Don't worry. The bus driver can see everything. There's a rearview mirror at the front of the bus. The driver can look in it and open the doors."

Tom said, "I don't know why I was worried. Look! This is our stop."

## Unit 3 The Water Cycle

Water is always changing. It is always moving.

But the total amount of water on Earth never changes.

Rain falls from a cloud into a river. It evaporates into the air. It condenses into a cloud.

Rain falls from a cloud again. This is the water cycle.

Let's watch and see.

Step 1. Put a clear plastic cup filled with ice in a zipper bag. Seal the bag and weigh it.

Put the bag next to a sunny window.

Step 2. Day 1: The ice in the cup melts, and water drops from the cup into the zipper bag.

Step 3. Days 2 and 3: The amount of water inside the cup decreases, and the amount of water outside the cup increases.

Step 4. Weigh the bag again. What do you notice?

The water left the cup. But it didn't leave the bag. The weight didn't change.

Why? Because the total amount of water in the bag did not change.

The total amount of water on Earth doesn't change, either.

Water can be rain. It can be ice or a cloud. But it's always the same water.

## Unit 4 Disappeared Water

Kate left a glass of water by the window.

She went on vacation and forgot all about it.

One week later, she came home and looked at the glass again. Half the water was gone!

“Mom! No one was home, but my water is gone! Who drank it?”

“Nobody drank it, Kate. The water evaporated. It became water vapor in the air. Do you see the clouds in the sky? Water vapor goes up high in the sky and becomes a cloud. Then it turns into water again.”

Kate said, “Then it falls from the sky as rain!”

“That’s right! The water from your cup evaporated and became a cloud.”

“Wow, so the water in my cup will be rain?”

“Yes, that’s right.”

“Water is so cool!”

## Unit 5 A Raft of Straws

A straw floats in water, but a coin sinks.

How can we make a coin float in water?

We can put it on a straw raft.

How can we make this raft?

Let's try to design it. We can see who makes the strongest raft.

Step 1. Draw a blueprint of your raft on paper.

Step 2. Make the raft using five straws, scissors, and a glue gun.

Step 3. Place coins, one at a time, on the raft. See how many coins make the raft sink.

Step 4. Design a new, better raft. Whose raft can hold the most weight?

Buoyancy is a force in water. This force pushes things upward in the water. It makes them float or sink.

Put an object in the water. When an object has high buoyancy, it floats. When an object has low buoyancy, it sinks.

A coin is heavy. It has low buoyancy, so it sinks.

The straw raft is light. It has high buoyancy, so it floats.

Put lots of coins on the raft. Now the raft is heavy. It sinks!

## Unit 6 How Does a Ship Float?

Clara and Brian went to the beach. They saw a big ship in the water.

Brian said, "Clara, how can that big ship float?"

"I don't know. Let's check on the Internet."

They searched for how boats float.

Brian said, "It says it's because the force of water pushes the ship up. It's called buoyancy."

"Yes, that's right," said Clara. "My smartphone says this, too. The big ship has lots of air in it. The ship is made of heavy iron. But the air makes it lighter.

The iron and air are lighter than the water. So the ship floats!"

"Oh, I see!" said Brian. "That's how that huge ship can float on water."

## Unit 7 Ice Fishing

Do you see people spraying things on the road, street, or stairs after heavy snow?

They are melting the ice.

People use salt and other ingredients to melt the ice. What happens when ice is mixed with salt?

Let's find out.

Step 1. Put some ice cubes in a cup filled with water.

Step 2. Place a string across the ice cubes. Make sure the string touches every ice cube.

Step 3. Sprinkle some salt on the ice and the string.

Step 4. Wait for a minute. Gently pull the string out of the cup and see what has happened.

Step 5. The ice and the string were separate before. Now the ice is stuck to the string!

Why is this? The secret is the salt.

Water usually freezes at zero degrees Celsius. But salt lowers the freezing point of the water.

The ice touching the salt becomes water.

Then the ice cubes cool down the water around them, and freeze it again. The string gets frozen, too.

It sticks to the ice.

## Unit 8 Frozen

It was a cold winter day.

Anna was on her way to her aunt's house. Her mom was driving.

They drove past a river. Anna looked out of the window and said, "Mom, look at that!

The river is frozen solid!"

Her mom said, "The weather must be very cold. Even the river froze."

Anna said, "Does the sea freeze on a cold day like today? I haven't seen a frozen sea before."

"Not on a day like today," her mom replied.

"The sea freezes in much colder weather."

Anna asked, "Why is that?"

"Because there is salt in sea water."

"Oh, I learned about that in school. Salt lowers the freezing point of water. So, does the sea freeze in much colder weather?"

"That's right, Anna!"



## Unit 9 The Power of Pulleys

Try to pick up your sofa at home. It's too heavy.

You can't lift it.

What could you use to lift it? You could use a pulley.

A pulley uses ropes and wheels to lift things.

With one, you can lift very heavy things.

Can we design and make our own pulley?

Let's make one and see how much weight it can lift.

Step 1. Poke three holes (near the top of the open end of the cup) in a clear cup. Cut wool yarn into three pieces of the same length.

Step 2. Tie the ends of the wool yarn through the holes in the cup. Tie the loose ends of the wool yarn together. Tie the three pieces of yarn to a long piece of yarn.

Step 3. Tape the other end of the long yarn onto an empty roll.

Step 4. Wrap the wool yarn around the empty roll.

Step 5. Slide a chopstick through the roll.

Step 6. Put small objects in the cup, and turn the chopstick to lift them.

A pulley is a simple machine that makes lifting heavy objects easier.

It distributes weight to reduce the amount of force it takes to lift something up. Where can we see people use a pulley?

## Unit 10 Inventions of the Past

Matthew went on a school trip to a Korean fortress.

The fortress was built 200 years ago. It was made of heavy rocks.

“But they didn’t have electricity. They didn’t have big metal machines. How did they build it?” asked Matthew.

“They used the Geojunggi. It’s a special machine. It easily lifts heavy things.”

“How does it work?”

“It uses pulleys. They make lifting easy. Tie an object to the rope. The rope goes through many wheels. Each wheel carries some of the object’s weight. The more wheels there are, the less force you need to use.”

“People were so clever back then!”

## Unit 11 A Volcanic Eruption

There are rocks deep inside Earth. It's very hot inside Earth. This makes rocks melt. Molten rock is called magma. There is magma inside a volcano. When volcanoes erupt, the molten rock comes out. We call it lava.

Lava is very hot. It's very dangerous. It breaks things around it. But it also makes things.

Lava cools down and becomes hard. It makes islands and new land.

Let's make a mini volcano and watch it erupt.

Step 1. Put 50 g of baking soda in a plastic bottle

Step 2. Add three to four drops of red food coloring and about ten drops of kitchen detergent.

Step 3. Close the bottle and shake it to mix the contents well.

Step 4. Place the plastic bottle on a large plate. Make a volcano around the bottle using clay.

Step 5. When the volcano is formed, open the lid of the bottle.

Step 6. Pour vinegar in the volcano crater and observe what happens.

Fake lava came out of our model volcano. It looked real!

There are volcanoes all over the world.

Is there one in your country?

## Unit 12 Volcanoes: Good or Bad?

Ka-boom!

Liam watches the news. A volcano is erupting in another country. He is worried.

Liam says, "Dad, are we in danger?"

"Don't worry, we're safe here."

"But volcanoes are so dangerous. They cause fire and ash."

"They are dangerous," Dad says, "but they are not all bad. Volcanoes create islands.

We went to Hawaii last year. Hawaii was made by volcanoes."

"That's cool!" says Liam. "What else can volcanoes do?"

"Well, hot magma under the surface heats up water. It makes hot springs that we can visit. It makes water vapor, too. We can turn this water vapor into electricity."

"Volcanoes are amazing! Can we go to a hot spring this weekend?"

## Unit 13 The Faults in Our Earth

The surface of Earth is called the crust. It is like a puzzle made up of about 20 puzzle pieces.

These pieces are always moving. But they move very slowly. We can't feel them move.

When one of these pieces slides past another piece, Earth's surface cracks. This is called a fault.

There are faults all over the world.

Let's see how they are made.

Step 1. Hold three books together with their spines facing up. Place them on a desk.

Step 2. Slide the books so that the book in the middle moves away from you.

Step 3. Slide the books again. This time, make the book in the middle slide toward you.

Step 4. Put the three books in a line. Lift them up and relax your hands so the book in the middle falls.

The surface of Earth is like these books.

When we moved the books, the "crust" broke. We made a fault.

Earthquakes happen at faults.

## Unit 14 Earthquake Safety

“Dad, what was that? The desk just shook!”

Dad ran over to Dina. He grabbed her hand and took her under the kitchen table.

He checked his phone for some news reports.

“What’s happening?” asked Dina.

“It’s an earthquake. It’s very dangerous. It can make buildings fall down. It can hurt people, too.”

“What should we do? Will we be okay?” Dina asked.

“Don’t worry. When things start shaking, get under the table like we did. It might get worse. If it does, we should turn off the power and the gas. We should leave our house.

Use the stairs. Don’t use the elevator. Cover your head. Go out to an open space like a field or a park.”

“Don’t worry, Dad! I know we’ll be okay.”

## Unit 15 Machines All Around

Machines help us in our everyday lives. They can be big or small, simple or complicated. A clock and a plane are both machines. Even the zipper on your pants is a simple machine!

Mechanical engineers work with machines. They think of new machines and make old ones work better. These machines make our lives easier.

Mechanical engineers work in many industries.

They make cars, planes, computers, and even robots!

They do so many different things! They design, build, and test new machines.

Turn on a light switch. Take a glass of cold milk from the fridge.

Say thank you to a mechanical engineer!

## Unit 16 Underwater Explorers

It's important to understand the past. The past can help us understand the future.

Archaeologists look all over Earth. They dig in the ground to learn about our past.

They find pots, walls, and bones. They study and learn from them.

But over 70 percent of Earth's surface is covered with water.

Do people look for items underwater?

Yes, underwater archaeologists do.

They swim deep in the water. They swim in rivers and lakes.

They even swim deep in the sea!

They find ships, bridges, and even houses underwater.

These objects can teach us about people who lived long ago.