Name: _____ Date: _____

How Water Climbs a Tall Tree

Circle group

A tall tree lifts water from its roots to leaves high above the ground. It has no heart and no pump. It gets help from the sun and from how water behaves.

Inside the trunk, thin tubes called xylem run from the roots to the leaves. Water moves up them in a long chain. The main push is evaporation. Leaves have tiny holes called stomata. When the sun warms a leaf, water escapes through the holes as vapor. This is called transpiration.

When one water molecule leaves, it pulls on the next one. Water molecules stick to one another. This sticking is called cohesion. Water also clings to the walls of the tubes. This helps keep the chain from breaking. The pull goes all the way down and draws more water in through the roots.

It is like drinking through a straw. You pull at the top, and the liquid at the bottom moves. The leaves do the pulling, and the sun gives the energy. Only a small part of the water is used to build the tree. Most is let out into the air. So trees can struggle in hot, dry weather when the soil dries out too.

Scientists have measured this pull. They find that the water in the xylem is often under tension, like a stretched rope. So a tree does not need a strong push from below. The roots are not pumping. They just supply water to the chain as it is drawn up. This is very different from how blood moves through an animal.

Questions

1. What are the thin tubes in a tree trunk called?

_____

_____

2. What are stomata?

_____

_____

3. What is the main push that moves water up a tree?

_____

_____

4. What is cohesion?

_____

_____

5. How is a tree like a person drinking through a straw?

_____

_____

6. Why might a tree struggle in hot, dry weather?

_____

_____

Words to know

xylem: the tubes in a plant that carry water upward
evaporation: the change of a liquid into a vapor or gas
stomata: tiny openings in leaves that let water vapor and air pass
transpiration: the loss of water vapor from a plant's leaves
cohesion: the way molecules of the same kind stick together

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

How Water Climbs a Tall Tree

Triangle group

A tall tree lifts water from its roots to leaves many stories above the ground, and it does so without a heart or a pump. The tree gets help from the sun and from some remarkable properties of water.

Inside the trunk, narrow tubes called xylem run from the roots to the leaves, and water moves up through them in a long, unbroken column that is driven mainly by evaporation. Leaves have tiny openings called stomata, and when sunlight warms a leaf, water escapes through them as vapor, a process called transpiration.

As each water molecule leaves, it pulls on the one behind it, because water molecules stick to one another, a stickiness called cohesion. Water also clings to the walls of the narrow tubes, which helps keep the column from breaking, and the pull travels all the way down the tube and draws more water in through the roots.

Think of drinking through a straw: pulling at the top moves the liquid at the bottom. A tree's leaves do the pulling, and the sun supplies the energy. Only a small part of the water that travels up the trunk is used to build the tree. Much of it is released into the air, which is why trees in hot, dry weather can struggle if the soil also runs dry.

Scientists who study trees have measured this pull directly, and they find that the water inside the xylem is often under tension, like a stretched rope. This explains why a tree does not need a strong push from below to lift its water. The roots are not pumping. They simply supply water to the column as it is drawn upward, which is a very different system from the one that moves blood through an animal.

Questions

1. What are the narrow tubes inside a tree trunk called?

_____

_____

2. What are stomata?

_____

_____

3. What is the main driver that moves water up the tree?

_____

_____

4. What is cohesion?

_____

_____

5. How is a tree like a person drinking through a straw?

_____

_____

6. Why might a tree struggle in hot, dry weather?

_____

_____

Words to know

xylem: the tubes in a plant that carry water upward
evaporation: the change of a liquid into a vapor or gas
stomata: tiny openings in leaves that let water vapor and air pass
transpiration: the loss of water vapor from a plant's leaves
cohesion: the way molecules of the same kind stick together

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

How Water Climbs a Tall Tree

Square group

A tall tree lifts water from its roots all the way to leaves many stories above the ground, and remarkably, it accomplishes this without a heart or a pump of any kind. The tree relies instead on the energy of the sun and on some extraordinary properties of water.

Inside the trunk, narrow tubes called xylem extend from the roots to the leaves, and water travels upward through them in a long, unbroken column, and the principal driving force behind this upward journey is evaporation. Leaves are dotted with tiny openings called stomata, and when sunlight warms a leaf, water escapes through those openings as vapor, a process that is known as transpiration.

As each water molecule departs, it tugs on the molecule behind it, because water molecules are attracted to one another. This attraction is called cohesion. Water also clings to the walls of the narrow tubes, which helps prevent the column from breaking. The pull travels all the way down the tube and draws additional water in through the roots.

Consider what happens when you drink through a straw: pulling at the top moves the liquid at the bottom. A tree's leaves do the pulling, and the sun supplies the energy. Only a small portion of the water that travels up the trunk is actually used to build the tree. Much of it is released into the air, which is why trees can struggle in hot, dry weather if the soil also runs dry.

Scientists who study trees have measured this pull directly, and they find that the water inside the xylem is often under tension, like a stretched rope. This explains why a tree does not require a strong push from below in order to lift its water. The roots are not pumping at all. They simply supply water to the column as it is drawn upward, which is a very different system from the one that moves blood through an animal.

Questions

1. What are the narrow tubes inside a tree trunk called?

_____

_____

2. What are stomata?

_____

_____

3. What is the principal driving force that moves water up a tree?

_____

_____

4. What is cohesion?

_____

_____

5. How does drinking through a straw resemble what a tree does?

_____

_____

6. Why might a tree struggle in hot, dry weather?

_____

_____

Words to know

xylem: the tubes in a plant that carry water upward
evaporation: the change of a liquid into a vapor or gas
stomata: tiny openings in leaves that let water vapor and air pass
transpiration: the loss of water vapor from a plant's leaves
cohesion: the way molecules of the same kind stick together

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

For the teacher: How Water Climbs a Tall Tree

Each student sheet carries a shape, not a level. The same topic and facts, written three ways.

Circle: How Water Climbs a Tall Tree

Easier · 259 words · Flesch-Kincaid grade 3

1. Xylem.
2. Tiny holes in leaves where water escapes as vapor.
3. Evaporation from the leaves, called transpiration.
4. Water molecules sticking to one another.
5. Pulling at the top moves the liquid at the bottom, as the leaves pull water up from the roots.
6. It lets out a lot of water, and dry soil cannot replace it.

Triangle: How Water Climbs a Tall Tree

This passage · 295 words · Flesch-Kincaid grade 8.5

1. Xylem.
2. Tiny openings in leaves where water escapes as vapor.
3. Evaporation from the leaves, which is called transpiration.
4. The stickiness of water molecules to one another.
5. Pulling at the top moves the liquid at the bottom, as leaves pull water up from the roots.
6. It loses much water to the air, and dry soil cannot replace it.

Square: How Water Climbs a Tall Tree

Harder · 325 words · Flesch-Kincaid grade 9.3

1. Xylem.
2. Tiny openings in leaves through which water escapes as vapor.
3. Evaporation from the leaves, known as transpiration.
4. The attraction of water molecules to one another.
5. Pulling at the top moves the liquid at the bottom, just as leaves pull water up from the roots.
6. It releases much of its water into the air, and dry soil cannot replace it.