Name: _____ Date: _____

How Bridges Stay Up

Circle group

A bridge must hold heavy loads and not fall. Engineers think about two forces that push and pull on each part.

Compression is a force that squeezes, or pushes things together. Tension is a force that stretches, or pulls things apart. When a heavy truck is on a beam, the top is squeezed and the bottom is stretched. A good bridge keeps both forces in check.

The most simple bridge is a beam bridge. It is a strong beam laid across a gap. It works well for short gaps. For a long gap, builders may choose an arch. An arch bridge has a curve. The curve turns the weight on it into compression. This flows along the arch to the ground at both ends. Stone arches have stood for hundreds of years, since stone is strong when squeezed.

A suspension bridge hangs the road from long steel cables. The cables go over tall towers and are tied down at each end. The road's weight pulls on the cables, so they are in tension. The towers are squeezed. Steel cables are very strong when they are pulled.

Each bridge uses a shape that fits the gap, the ground, and what it is made of.

Questions

1. What is compression?

_____

_____

2. What is tension?

_____

_____

3. What is the most simple bridge?

_____

_____

4. How does an arch bridge hold weight?

_____

_____

5. In a suspension bridge, which parts are in tension? Which are squeezed?

_____

_____

6. Why is stone good for an arch?

_____

_____

7. Why might builders use one kind of bridge for a long gap and another for a short gap?

_____

_____

Words to know

engineers: people who plan and design things such as bridges and machines
compression: a force that squeezes or pushes something together
tension: a force that stretches or pulls something apart
arch: a curved shape that holds up weight above an opening
suspension: hanging from above, as a road hangs from cables
cables: thick, strong ropes made of twisted wires

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 Bridges Stay Up

Triangle group

A bridge must carry heavy loads without falling. Engineers design bridges by thinking about two forces that push and pull on every part.

Compression is a force that squeezes, or pushes together. Tension is a force that stretches, or pulls apart. When a heavy truck crosses a beam, the top of the beam is squeezed and the bottom is stretched. A good bridge keeps both forces under control.

The simplest bridge is a beam bridge, which is a strong beam laid across a gap. It works well over short distances. For a longer gap, builders may choose an arch. An arch bridge is curved, and the curve turns the weight pressing down on it into compression that flows along the arch to the ground at both ends. Stone arches have stood for centuries, because stone is strong when it is squeezed.

A suspension bridge hangs the road from long steel cables. The cables run over tall towers and are anchored at each end. The weight of the road pulls on the cables, so they are in tension, while the towers are squeezed. Steel cables are very strong when they are pulled.

Each design uses a shape that fits the gap, the ground, and the materials.

Questions

1. What is compression?

_____

_____

2. What is tension?

_____

_____

3. What is the simplest kind of bridge?

_____

_____

4. How does an arch bridge carry weight?

_____

_____

5. In a suspension bridge, which parts are in tension and which are squeezed?

_____

_____

6. Why is stone a good material for an arch?

_____

_____

7. Why might builders choose a different kind of bridge for a long gap than for a short one?

_____

_____

Words to know

engineers: people who plan and design things such as bridges and machines
compression: a force that squeezes or pushes something together
tension: a force that stretches or pulls something apart
arch: a curved shape that holds up weight above an opening
suspension: hanging from above, as a road hangs from cables
cables: thick, strong ropes made of twisted wires

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 Bridges Stay Up

Square group

A bridge must support heavy loads without collapsing. When engineers design bridges, they consider two forces that push and pull on every component.

Compression is a force that squeezes, or presses material together. Tension is a force that stretches, or pulls material apart. When a heavy truck travels across a beam, the upper surface of the beam is compressed while the lower surface is stretched. A well-designed bridge keeps both forces under control.

The most basic design is a beam bridge, which consists of a sturdy beam laid across a gap. It performs effectively over short distances. For a longer gap, however, builders may select an arch. An arch bridge is curved, and its curve converts the weight pressing down on it into compression that travels along the arch to the ground at either end. Stone arches have endured for centuries, because stone is exceptionally strong when it is compressed.

A suspension bridge hangs its roadway from lengthy steel cables. The cables pass over tall towers and are anchored securely at each end. The weight of the roadway pulls on the cables, placing them in tension, while the towers are compressed. Steel cables are extremely strong when they are pulled.

Ultimately, each design employs a shape suited to the gap, the ground, and the available materials.

Questions

1. What is compression?

_____

_____

2. What is tension?

_____

_____

3. What is the most basic design for a bridge?

_____

_____

4. Explain how an arch bridge supports weight.

_____

_____

5. In a suspension bridge, which components are in tension and which are compressed?

_____

_____

6. Why is stone an appropriate material for an arch?

_____

_____

7. Why might builders select a different design for a long gap than for a short one?

_____

_____

Words to know

engineers: people who plan and design things such as bridges and machines
compression: a force that squeezes or pushes something together
tension: a force that stretches or pulls something apart
arch: a curved shape that holds up weight above an opening
suspension: hanging from above, as a road hangs from cables
cables: thick, strong ropes made of twisted wires

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 Bridges Stay Up

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

Circle: How Bridges Stay Up

Easier · 203 words · Flesch-Kincaid grade 2.4

1. A force that squeezes, or pushes things together.
2. A force that stretches, or pulls things apart.
3. A beam bridge. It is a strong beam laid across a gap.
4. The curve turns the weight into compression. It flows along the arch to the ground at both ends.
5. The cables are in tension. The towers are squeezed.
6. Stone is strong when it is squeezed, and an arch is mostly squeezed.
7. A beam bridge works well for short gaps. An arch or a suspension bridge can cross a long gap.

Triangle: How Bridges Stay Up

This passage · 205 words · Flesch-Kincaid grade 4.8

1. A force that squeezes, or pushes together.
2. A force that stretches, or pulls apart.
3. A beam bridge, which is a strong beam laid across a gap.
4. Its curve turns the weight pressing down into compression that flows along the arch to the ground at both ends.
5. The cables are in tension, and the towers are squeezed.
6. Stone is strong when it is squeezed, and an arch is mostly squeezed.
7. A beam bridge works well over short distances, and an arch or a suspension bridge can cross a longer gap.

Square: How Bridges Stay Up

Harder · 217 words · Flesch-Kincaid grade 7.8

1. A force that squeezes, or presses material together.
2. A force that stretches, or pulls material apart.
3. A beam bridge, which is a sturdy beam laid across a gap.
4. Its curve converts the weight pressing down into compression that travels along the arch to the ground at either end.
5. The cables are in tension, and the towers are compressed.
6. Stone is exceptionally strong when compressed, and an arch is mostly under compression.
7. A beam bridge performs well over short distances, while an arch or a suspension bridge can span a longer gap.