Name: _____ Date: _____

The Gaps That Keep Bridges From Buckling

Circle group

Drive across a big bridge. You may feel a quick thump as the tires cross a strip of metal teeth in the road. The teeth are called an expansion joint. The bridge needs them. They make room for a change we cannot see. Nearly everything grows a little larger when it warms up.

The reason is in the particles that make up matter. In a solid, the particles stay in place, but they jiggle back and forth. When the solid is heated, they jiggle more widely. Each particle needs a little more room. Across millions of particles, the whole object grows. When it cools, it shrinks.

The change is small. But a steel bridge is very long, so a small part of its length adds up. A bridge can be longer on a hot afternoon than on a freezing night. If its ends were fixed tightly, the steel would push hard on its supports. That force could crack concrete or bend metal.

Engineers leave gaps. They cover the gaps with teeth that slide past each other as the bridge grows and shrinks. The same idea is used in other places. Concrete sidewalks have grooves, so cracks form along planned lines. Long pipes often have bends that can flex. Good builders plan for heat.

Questions

1. What is the strip of metal teeth in the road called?

_____

_____

2. What do the particles in a solid do when it is heated?

_____

_____

3. Why does a heated object grow larger?

_____

_____

4. What could happen if a bridge's ends were fixed tightly?

_____

_____

5. Why might a bridge be longer on a hot afternoon than on a cold night?

_____

_____

6. What do concrete sidewalks have that is like an expansion joint?

_____

_____

Words to know

expansion: growing larger in size
joint: a place where two parts meet
particles: the tiny pieces that make up all matter
engineers: people who design and build things using science

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: _____

The Gaps That Keep Bridges From Buckling

Triangle group

Drive across a large bridge and you may feel a quick thump as the tires pass over a strip of metal teeth set into the road. Those teeth are an expansion joint, and the bridge could not survive for long without them, because their purpose is to make room for a change that is invisible to us: nearly everything grows a little larger when it is warmed.

The explanation lies in the particles that make up matter. In a solid, the particles are held in place, but they are never perfectly still, and they jiggle back and forth. When the solid is heated, the jiggling grows wider, and each particle needs a little more room, so that, added together across millions of particles, the whole object grows. Cooling does the opposite, and the object shrinks.

The change is small, but a long steel bridge is enormous, so even a tiny fraction of its length adds up to a noticeable amount, and a bridge deck can be longer on a hot afternoon than on a freezing night. If the ends were fixed tightly, the steel would push hard against its supports, and that force could crack concrete or bend the metal.

Engineers solve the problem by leaving gaps and covering them with interlocking teeth that slide past each other as the bridge grows and shrinks. The same idea appears in many places. Concrete sidewalks have grooves so that cracks form along planned lines, and long pipes often include bends that can flex. Good builders do not fight heat. They plan for it.

Questions

1. What is the strip of metal teeth in the road called?

_____

_____

2. What happens to the particles in a solid when it is heated?

_____

_____

3. Why does a heated object grow larger?

_____

_____

4. What could happen if a bridge's ends were fixed tightly?

_____

_____

5. Why might a bridge be longer on a hot afternoon than on a cold night?

_____

_____

6. What do concrete sidewalks have that is a similar idea to expansion joints?

_____

_____

Words to know

expansion: growing larger in size
joint: a place where two parts meet
particles: the tiny pieces that make up all matter
interlocking: fitting together like the fingers of two hands
engineers: people who design and build things using science

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: _____

The Gaps That Keep Bridges From Buckling

Square group

Drive across a large bridge and you may feel a sudden thump as your tires pass over a strip of metal teeth set into the roadway. Those teeth form an expansion joint, and the bridge could not last long without them. Their purpose is to make room for a change that is invisible to ordinary observers, because nearly everything grows slightly larger whenever it is warmed.

The reason lies in the particles that make up matter. In a solid, the particles are held in position, yet they are never perfectly still, and they jiggle constantly back and forth; when the solid is heated, the jiggling becomes wider, so each particle requires a little more room, and, added together across millions upon millions of particles, the entire object grows. Cooling has precisely the opposite effect, and the object shrinks.

The change is small, but a long steel bridge is enormous, so even a tiny fraction of its length adds up to a noticeable amount, and a bridge deck can be considerably longer on a hot afternoon than on a freezing night. If its ends were fixed rigidly, the steel would press hard against its supports, and the resulting force could crack concrete or bend metal.

Engineers solve the problem by leaving gaps and covering them with interlocking teeth that slide past one another as the bridge grows and shrinks, and the same idea appears in many other places, since concrete sidewalks are cut with grooves so that cracks will form along planned lines, and long pipes frequently include bends that are able to flex. Skilled builders do not fight heat; they plan for it.

Questions

1. What is the strip of metal teeth set into the roadway called?

_____

_____

2. What happens to the particles in a solid when it is heated?

_____

_____

3. Why does a heated object grow larger overall?

_____

_____

4. What might happen if a bridge's ends were fixed rigidly?

_____

_____

5. Why might a bridge be longer on a hot afternoon than on a freezing night?

_____

_____

6. What feature of concrete sidewalks follows a similar idea to expansion joints?

_____

_____

Words to know

expansion: growing larger in size
joint: a place where two parts meet
particles: the tiny pieces that make up all matter
interlocking: fitting together like the fingers of two hands
engineers: people who design and build things using science

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: The Gaps That Keep Bridges From Buckling

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

Circle: The Gaps That Keep Bridges From Buckling

Easier · 213 words · Flesch-Kincaid grade 3

1. An expansion joint.
2. They jiggle back and forth more widely.
3. Each particle needs more room, and this adds up across millions of particles.
4. The steel could push on its supports and crack concrete or bend metal.
5. Heat makes steel expand, and cold makes it shrink.
6. Grooves that make cracks form along planned lines.

Triangle: The Gaps That Keep Bridges From Buckling

This passage · 261 words · Flesch-Kincaid grade 8.2

1. An expansion joint.
2. They jiggle back and forth more widely.
3. Each particle needs a little more room, and the added room adds up across millions of particles.
4. The steel could push on its supports and crack concrete or bend metal.
5. Heat makes the steel expand, and cold makes it shrink.
6. Grooves that make cracks form along planned lines.

Square: The Gaps That Keep Bridges From Buckling

Harder · 273 words · Flesch-Kincaid grade 12.2

1. An expansion joint.
2. Their jiggling becomes wider.
3. Each particle requires more room, and the added room adds up across millions of particles.
4. The steel would press on its supports and could crack concrete or bend metal.
5. Heat makes the steel expand, and cold makes it shrink.
6. Grooves that make cracks form along planned lines.