Name: _____ Date: _____

Four Ropes Make a Heavy Crate Feel Light

Circle group

Say you must lift a heavy crate. You could pull on one rope. Your arms would get tired fast. A set of pulleys can help. It is called a block and tackle.

A pulley is a wheel with a groove. A rope rides in the groove. A block and tackle has two blocks of pulleys. One block hangs from a beam above. The other is tied to the load. One long rope loops back and forth between them.

Here is the trick. Every rope that holds up the load shares its weight. Say four ropes hold it up. Then each rope carries about a quarter of the weight. You need only about a quarter of the pull.

But there is a trade. To lift the crate one foot, you pull four feet of rope. You use less force, but you pull farther. Many simple machines work this way.

Sailors and builders use this idea. Cranes use it too.

Questions

1. What is a pulley?

_____

_____

2. How many blocks does a block and tackle have?

_____

_____

3. If four ropes hold the load, how much weight does each rope carry?

_____

_____

4. What do you give up to use less force?

_____

_____

5. Why is pulling easier with more ropes?

_____

_____

6. Why would a boat crew like a block and tackle?

_____

_____

Words to know

pulley: a wheel with a groove that guides a rope
groove: a long, narrow channel cut into something
load: the weight that a machine has to move

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: _____

Four Ropes Make a Heavy Crate Feel Light

Triangle group

Suppose you need to lift a heavy crate off the ground. You could tug on a single rope, but your arms would soon give out. A set of pulleys called a block and tackle can make the same job far easier.

A pulley is a wheel with a groove around its edge, and a rope rides in that groove. In a block and tackle, several pulleys are grouped into two blocks. One block is fixed to a beam overhead. The other is attached to the load. A single long rope loops back and forth between the two blocks.

Here is the trick. The weight of the crate is shared by every length of rope that holds up the moving block. If four lengths of rope hold it up, each one carries about a quarter of the weight. So the person pulling needs only about a quarter of the force the crate would normally need.

There is a trade, though. To raise the crate one foot, you must pull four feet of rope through the pulleys. You use less force, but you pull over a longer distance. This trade shows up in many simple machines.

Sailors, builders, and mechanics have all used this idea. Cranes and boat rigging depend on it, and so do many gym machines that use cables.

Questions

1. What is a pulley?

_____

_____

2. How many blocks are in a block and tackle?

_____

_____

3. If four lengths of rope hold the load, about how much weight does each carry?

_____

_____

4. What must you give up to use less force?

_____

_____

5. Why does pulling feel easier with more ropes holding the crate?

_____

_____

6. Why would a boat crew find a block and tackle useful?

_____

_____

Words to know

pulley: a wheel with a groove that guides a rope
groove: a long, narrow channel cut into something
load: the weight that a machine has to move
overhead: above your head
rigging: the ropes and gear that handle a ship's sails

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: _____

Four Ropes Make a Heavy Crate Feel Light

Square group

Suppose you need to raise a heavy crate off the ground. You could simply tug on a single rope, but your arms would soon give out from the strain. A system of pulleys known as a block and tackle can make the same task dramatically easier.

A pulley is a wheel with a groove around its rim, and a rope rides inside that groove. In a block and tackle, several pulleys are grouped into two separate blocks. One block is fastened to a sturdy beam overhead, while the other is attached to the load itself. A single long rope loops back and forth between the two blocks.

Here is the clever part. The weight of the crate is divided among every length of rope supporting the moving block. If four lengths of rope hold it up, each carries only about a quarter of the weight, so the person pulling needs just a quarter of the force the crate would otherwise demand.

There is a trade, however. To raise the crate a single foot, you must draw four feet of rope through the pulleys. You use less force, but you pull across a longer distance, and that exchange appears in many simple machines.

Sailors, builders, and mechanics have all relied on this principle. Cranes and boat rigging depend on it, as do many gym machines that use cables.

Questions

1. What is a pulley?

_____

_____

2. How many blocks make up a block and tackle?

_____

_____

3. If four lengths of rope support the load, about how much weight does each one carry?

_____

_____

4. What must you accept in exchange for using less force?

_____

_____

5. Why does pulling feel easier when more ropes support the crate?

_____

_____

6. Why would a boat crew find a block and tackle valuable?

_____

_____

Words to know

pulley: a wheel with a groove that guides a rope
groove: a long, narrow channel cut into something
load: the weight that a machine has to move
overhead: above your head
rigging: the ropes and gear that handle a ship's sails

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: Four Ropes Make a Heavy Crate Feel Light

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

Circle: Four Ropes Make a Heavy Crate Feel Light

Easier · 158 words · Flesch-Kincaid grade 1

1. A wheel with a groove that a rope rides in.
2. Two.
3. About a quarter of the weight.
4. You pull the rope farther.
5. The ropes share the weight, so each needs less pull.
6. It lets a few people move heavy loads with less effort.

Triangle: Four Ropes Make a Heavy Crate Feel Light

This passage · 219 words · Flesch-Kincaid grade 3.7

1. A wheel with a groove around its edge that a rope rides in.
2. Two.
3. About a quarter of the weight.
4. You must pull the rope over a longer distance.
5. The weight is shared among the ropes, so each one needs less pull.
6. It would let a few people raise or move heavy loads with less effort.

Square: Four Ropes Make a Heavy Crate Feel Light

Harder · 227 words · Flesch-Kincaid grade 6.1

1. A wheel with a groove around its rim that holds a rope.
2. Two.
3. About a quarter of the weight.
4. You must pull the rope across a longer distance.
5. The weight is divided among the ropes, so each one needs less pull.
6. It would allow a few people to move heavy loads with much less effort.