Name: _____ Date: _____

What Really Tells You to Breathe

Circle group

Many people think the urge to breathe means the body is out of oxygen. That is not quite right. The main trigger is carbon dioxide. This is a waste gas. Your cells make it when they use oxygen to get energy from food.

Carbon dioxide goes in the blood to the lungs. There, you breathe it out. If you breathe too slowly, carbon dioxide builds up. It makes the blood a little more acidic. Sensors in the brainstem and in big blood vessels notice this. They send a message to the muscles that run your breathing. The main one is the diaphragm. It is a dome-shaped sheet under the lungs. The diaphragm tightens and flattens. The chest gets bigger. Air rushes in. You do not have to think about it. That is why you keep breathing in your sleep.

You can take some control. You can stop for a moment or take a deep breath. But the automatic system wins in the end. As carbon dioxide goes up, the urge to breathe gets stronger. It gets uncomfortable. At last the body makes you breathe in.

The same system explains why you pant when you exercise. Working muscles make more carbon dioxide. So the brain makes you breathe faster and deeper. When you rest, the level drops and you slow down.

Questions

1. What is the main trigger for breathing?

_____

_____

2. Where are the sensors that notice the change?

_____

_____

3. Which muscle does the main work of breathing?

_____

_____

4. Why do you keep breathing when you are asleep?

_____

_____

5. Why do you pant when you exercise?

_____

_____

6. What happens to the urge to breathe as carbon dioxide goes up?

_____

_____

Words to know

carbon dioxide: a waste gas that cells make and the lungs breathe out
diaphragm: the dome-shaped muscle under the lungs that pulls air in
brainstem: the part of the brain that joins it to the spinal cord
automatic: happening by itself without any thinking
acidic: having more acid, which changes the chemistry of a liquid

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: _____

What Really Tells You to Breathe

Triangle group

Most people assume that the urge to breathe means the body is running out of oxygen. The truth is a little different. The main trigger for breathing is carbon dioxide, a waste gas that your cells produce as they use oxygen to release energy from food.

Carbon dioxide travels in the blood to the lungs, where it is breathed out. If you breathe more slowly than your cells require, carbon dioxide builds up and makes the blood slightly more acidic. Special sensors in the brainstem and in large blood vessels notice this change. They send a message to the muscles that control breathing, mainly the diaphragm, a dome-shaped sheet beneath the lungs. The diaphragm tightens and flattens, the chest expands, and air rushes in. All of this happens without any thought, which is why you keep breathing while you sleep.

You can take some control, since you can pause for a moment or take a deep breath on purpose. But the automatic system always wins in the end. As carbon dioxide rises, the urge to breathe grows stronger and more uncomfortable until the body makes you inhale.

The same system explains why exercise makes you pant. Working muscles make more carbon dioxide, so the brain raises both the speed and the depth of your breathing to clear it away. When you rest, the carbon dioxide level falls and your breathing slows again. Thanks to these chemical sensors, a job that is vital to life can run safely on autopilot while your mind is busy with other things.

Questions

1. What is the main trigger for breathing?

_____

_____

2. Where are the sensors that notice the change in the blood?

_____

_____

3. Which muscle does most of the work of breathing?

_____

_____

4. Why do you keep breathing while you are asleep?

_____

_____

5. Why does exercise make you pant?

_____

_____

6. What happens to the urge to breathe as carbon dioxide rises?

_____

_____

Words to know

carbon dioxide: a waste gas that cells make and the lungs breathe out
diaphragm: the dome-shaped muscle under the lungs that pulls air in
brainstem: the part of the brain that joins it to the spinal cord
automatic: happening by itself without any thinking
acidic: having more acid, which changes the chemistry of a liquid

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: _____

What Really Tells You to Breathe

Square group

Most people presume that the urge to take a breath signals that the body is running short of oxygen. The reality is somewhat different. The principal trigger for breathing is carbon dioxide, a waste gas that your cells generate as they use oxygen to release energy from the food you eat.

Carbon dioxide is carried by the blood to the lungs, where it is exhaled. Should you breathe more slowly than your cells require, carbon dioxide accumulates and renders the blood slightly more acidic. Specialized sensors in the brainstem and in large blood vessels detect this change and transmit a message to the muscles that control breathing, chiefly the diaphragm, a dome-shaped sheet lying beneath the lungs. The diaphragm tightens and flattens, the chest expands, and air rushes in. Because all of this occurs without any conscious thought, you continue to breathe while you sleep.

You can exert a degree of control, since you may pause briefly or draw a deep breath deliberately. Nevertheless, the automatic system always prevails in the end. As the level of carbon dioxide climbs, the urge to breathe grows steadily stronger and more uncomfortable, until the body compels you to inhale.

The same system explains why exercise makes you pant. Working muscles produce additional carbon dioxide, so the brain increases both the rate and the depth of your breathing in order to clear it away. Once you rest, the carbon dioxide level falls and your breathing slows again. Thanks to these chemical sensors, a task that is essential to life can run safely on autopilot while your mind is occupied with other matters.

Questions

1. What is the principal trigger for breathing?

_____

_____

2. Where are the specialized sensors that detect the change located?

_____

_____

3. Which muscle chiefly controls breathing?

_____

_____

4. Why do you continue to breathe while you sleep?

_____

_____

5. Why does exercise cause you to pant?

_____

_____

6. What happens to the urge to breathe as carbon dioxide climbs?

_____

_____

Words to know

carbon dioxide: a waste gas that cells make and the lungs breathe out
diaphragm: the dome-shaped muscle under the lungs that pulls air in
brainstem: the part of the brain that joins it to the spinal cord
automatic: happening by itself without any thinking
acidic: having more acid, which changes the chemistry of a liquid

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: What Really Tells You to Breathe

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

Circle: What Really Tells You to Breathe

Easier · 221 words · Flesch-Kincaid grade 3

1. Carbon dioxide building up in the blood.
2. In the brainstem and in big blood vessels.
3. The diaphragm.
4. The system is automatic, so you do not have to think about it.
5. Working muscles make more carbon dioxide, so the brain makes you breathe faster and deeper.
6. It gets stronger and more uncomfortable until the body makes you breathe in.

Triangle: What Really Tells You to Breathe

This passage · 258 words · Flesch-Kincaid grade 7.4

1. Carbon dioxide building up in the blood.
2. In the brainstem and in large blood vessels.
3. The diaphragm.
4. The system is automatic and needs no thought.
5. Working muscles make more carbon dioxide, so the brain speeds up and deepens breathing.
6. It grows stronger and more uncomfortable until the body makes you inhale.

Square: What Really Tells You to Breathe

Harder · 269 words · Flesch-Kincaid grade 9.7

1. A buildup of carbon dioxide in the blood.
2. In the brainstem and in large blood vessels.
3. The diaphragm.
4. The system works automatically, without any conscious thought.
5. Working muscles produce more carbon dioxide, so the brain increases the rate and depth of breathing.
6. It grows stronger and more uncomfortable until the body compels you to inhale.