The Gas Relay

Trace how breathing and blood flow supply working muscles.

HAP.9.a "Construct an explanation of how the circulatory system works with respiration to transport respiratory gases."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline sentences that describe a gas moving between air and blood or between blood and cells. In paragraph 2, circle the two sentences that tell which side of the heart pumps blood to the lungs and which side pumps it to the legs.

Maya Climbs the Stairs

1 At the top of a flight of stairs, Maya notices that her breathing and pulse have sped up. Her leg muscles need oxygen to release energy from food, and they produce carbon dioxide as a waste gas. Breathing moves fresh air into tiny air sacs called alveoli. Each alveolus has a thin wall and is wrapped in capillaries, the body's smallest blood vessels. Oxygen moves from air in the alveoli into blood because its concentration is higher in the air than in the arriving blood. Carbon dioxide moves the other way, from blood into the alveoli, and leaves when Maya exhales.

2 Blood arriving at the lungs has returned from body tissues through veins and the right side of the heart. The right side pumps it through pulmonary arteries to the lung capillaries. There, red blood cells pick up oxygen, most of which binds to hemoglobin. Blood with more oxygen travels through pulmonary veins to the left side of the heart. The left side pumps this blood through arteries toward Maya's working legs. Breathing alone could not deliver oxygen to her leg cells: the heart and blood vessels carry it from the lungs to tissues far away.

3 In capillaries near her leg muscles, oxygen leaves the blood and enters cells, where it helps release energy. The cells' carbon dioxide enters the blood because its concentration is higher in the tissues than in the arriving blood. Some carbon dioxide travels dissolved in plasma, but most is carried as bicarbonate in blood. Veins return this blood to the right side of the heart, which sends it back to the lungs. As Maya climbs, faster breathing brings in more fresh air and removes more carbon dioxide, while faster circulation moves blood between lungs and muscles more quickly.

2 ANSWER WITH EVIDENCE

Use the passage

1. Why would breathing in oxygen not, by itself, supply Maya's leg cells? Explain what the blood and heart must do.

2. Explain how the right and left sides of the heart move blood through the lungs so it can carry oxygen to the legs.

3. Trace carbon dioxide from Maya's leg cells until it leaves her body. Include the roles of blood, the heart, and breathing.

4. Why do both Maya's breathing and pulse speed up as she climbs? Explain how the two changes work together.

3 YOUR TURN

Your own words

Imagine Maya holds her breath briefly while her heart keeps beating and her leg cells keep working. In four or five sentences, explain what happens over time to oxygen delivery and carbon dioxide removal, tracing blood through the lungs, heart, and legs, then explain what changes when she breathes again.

The Gas Relay

PART 1 · READ AND MARK

Underline sentences that describe a gas moving between air and blood or between blood and cells. In paragraph 2, circle the two sentences that tell which side of the heart pumps blood to the lungs and which side pumps it to the legs. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Why would breathing in oxygen not, by itself, supply Maya's leg cells? Explain what the blood and heart must do.	**Oxygen enters blood at the alveoli. The heart pumps that blood to the legs, where oxygen leaves the blood and enters muscle cells.**
2	Explain how the right and left sides of the heart move blood through the lungs so it can carry oxygen to the legs.	**The right side pumps blood through pulmonary arteries to lung capillaries, where it picks up oxygen. Pulmonary veins carry it to the left side, which pumps it toward the legs.**
3	Trace carbon dioxide from Maya's leg cells until it leaves her body. Include the roles of blood, the heart, and breathing.	**Carbon dioxide enters blood near the leg cells. Blood returns through veins to the right side of the heart, which pumps it to the lungs. Carbon dioxide moves from blood into the alveoli and leaves when Maya exhales.**
4	Why do both Maya's breathing and pulse speed up as she climbs? Explain how the two changes work together.	**Faster breathing brings more fresh air to the lungs and removes more carbon dioxide. Faster circulation moves blood between the lungs and working muscles more quickly.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

While Maya holds her breath, her heart keeps moving blood from the lungs to her legs, so her cells can use oxygen already in the blood. Without fresh air entering the alveoli, the blood picks up less oxygen over time, reducing the oxygen available to her leg cells. Carbon dioxide from those cells still enters the blood and travels through the right side of her heart to her lungs. Because she is not exhaling, carbon dioxide is not released from her body and builds up. When she breathes again, fresh air supplies oxygen for the blood to carry, and exhaling removes carbon dioxide.

Accept explanations that distinguish continued blood flow during the brief breath hold from reduced gas exchange with outside air. Students should trace both gases and explain the roles of the lungs and heart.