Circulation in Motion

Use a tubing model to investigate how blood moves.

HAP.10.1 "Design and use models to investigate the functions of the organs of the cardiovascular system."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the parts of the model that stand for cardiovascular structures, and number the tubes and bulbs in the order liquid travels through them. Use your marks to compare what the model shows with what happens in the body.

Two Circuits, One Flow

1. During a sprint, working muscles need a steady delivery of oxygen and nutrients. The heart drives blood through two linked circuits. Its right side sends blood through pulmonary arteries to tiny lung capillaries, where blood releases carbon dioxide and takes in oxygen. Pulmonary veins carry that blood to the heart's left side. The left side pushes it through systemic arteries toward body tissues. In body capillaries, substances move between blood and tissues. Systemic veins return blood to the right side. Arteries carry blood away from the heart; veins carry it back, regardless of oxygen content.

2. To study this route, imagine a closed tubing model filled with colored water. Two squeeze bulbs stand for the heart's right and left pumping sides. One tubing loop passes through a bundle of thin tubes marked “lungs”; the other passes through a bundle marked “body.” These bundles represent capillary networks. Wider tubes leading away from each bulb represent arteries, and tubes returning to a bulb represent veins. One-way flaps at each bulb's inlet and outlet stand for heart valves: they keep liquid moving forward when the bulb is squeezed and released. The model tracks direction, not the blood's chemical changes.

3. Use the model to test how a change affects circulation. Attach a flow meter to a wide tube and record how much liquid passes in one minute. Keep each squeeze equally strong, then partly pinch one tube and repeat the measurement. A narrowed path resists flow, so less liquid may move through the complete circuit under the same pumping conditions. If an outlet flap is removed, liquid can slip backward into a relaxed bulb instead of moving only forward. The model cannot show real oxygen uptake, nutrient exchange, or the electrical signals that coordinate heartbeats. Its value is showing routes and testing how changes affect flow.

2 ANSWER WITH EVIDENCE

Use the passage

1. Trace one complete trip from the right bulb back to the right bulb. Name both capillary bundles and the bulb between them in the order liquid reaches them.

2. If you partly pinch the tube bundle marked “lungs,” what change might the flow meter show under the same pumping conditions? What body structure does the pinched bundle represent?

3. Suppose you remove the right bulb's outlet flap. What might happen when the bulb relaxes, and what does this test show about heart valves?

4. Could colored water moving through the “lungs” bundle demonstrate that blood takes in oxygen? Explain using a limit of the model.

3 YOUR TURN

Your own words

In the box, sketch a tubing model you could use to investigate how faster heartbeats affect flow. Label both bulbs, both capillary bundles, the flow meter, and the one-way flaps; then write two sentences stating what you would change, what you would keep the same, and what you predict the meter would show.

ANSWER KEY

Circulation in Motion

PART 1 · READ AND MARK

Underline the parts of the model that stand for cardiovascular structures, and number the tubes and bulbs in the order liquid travels through them. Use your marks to compare what the model shows with what happens in the body. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Trace one complete trip from the right bulb back to the right bulb. Name both capillary bundles and the bulb between them in the order liquid reaches them.	**Right bulb → lung capillary bundle → left bulb → body capillary bundle → right bulb.**
2	If you partly pinch the tube bundle marked "lungs," what change might the flow meter show under the same pumping conditions? What body structure does the pinched bundle represent?	**The meter may show less liquid passing per minute. The pinched bundle represents lung capillaries.**
3	Suppose you remove the right bulb's outlet flap. What might happen when the bulb relaxes, and what does this test show about heart valves?	**Liquid may slip backward into the relaxed bulb. Heart valves help keep blood moving in one direction.**
4	Could colored water moving through the "lungs" bundle demonstrate that blood takes in oxygen? Explain using a limit of the model.	**No. The model shows the route through lung capillaries but does not show oxygen moving into blood.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Sketch: right bulb → lung capillaries → left bulb → body capillaries → right bulb, with one-way flaps at both bulbs' inlets and outlets and a flow meter on a wide tube. I will squeeze the bulbs more often while keeping the tubing and squeeze strength the same. I predict the meter will show more liquid passing each minute.

Accept sketches with both linked circuits and forward-facing flaps at each bulb's inlet and outlet. The prediction should compare flow per minute while holding at least one other condition constant.