One-Way Blood Flow

Read how valves respond to changing pressure and movement.

HAP.10.4 "Demonstrate the role of valves in regulating blood flow."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline what makes each valve open, and circle what makes it close. Use your marks to trace how the valves keep blood moving forward.

A Sprint, a Heartbeat, and a Walk

1. At the start of a sprint, blood must travel forward even as pressure inside the heart changes. The right and left sides each have an upper atrium and a lower ventricle. Between each atrium and ventricle sits an atrioventricular (AV) valve. When a ventricle fills, pressure in its atrium is higher, so the AV valve opens and blood moves into the ventricle. When the ventricle contracts, its pressure rises and pushes the valve shut. This closure prevents blood from being forced back into the atrium. The valve does not pull blood forward. Pressure differences move blood.

2. The same contraction sends blood toward an artery through a semilunar valve. On the right, the pulmonary valve opens toward the pulmonary artery, which carries blood to the lungs. On the left, the aortic valve opens toward the aorta, which carries blood to the body. Each valve opens when pressure in its ventricle exceeds pressure in the connected artery. As a ventricle relaxes, arterial pressure becomes higher and the semilunar valve shuts. Blood in the artery is then kept from slipping back into the ventricle. One heartbeat uses different valves to block backward flow at different moments.

3. Far from the heart, blood returning from the feet faces another challenge: gravity. Many leg veins contain one-way valves. When walking, contracting calf muscles squeeze these veins and push blood toward the heart. A valve above the squeezed section opens as blood moves upward, while a valve below it closes to limit downward flow. When the muscle relaxes, the upper valve can shut, keeping blood from falling back into the section. If a vein valve fails to close tightly, blood can flow backward and pool in the lower leg, making the return trip less efficient.

2 ANSWER WITH EVIDENCE

Use the passage

1. When does an AV valve open, and where does blood go when it opens?

2. Why does an AV valve shut when a ventricle contracts? What backward flow does it prevent?

3. What pressure change shuts a semilunar valve, and where would blood flow if it stayed open?

4. When a calf muscle squeezes a leg vein, how do the valves above and below the squeezed section control blood flow?

3 YOUR TURN

Your own words

Imagine a runner stops moving, then walks slowly after a race. In three or four sentences, explain how calf muscles and healthy vein valves affect blood returning from the feet at both stages. Predict what would change if the vein valves did not seal.

One-Way Blood Flow

PART 1 · READ AND MARK

Underline what makes each valve open, and circle what makes it close. Use your marks to trace how the valves keep blood moving forward. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	When does an AV valve open, and where does blood go when it opens?	**It opens when pressure in the atrium is higher than pressure in the filling ventricle. Blood moves from the atrium into the ventricle.**
2	Why does an AV valve shut when a ventricle contracts? What backward flow does it prevent?	**Rising pressure in the contracting ventricle pushes the valve shut, preventing blood from flowing back into the atrium.**
3	What pressure change shuts a semilunar valve, and where would blood flow if it stayed open?	**As the ventricle relaxes, pressure in the artery becomes higher than pressure in the ventricle. Without valve closure, blood could flow from the artery back into the ventricle.**
4	When a calf muscle squeezes a leg vein, how do the valves above and below the squeezed section control blood flow?	**The valve above opens to let blood move toward the heart. The valve below closes to limit flow back toward the foot.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

When the runner stops, the calf muscles no longer squeeze the leg veins with each step. Healthy vein valves help keep blood from falling back toward the feet between squeezes. As the runner walks, calf contractions push blood upward while the valves limit downward flow. If the valves do not seal, some blood can fall back and pool in the lower legs, making its return to the heart less efficient.

Accept answers that link valve opening and closure to blood moving forward rather than backward. For Part 3, look for a contrast between stillness and walking, plus a prediction about blood flowing backward through faulty valves.