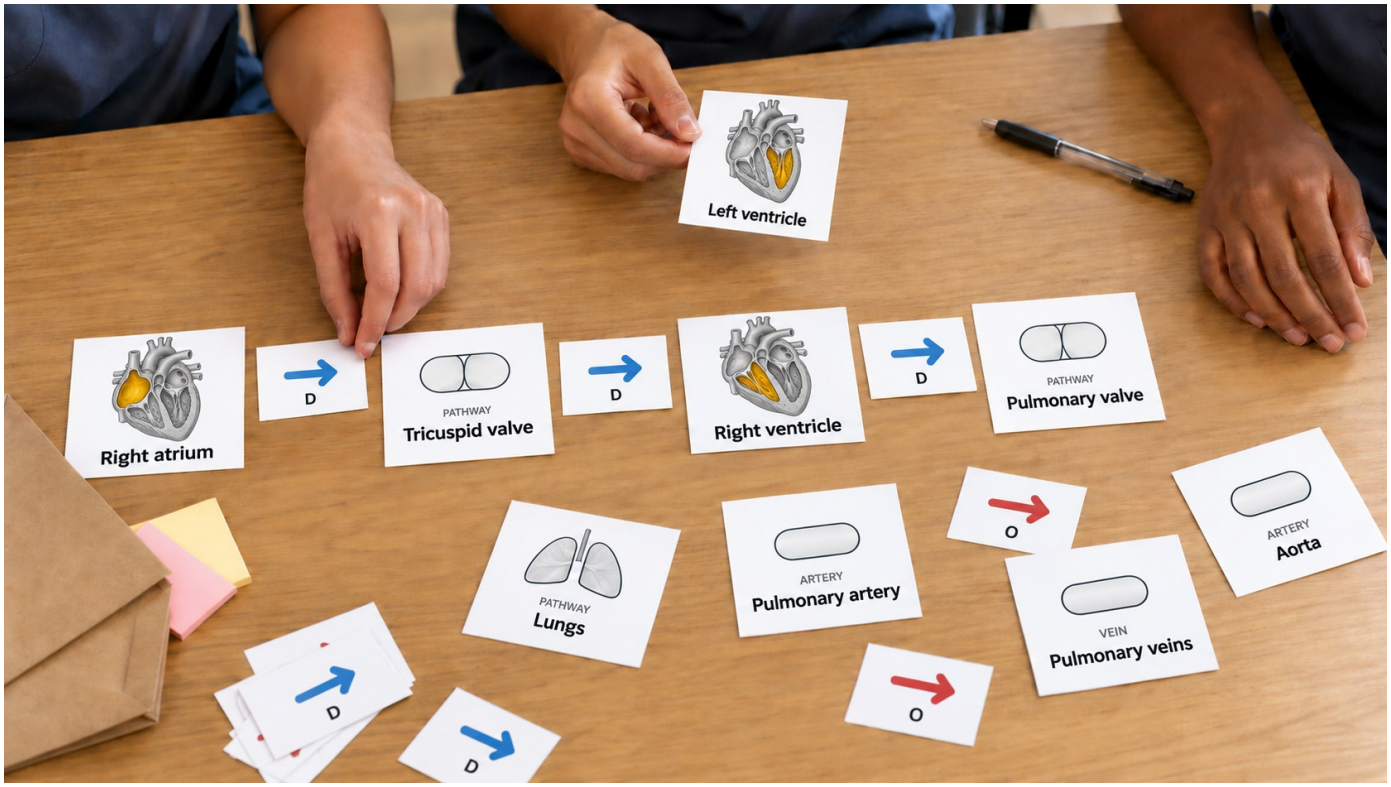
Cardiac Blood Flow Game

Build It Then Break It

A short lecture activity in which teams build a blood flow circuit, match functions, and change the map to explain a cardiac problem.



7 minutes | Teams of 3 to 4 | Tabletop or whiteboard

Build the loop. Match the functions. Reveal one scenario. Earn challenge points by explaining a correction or defending an accurate placement.

Prepare your team kits

Print pages 4 to 8 for each team. Print page 9 once per six teams and give each team one scenario card. Cut the cards before class and add sticky notes, a pen, and an envelope.

Instructor setup and timing are on pages 2 to 3. Answer keys are on pages 10 to 13. Debrief prompts and sources are on page 14.

Set up the activity

A seven minute team challenge for a nursing lecture. Pre-cut and pre-distribute the materials so students stay at their seats.

Learning targets

Trace a complete blood flow circuit. Identify where oxygen content changes. Connect chambers and valves with their functions. Explain how obstruction, valve failure, or reduced pumping changes flow and assessment findings.

Prepare before class

1. Make teams of 3 to 4. Pair neighboring teams for the challenge. Use a shared table or a large sheet of paper for each team.

2. Print pages 4 to 8 once per team, single-sided at 100% size. Blue D arrows mean deoxygenated blood. Red O arrows mean oxygenated blood. The letters also support grayscale printing.

3. Cut along all borders. Each kit has 14 pathway cards, 6 function cards, 2 shared function spares, 20 arrows, and 6 scenario markers. Keep the 2 blank pathway spares available if needed.

4. Print page 9 once per six teams. Assign one scenario per team. Duplicate the page for more teams; it is fine for teams to receive the same scenario.

5. Add 4 sticky notes and a pen per team. Keep scenarios face down until the break phase. Prepare a visible timer and keep pages 10 to 14 for the instructor.

Roles

Builder arranges structures. Flow checker places arrows. Function matcher adds labels. Explainer prepares the scenario response and challenge. With three students, combine flow checker and function matcher.

Print guide

Pages	Use
1	Cover and activity overview
2 to 3	Instructor setup, script, timing, and scoring
4 to 8	One cutout kit per team
9	Six scenarios; distribute one per team
10 to 13	Instructor keys and challenge examples
14	Debrief and clinical sources

The map is a simplified adult circulation model without a shunt. Symbols are teaching diagrams, not anatomical proportions. Arteries and veins are named by direction relative to the heart. Structure names and vessel tags are neutral. Gold identifies the chamber named on a card; arrow colors identify blood oxygen status.

Run the game

One round uses one scenario per team and takes seven minutes.

Time	Phase	Instructor cue
0:00 to 0:30	Launch	Assign roles and state the goal.
0:30 to 2:30	Build	Place all 14 structures in a closed loop. Add colored arrows.
2:30 to 3:30	Match	Place the 6 functions. Use spares or sticky notes for overlap.
3:30 to 5:00	Break	Open one scenario. Change the map and explain the effect.
5:00 to 6:00	Challenge	Neighboring teams review each other simultaneously.
6:00 to 7:00	Debrief	Reveal the key and correct one misconception.

Read aloud at launch

"Build the route blood follows from the body through the heart and lungs and back to the body. Use blue D arrows for oxygen-poor blood and red O arrows for oxygen-rich blood. Add the six functions. When I say break it, open your scenario and show what changes. Be ready to explain the location, the flow change, and one assessment priority."

Challenge rule

Each team gets 30 seconds to challenge one placement on its neighbor's map: "We challenge ___ because ___. We would change it to ___." The other team accepts or defends with a reason. Both teams take a turn within the same minute. The instructor settles disputes using the key.

If the map is correct, defend a placement: "We agree with ___ because ___." An accurate defense earns the same points as a correction. Do not invent an error.

Score out of ten

Phase	Points	Award criteria
Build	4	2: correct 14-card loop and arrow direction. 2: correct D/O arrows and all six function labels, including overlap.
Break	4	1 each: correct site, map change, effect on function, and relevant assessment or symptom.
Challenge	2	1: specific correction or accurate defense. 1: clear physiological reason.

Team _____ Build ____/4 Break ____/4 Challenge ____/2 Total ____/10

Teams self-score after the reveal. No speed bonus. Share tied wins or ask both teams to explain one oxygen color change.

Five minute option

Preassemble the 14-card loop. Launch 15 sec; check arrows 45 sec; match 45 sec; break 75 sec; challenge 60 sec; debrief 60 sec. Keep cutting and distributing materials outside game time.

Blood flow pathway cards

Print one page per team. Cut along the borders and shuffle with page 5.



PATHWAY | VEIN

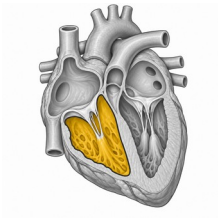
Superior and inferior vena cava

Use one card for both large veins.



PATHWAY

Mitral valve



PATHWAY

Right ventricle



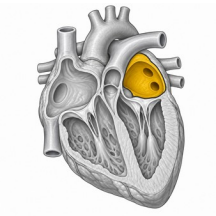
PATHWAY

Lungs



PATHWAY

Aortic valve



PATHWAY

Left atrium



PATHWAY | ARTERY

Pulmonary artery

Represents the pulmonary arterial route.



PATHWAY

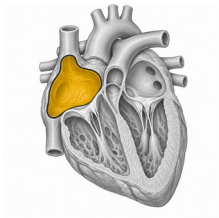
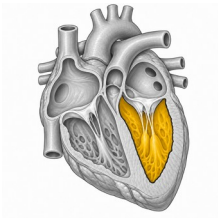
Body

Represents systemic tissues and circulation.

The cards are intentionally shuffled. The circuit returns from the body to the venae cavae. Heart cutaways show patient right on the viewer's left. Gold highlights the named chamber.

Blood flow pathway cards continued

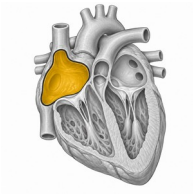
Print one page per team. Cut along the borders and shuffle with page 4.

PATHWAY **Tricuspid valve**	PATHWAY | ARTERY **Aorta**
 PATHWAY **Right atrium**	PATHWAY | VEIN **Pulmonary veins**
 PATHWAY **Left ventricle**	PATHWAY **Pulmonary valve**
SPARE **Write your own label** _____	SPARE **Write your own label** _____

The two blank spares are optional. They are not extra structures required for the normal 14-card loop.

Function cards

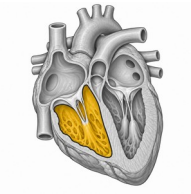
Print one page per team. Cut along the borders. Explain any shared placement.



FUNCTION | Right atrium

Receives deoxygenated blood

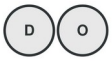
Receives oxygen-poor blood returning from the body.



FUNCTION | Right ventricle

Pumps blood to lungs

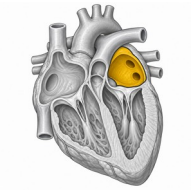
Propels blood into the pulmonary circulation.



FUNCTION

Gas exchanged

Oxygen enters blood and carbon dioxide leaves it in the lungs.



FUNCTION | Left atrium

Receives oxygenated blood

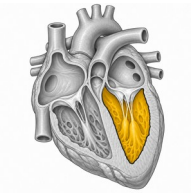
Receives oxygen-rich blood returning from the lungs.



FUNCTION

One-way blood flow

Prevents backflow through the heart valves.



FUNCTION | Left ventricle

Pumps blood to body

Propels blood into the systemic circulation.



SPARE

Shared function

Function _____



SPARE

Shared function

Function _____

Bridge the one-way flow card across all four valves or repeat the label using the spares and sticky notes. Explain a more specific receiving-chamber placement if challenged.

Blood flow arrows

Print one page per team. Cut along all borders. Rotate each arrow to match the route.

 D Deoxygenated	 D Deoxygenated	 O Oxygenated	 O Oxygenated
 D Deoxygenated	 D Deoxygenated	 O Oxygenated	 O Oxygenated
 D Deoxygenated	 D Deoxygenated	 O Oxygenated	 O Oxygenated
 D Deoxygenated	 D Deoxygenated	 O Oxygenated	 O Oxygenated
 D Deoxygenated	 D Deoxygenated	 O Oxygenated	 O Oxygenated

How many arrows

20 arrows total: 10 blue D and 10 red O. The normal loop uses 7 blue and 7 red arrows. Keep 3 of each for scenario changes.

Where the color changes

Across the lungs: incoming D becomes outgoing O. Across the body tissues: incoming O becomes outgoing D. Blood is always red in the body; blue is a teaching convention for lower oxygen content. Deoxygenated blood still contains some oxygen.

Individual arrow colors identify oxygen status. Structure names and vessel tags are neutral. Pulmonary arteries carry D blood and pulmonary veins carry O blood in this adult model. [1, 2]

Scenario markers

Print one page per team. Cut into six cards. Use only the markers needed for your scenario.



MARKER

BLOCKAGE

Place at the affected vessel or branch.



MARKER

REDUCED FLOW

Cover part of an arrow to show less forward flow.



MARKER

WEAK PUMP

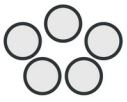
Place beside the affected ventricle.



MARKER

BACKFLOW

Add a reverse arrow at the leaking valve.



MARKER

CONGESTION

Place in the upstream circulation with a note.



MARKER

POOR PERFUSION

Place by the body when systemic delivery falls.

Congestion means pressure and fluid buildup. It does not automatically mean blood reverses through a valve. Keep the normal forward route visible unless the scenario says otherwise.

Break it scenario cards

Print once per six teams. Cut into six cards. Give each team one card face down.



SCENARIO A

Pulmonary artery blockage

MODEL: A clot partly obstructs a pulmonary artery branch.

Show the site and reduced flow to that lung region. Explain the effect on lung perfusion and one assessment priority.



SCENARIO B

Mitral valve backflow

MODEL: The mitral valve leaks during ventricular contraction.

Add a reverse arrow across the valve. Explain the direction of backflow and one possible patient effect.



SCENARIO C

Weak pump and low output

MODEL: The left ventricle contracts weakly and ejects less blood.

Show reduced forward flow to the body. Name one sign you would assess for poor perfusion.



SCENARIO D

Right sided heart failure

MODEL: Right ventricular pumping is impaired, with systemic venous congestion.

Mark the pump and the upstream circulation. Name one assessment finding that fits.



SCENARIO E

Left sided heart failure

MODEL: Left ventricular dysfunction raises pressure upstream into the pulmonary circulation.

Mark the affected side and congestion site. Name one respiratory assessment priority.



SCENARIO F

Aortic valve narrowing

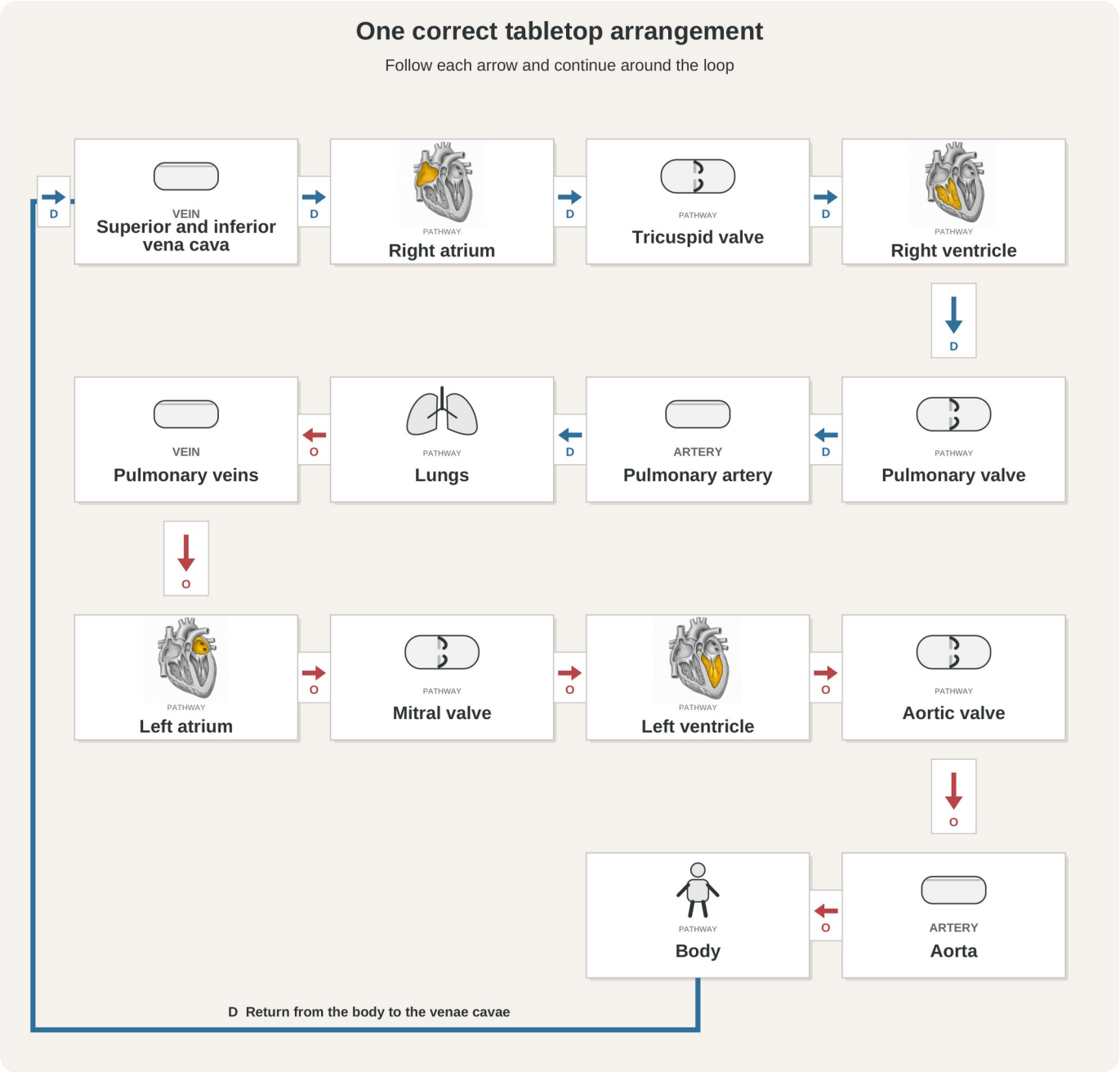
MODEL: Aortic stenosis restricts left ventricular outflow.

Mark the valve and reduced forward opening. Explain the effect on ejection and one symptom to ask about.

Fictional teaching models. Show one specified mechanism per team. A partial obstruction or weak pump does not mean the entire circulation stops.

Normal circuit answer key

Instructor only. Reveal after the challenge. The pathway is a continuous loop, so teams may start at any card.



ARROWS: BLOOD OXYGEN STATUS

Blue D = Oxygen-poor blood

Red O = Oxygen-rich blood

Arrow colors represent changes in blood oxygen content across the lungs and body tissues.

Arteries carry blood away from the heart. Veins return blood to the heart. Vessel type does not determine oxygen content.

CHAMBER HIGHLIGHT

Gold = The chamber named on the card.

14 connections: 7 blue D and 7 red O. Add functions using page 11. Other layouts earn credit when the sequence, connections, and arrow colors are correct. Cards are shown smaller than print size. [1, 2]

Function answer key

Instructor only. Six function labels are required. The two shared cards are spares, not additional functions.

Function	Best match and acceptable explanation
Receives deoxygenated blood	Right atrium receives systemic venous return. Right ventricle also receives oxygen-poor blood from the right atrium; accept if the team explains that connection.
Pumps blood to lungs	Right ventricle.
Gas exchanged	Lungs: at the alveolar and pulmonary capillary interface. Body tissues also exchange gases with systemic capillaries; accept a shared label if the team distinguishes the direction of exchange.
Receives oxygenated blood	Left atrium receives pulmonary venous return. Left ventricle also receives oxygen-rich blood from the left atrium; accept with that explanation.
One-way blood flow	Tricuspid, pulmonary, mitral, and aortic valves. Accept one card spanning all four or repeated labels using spares and sticky notes.
Pumps blood to body	Left ventricle ejects through the aortic valve into the aorta.

Function placements are supported by sources 1 and 2. Prefer the atria for returning blood and the ventricles for ejection into the two circulations. Accurate, explained overlap earns credit.

Connect pumping with cardiac output

The left ventricle propels systemic blood flow. Reduced stroke volume can reduce blood delivery to tissues. Cardiac output is heart rate multiplied by stroke volume. [3]

Fair partial credit

Pathway: award 2 for all 14 structures and connections; 1 for one sequencing or direction error; 0 for multiple errors. Functions and colors: award 2 for all six labels and all D/O arrows correct; 1 for one or two errors in total; 0 for three or more errors. Count a misplaced label once, including its shared placements.

Challenge examples

"We challenge red arrows in the pulmonary artery. This artery carries oxygen-poor blood toward the lungs. An artery is defined by flow away from the heart."

"We agree with placing one-way flow at all four valves because each prevents reverse flow when it closes."

These are game scoring rules, not competency pass criteria. Do not infer a patient diagnosis from one symptom or from card placement alone.

Blockage valve failure and weak pump

Instructor only. Award one break point each for site, map change, functional effect, and an appropriate assessment or symptom.

Scenario A Pulmonary artery blockage

Map: place BLOCKAGE at the pulmonary artery and label it "partial branch obstruction." Cover part of its blue arrow with REDUCED FLOW; keep the route to the rest of the lungs open. The lungs still receive air, but less blood reaches the affected region. [4]

Effect and assessment: impaired pulmonary perfusion can reduce effective oxygen transfer. Assess breathing, oxygen saturation, chest discomfort, heart rate, and blood pressure. The clot is in the pulmonary vasculature, not the airway. [4]

Model response: "A clot partly blocks a lung artery branch. Less blood reaches that region, so I would assess breathing and oxygen saturation."

Scenario B Mitral valve backflow

Map: place BACKFLOW at the mitral valve. Add a red O arrow from the left ventricle through the mitral valve toward the left atrium during ventricular systole. Retain forward flow through the aortic valve. [2, 5]

Effect and assessment: some ejected blood returns to the atrium, reducing effective forward ejection and potentially raising pulmonary venous pressure. Ask about dyspnea or reduced exercise tolerance; assess breathing and heart sounds. Do not reverse the whole circuit or turn the arrow blue. [2, 5]

Model response: "The leaking mitral valve allows blood to return from the left ventricle to the left atrium during contraction. I would assess for shortness of breath."

Scenario C Weak pump and low output

Map: place WEAK PUMP at the left ventricle. Partly cover the red arrow leaving the ventricle and place POOR PERFUSION at the body. Keep all arrows pointing forward. [3, 6]

Effect and assessment: reduced stroke volume can lower cardiac output if not offset by heart rate. Assess blood pressure, mentation, skin perfusion, fatigue, and urine output as appropriate. A fast heart rate alone does not prove adequate output. [3, 6, 7]

Model response: "The left ventricle ejects less blood each beat, reducing delivery to the body. I would assess blood pressure and mentation."

Challenge to listen for

"We challenge showing all arrows reversed for heart failure. A weak pump reduces forward performance; it does not by itself establish valve regurgitation."

Heart failure and valve narrowing

Instructor only. The scenarios isolate a teaching mechanism. Real patients can have overlapping problems.

Scenario D Right sided heart failure

Map: place WEAK PUMP at the right ventricle and REDUCED FLOW on its pulmonary outflow. Place CONGESTION beside the venae cavae and body and label "systemic venous pressure and fluid buildup." Do not add a reverse valve arrow unless regurgitation is separately specified. [6, 7]

Effect and assessment: systemic venous congestion can produce dependent edema, neck vein distention, abdominal swelling, or weight gain. Assess edema, neck veins, weight trend, and abdominal symptoms. Reduced right ventricular output can also reduce left heart filling. [2, 6, 7]

Model response: "The right ventricle is impaired. Pressure builds upstream in the systemic veins, so I would assess peripheral edema and neck veins."

Scenario E Left sided heart failure

Map: mark left ventricular dysfunction. Place CONGESTION at the pulmonary veins and lungs and label "pulmonary pressure and fluid buildup." The normal forward route stays visible. A reverse arrow through the mitral valve is not required. [6, 7]

Effect and assessment: increased upstream pressure can cause pulmonary congestion and breathing difficulty. Assess respiratory effort, oxygen saturation, lung sounds, and ability to lie flat. Left heart failure can involve impaired contraction or filling, including preserved ejection fraction. [6, 7]

Model response: "Left ventricular dysfunction raises pressure upstream toward the lungs. I would assess breathing, oxygen saturation, and orthopnea."

Scenario F Aortic valve narrowing

Map: place REDUCED FLOW at the aortic valve and partly cover the red arrow leaving it. Label "narrow opening, restricted ejection." Keep the arrow forward. [5]

Effect and assessment: the left ventricle must generate greater pressure to eject through the narrowed opening; severe narrowing can limit output. Ask about exertional chest pain, faintness or syncope, and breathlessness. Narrowing is stenosis; leaking backward is regurgitation. [2, 5]

Model response: "A narrowed aortic valve obstructs left ventricular outflow. I would ask about exertional faintness, chest discomfort, and breathlessness."

Challenge to listen for

"We challenge placing congestion only at the feet in the left heart scenario. This model specifies pressure buildup upstream into the pulmonary circulation."

Heart failure on either side can coexist or progress to affect both sides. Findings vary with severity; none of the listed symptoms is required in every patient. [6, 7]

Debrief and clinical sources

Choose one prompt for the final minute. The game develops anatomy and mechanism reasoning within a lecture.

Ask the class

1. Why do blue D arrows enter the lungs through the pulmonary artery, while red O arrows return through the pulmonary veins?

2. Where does oxygen status change in the normal circuit?

3. Which scenario changes direction, which restricts forward flow, and which raises pressure upstream?

4. Where would congestion appear with isolated right versus left heart dysfunction?

Read aloud to close

"Trace the circuit before naming the problem. Then point to what changed: the opening, the direction, the pump, or the pressure upstream. Connect that change to one assessment finding."

Keep it within a lecture

Use two neighboring teams per shared map when desk space is limited. For a large class, reveal the key on screen and let teams self-score. Reuse the cards for a later round with a new scenario.

Clinical sources

The activity, timing, prompts, and scoring are educator-designed. Numbered references support the instructor keys. This packet teaches physiology and assessment reasoning; it does not set treatment protocols.

1. NHLBI. How Blood Flows through the Heart.
https://www.nhlbi.nih.gov/health/heart/blood-flow

2. OpenStax. Anatomy and Physiology 2e. Heart Anatomy.
https://openstax.org/books/anatomy-and-physiology-2e/pages/19-1-heart-anatomy

3. OpenStax. Anatomy and Physiology 2e. Cardiac Physiology.
https://openstax.org/books/anatomy-and-physiology-2e/pages/19-4-cardiac-physiology

4. NHLBI. Pulmonary Embolism.
https://www.nhlbi.nih.gov/health/pulmonary-embolism

5. NHLBI. Heart Valve Diseases.
https://www.nhlbi.nih.gov/health/heart-valve-diseases

6. NHLBI. Heart Failure Causes and Risk Factors.
https://www.nhlbi.nih.gov/health/heart-failure/causes

7. NHLBI. Heart Failure Symptoms.
https://www.nhlbi.nih.gov/health/heart-failure/symptoms