

TOPIC: CARDIAC CYCLE

Systole, Diastole, Pressure, & Valve

♦ **Cardiac Cycle:** cycle of contraction and _____ that moves blood through the heart.

▶ **Systole:** _____.

 *Systole* = _____.

▶ **Diastole:** _____.

 *Diastole* = pressure _____.

♦ Changes in the _____ force valves open and closed.

▶ The _____ cause most of the pressure change.

▶ *Recall:* Atrioventricular (AV) valve = "in valve"; Semilunar (SL) valve = "out" valve



♦ Ventricular Systole - pressure _____:

1. AV valve _____.

2. Semilunar valve _____.



♦ Ventricular Diastole - pressure _____:

3. Semilunar valve _____.

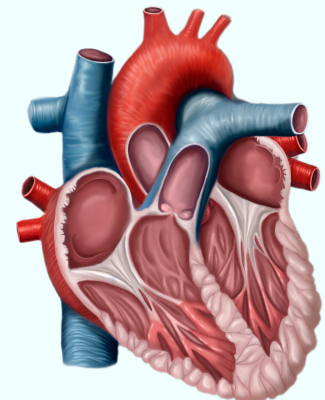
4. AV valve _____.



EXAMPLE

The opening and closing of heart valves is due to the relative pressure in the ventricles compared to the atria and the arteries. Use your knowledge of heart anatomy to complete the following table.

Relative pressure	Valve affected?	Is valve open or closed?	Ventricle in Systole or Diastole?
Aorta > Left Ventricle			
Right atrium > Right Ventricle			
Left Atrium < Left Ventricle			
Pulmonary Artery < Right Ventricle			



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PRACTICE

When the pressure inside the ventricle causes the atrioventricular valve to close and the semilunar valve to open, which statement about the heart is true?

- a) The ventricles are in systole.
- b) The ventricles are in diastole.
- c) The pressure in the left ventricle is greater than in the aorta.
- d) Both A & C are correct.

PRACTICE

For the atrioventricular valves to be open, the pressure in the ventricles must be:

- a) Greater than the pressure in the pulmonary artery.
- b) Greater than the pressure in the aorta.
- c) Greater to the pressure in the atria.
- d) Less than the pressure in the atria.

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Events in the Cardiac Cycle

♦ _____ events in the cardiac cycle:

- Based on: 1) whether ventricles are in systole or diastole & 2) whether blood is _____.

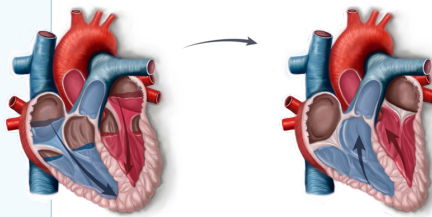
A) Ventricular _____

Blood flows through the atria into the ventricles.

Ventricles: _____

Ventricular pressure: _____

AV valves: _____ **SL valves:** _____



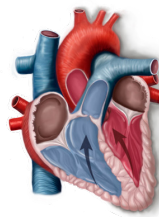
B) Isovolumetric _____

Blood contained in the ventricles as they contract.

Ventricles: _____

Ventricular pressure: _____

AV valves: _____ **SL valves:** _____



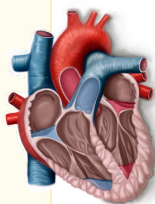
D) Isovolumetric _____

Ventricles relax, no movement of blood in the heart.

Ventricles: _____

Ventricular pressure: _____

AV valves: _____ **SL valves:** _____



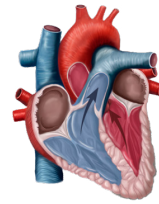
C) Ventricular _____

Blood flows into the aorta and pulmonary trunk.

Ventricles: _____

Ventricular pressure: _____

AV valves: _____ **SL valves:** _____



EXAMPLE

The steps of the cardiac cycle are described below. Match each description below with the phase of the cardiac cycle it describes.

- a) Both sets of valves are closed. Atria in diastole, ventricles in diastole.
- b) AV valves are open, semilunar valves are closed. Atria in systole, ventricles in diastole.
- c) Both sets of valves are closed. Atria in diastole, ventricles in systole.
- d) AV valves are closed, semilunar valves are open. Atria is diastole, ventricles in systole.

Ventricular Filling: _____

Isovolumetric Contraction: _____

Ventricular Ejection: _____

Isovolumetric Relaxation: _____

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PRACTICE

What event immediately follows the closure of the atrioventricular valves and coincides with the onset of ventricular systole?

- | | |
|-------------------------------|------------------------------|
| a) Isovolumetric contraction. | c) Ventricular ejection. |
| b) Atrial systole. | d) Isovolumetric relaxation. |

PRACTICE

During which following phase (or phases) of the cardiac cycle is the blood volume in the ventricles constant?

- | | |
|-------------------------------|--------------------------|
| a) Isovolumetric contraction. | c) Ventricular ejection. |
| b) Isovolumetric relaxation. | d) A & B are correct. |

PRACTICE

If the pressure in the ventricles is higher than in the atria, which of the following statements must be true?

- | | |
|--|----------------|
| I. The atrioventricular valves are closed. | |
| II. The semilunar valves are open. | |
| III. The ventricles are in systole. | |
| a) I only. | c) I and III. |
| b) I and II. | d) II and III. |

PRACTICE

True or False: if false, choose the answer that best corrects the statement.

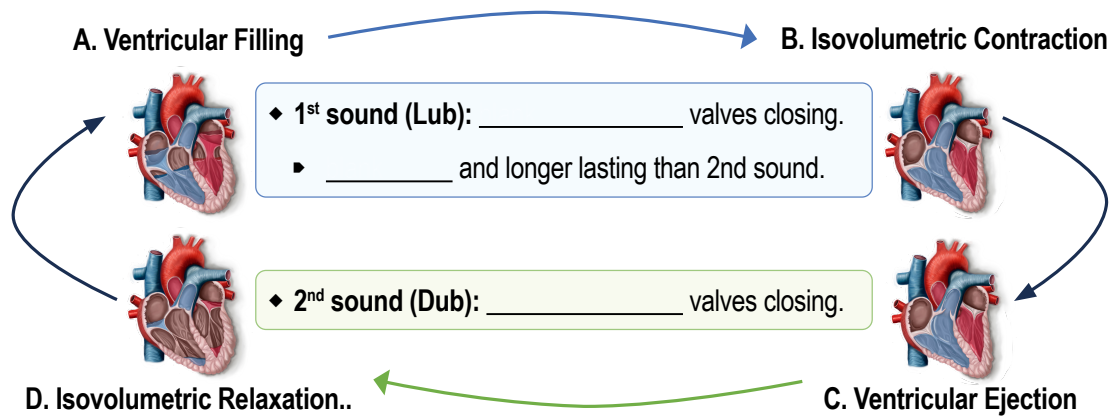
Ventricular filling is defined as the period that the atria are in systole.

- a) True.
- b) False; ventricular filling is defined as the period that the semilunar valves are open.
- c) False; ventricular filling is defined as the period when the AV valves are open, and the SL valves are closed.
- d) False; ventricular filling is defined as the period when the pressure in the ventricles is greater than in the atria.

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Sounds in the Cardiac Cycle

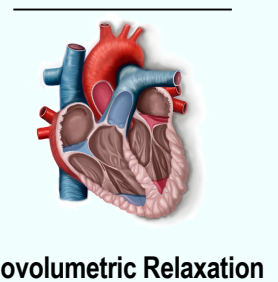
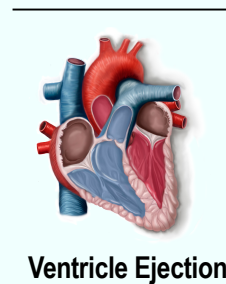
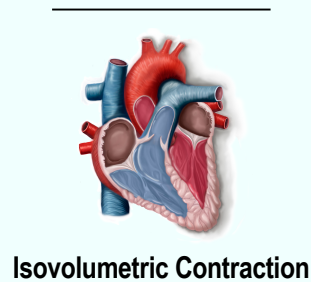
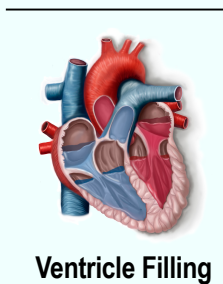
- ♦ Heartbeat sounds are created when valves _____: 2 basic heart sounds.



- ♦ Regularity and timing of heart sounds can help indicate different heart _____ pathologies.
 - *Murmur*: sound created by _____ flow of blood.
 - Often harmless (innocent) in especially _____.

EXAMPLE

Heart sounds are made at the transition from one stage of the cardiac cycle to the next. Identify which heart sound would be heard at the start of each phase of the cardiac cycle. If there is no distinct sound at the start of a phase, write "none".



PRACTICE

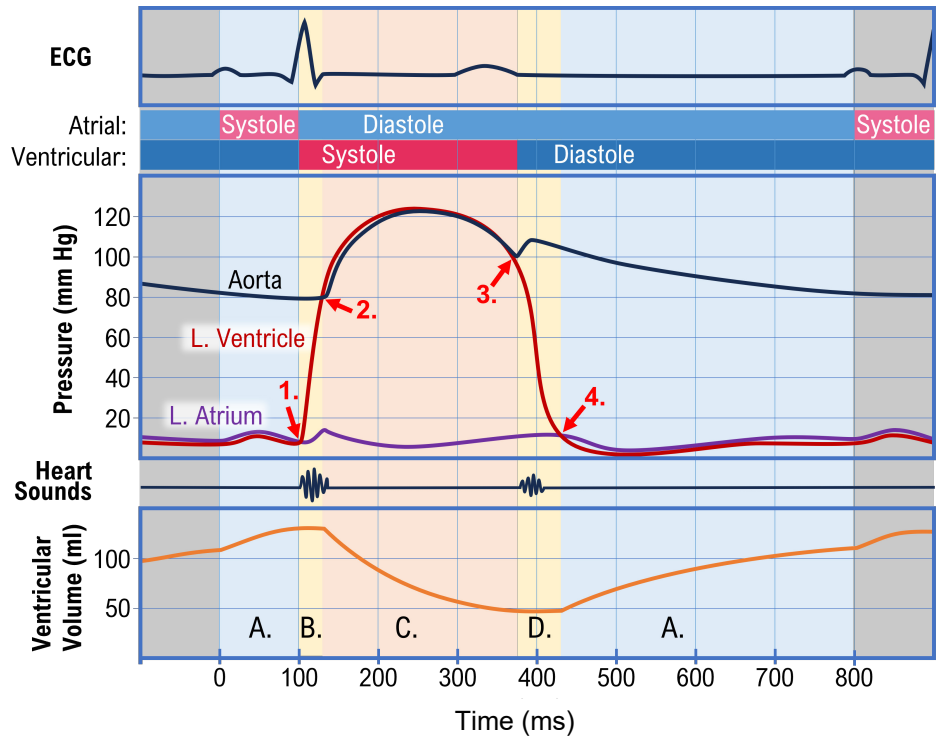
Using a stethoscope, you listen to the heart of a patient in their early forties. You hear a clear 1st heart sound (lub), but the second heart sound is muffled and followed by a whooshing noise. What structure could be dysfunctional in this patient?

- a) Mitral Valve.
- b) Right atrioventricular valve.
- c) Aortic Valve.
- d) Both A & B could be the cause.

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Cardiac Cycle: Putting It All Together

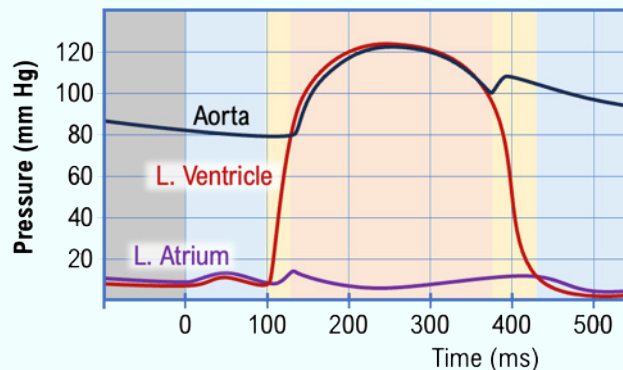
- ♦ Often, events of cardiac cycle are displayed in one diagram.
- ♦ When pressure plots cross:
 1. AV valve _____.
 2. AV valve _____.
 3. Semilunar valve _____.
 3. Semilunar valve _____.
 4. AV valve _____.
- ♦ Events of cardiac cycle:
 - A. Ventricular _____.
 - B. Isovolumetric _____.
 - C. Ventricular _____.
 - D. Isovolumetric _____.



EXAMPLE

On the graph below, identify the following areas:

- a) Circle the area(s) of the plot where the atrioventricular valves will be open.
- b) Put a box around the area(s) where the semilunar valves will be open.
- c) Place a star where you would hear first heart sound (the “lub”) of a heartbeat.
- d) Place a “X” where you would hear second heart sound (the “dub”) of a heartbeat.



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PRACTICE

During which phase or phases of the cardiac cycle does the ventricular pressure change the least?

- a) Ventricular filling.
- b) Isometric contraction.
- c) Isometric relaxation.
- d) Both B & C are correct.

PRACTICE

During which phase of the cardiac cycle do you hear the second heart sound?

- a) Ventricular filling.
- b) Isometric contraction.
- c) Isometric relaxation.
- d) Both B & C are correct.

PRACTICE

You are listening to the heart through a stethoscope. When you hear the first heart sound, which of the following options correctly matches the structure to the pressure change that would be most responsible for producing that sound?

- a) Ventricles: pressure increasing.
- b) Aorta: pressure decreasing.
- c) Ventricles: pressure decreasing.
- d) Atria: pressure increasing.