

SYSTEMIC PUMP

List the route of one RBC bringing oxygenated blood from the lungs to the left side of the heart, and returning deoxygenated blood to the right side of the heart. Include blood vessels, chambers and valves.

1. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

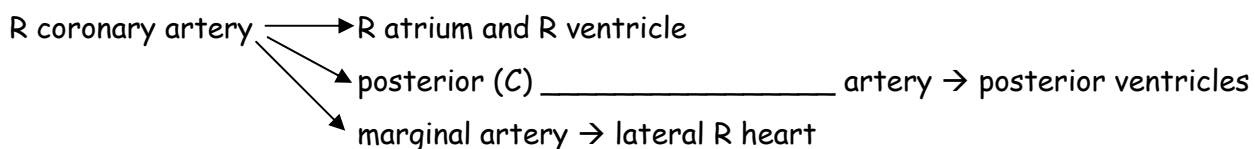
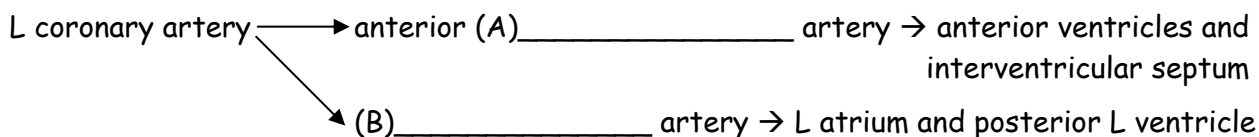
2. What process causes gas exchange at the tissues? \_\_\_\_\_

3. The \_\_\_\_\_ prevent prolapse of the atrioventricular valves.  
Prolapse on the right side of the heart results in \_\_\_\_\_ edema.  
Prolapse on the left side results in \_\_\_\_\_ edema.

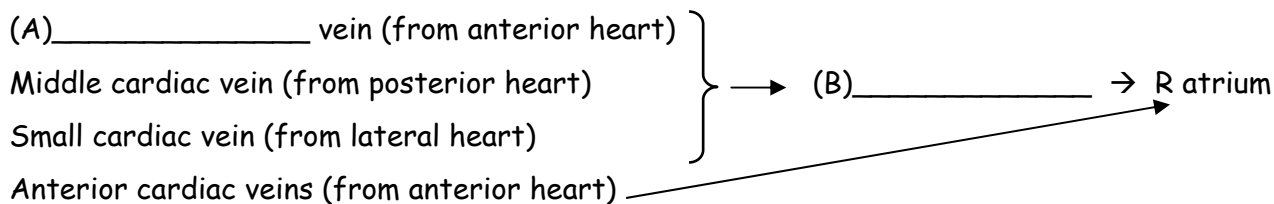
4. \_\_\_\_\_ circulation supplies the heart muscle with O<sub>2</sub> and removes CO<sub>2</sub>.

CORONARY CIRCULATION

5. Coronary arteries:



6. Coronary veins:



7. \_\_\_\_\_ is due to buildup of plaque in coronary arteries.

\_\_\_\_\_ is due to hardening and thickening of the coronary arteries.

8. An elevated level of the amino acid, \_\_\_\_\_, can lead to cardiovascular disease.

Lining of arteries inflamed → \_\_\_\_\_ → \_\_\_\_\_ → \_\_\_\_\_

Name 3 important vitamins that decrease homocysteine levels. \_\_\_\_\_

9. \_\_\_\_\_ are molecules with unpaired electrons that damage cells.

Name some antioxidants that will decrease these molecules. \_\_\_\_\_

### CARDIAC CONDUCTION SYSTEM

10. The myocardium contains \_\_\_\_\_ cells that are self-excitabile, and depolarize spontaneously without stimulation from a neuron.

The \_\_\_\_\_ is the pacemaker of the heart, and is located in the \_\_\_\_\_ .

11. List the 5 components of the conduction system.

\_\_\_\_\_ → \_\_\_\_\_ → \_\_\_\_\_ →  
 \_\_\_\_\_ → \_\_\_\_\_

12. What happens when the electrical activity reaches the AV node? \_\_\_\_\_

Why is there a slight delay at the AV node? \_\_\_\_\_

13. What happens when the electrical activity reaches the Purkinje fibers? \_\_\_\_\_

14. The parasympathetic nervous system \_\_\_\_\_ heart rate.

The sympathetic nervous system \_\_\_\_\_ heart rate.

### ABNORMAL HEART FUNCTION

15. Define bradycardia \_\_\_\_\_

Define tachycardia \_\_\_\_\_

16. Define fibrillation. \_\_\_\_\_

What happens to blood flow during ventricular fibrillation? \_\_\_\_\_

17. Define heart block. \_\_\_\_\_

1<sup>st</sup> degree heart block \_\_\_\_\_

2<sup>nd</sup> degree \_\_\_\_\_

3<sup>rd</sup> degree \_\_\_\_\_

What happens to the size of the heart and thickness of the heart walls?  
 \_\_\_\_\_

18. Name 3 things that can cause heart failure. \_\_\_\_\_

19. Define these terms and explain how they affect heart function.

Hypercalcemia \_\_\_\_\_

Hypocalcemia \_\_\_\_\_

Hypercapnia \_\_\_\_\_

Hyperkalemia \_\_\_\_\_

Hypokalemia \_\_\_\_\_

20. Define endocarditis \_\_\_\_\_

21. Define cardiomyopathy \_\_\_\_\_

22. List risk factors for a myocardial infarction. \_\_\_\_\_

**EKG**

23. What is the function of an EKG? \_\_\_\_\_

24. Summarize EKG and activity in heart

	P WAVE	QRS COMPLEX	T WAVE
<b>Movement of ions</b> <i>(depolarization &amp; repolarization of chambers)</i>			
<b>Electrical activity</b> <i>(conduction system)</i>			
<b>Physical activity in heart</b> <i>(systole/contraction &amp; diastole/relaxation of chambers)</i>			
<b>Pressure in chambers</b> <i>(increased or decreased in chambers)</i>			

**EVENTS IN CARDIAC ACTION POTENTIALS**

25. Depolarization is \_\_\_\_\_ *(fast or slow)*. \_\_\_\_\_ ions are moving into cells.

26. Plateau is \_\_\_\_\_ *(fast or slow)*. \_\_\_\_\_ ions are moving into cells.

27. Repolarization is \_\_\_\_\_ *(fast or slow)*. \_\_\_\_\_ ions are moving out of cells.

REFRACTORY PERIODS

28. During the \_\_\_\_\_ refractory period, the cells cannot respond to another stimulus, and another action potential cannot occur.

During the \_\_\_\_\_ refractory period, the cells will respond to a stronger stimulus, and an action potential can occur.

PHASES OF CARDIAC CYCLE

29. The cardiac cycle is everything that happens during \_\_\_\_\_.

30. Indicate stages (systole or diastole) and chambers.

\_\_\_\_\_ → \_\_\_\_\_ → \_\_\_\_\_ →  
 \_\_\_\_\_ → all chambers relaxed

31. Indicate when the valves are open or closed.

	ATRIOVENTRICULAR VALVES	SEMILUNAR VALVES
Ventricular filling		
Isovolumetric contraction		
Ventricular ejection		
Isovolumetric relaxation		

32. \_\_\_\_\_ pressure occurs in the ventricles when the valves are closed and the ventricles are contracting, but there is not enough pressure to open the semilunar valves.

33. Define these terms related to cardiac output.

Cardiac output \_\_\_\_\_

Heart rate \_\_\_\_\_

Stroke volume \_\_\_\_\_

End diastolic volume \_\_\_\_\_

End systolic volume \_\_\_\_\_

34. Give the equation for calculating cardiac output. \_\_\_\_\_

35. Define preload \_\_\_\_\_

How does the EDV affect preload? \_\_\_\_\_

How does this affect the force of contraction? \_\_\_\_\_

How does this affect SV? \_\_\_\_\_

What law defines this relationship? \_\_\_\_\_

36. Define afterload. \_\_\_\_\_  
How does this affect stroke volume? \_\_\_\_\_  
How does this affect ESV? \_\_\_\_\_  
How does this affect SV? \_\_\_\_\_
37. Give the equation showing the relationship between SV, EDV, ESV. \_\_\_\_\_
38. List some factors that affect CO. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

1. right and left pulmonary veins → left atrium → through bicuspid (mitral) valve → left ventricle → aortic semilunar valve → aorta → aortic arch and descending aorta → body tissues (gas exchange) → superior and inferior vena cava → right atrium
2. simple diffusion
3. chordae tendineae; pulmonary; systemic
4. coronary
5. (A) interventricular; (B) circumflex; (C) interventricular
6. (A) great cardiac; (B) coronary sinus
7. atherosclerosis; arteriosclerosis
8. homocysteine; thrombosis; embolus; infarct; folic acid, B<sub>6</sub> and B<sub>12</sub>
9. free radicals; vitamins C and D, SOD (superoxide dimetase), CoQ<sub>10</sub>
10. autorhythmic; sinoatrial node (SA); roof of right atrium
11. sinoatrial node → atrioventricular node → AV bundle (bundle of His) → R and L bundle branches → Purkinje fibers
12. atria contract; to allow atria to complete contraction before ventricles contract
13. ventricles contract
14. decreases; increases
15. bradycardia - heart rate slower than normal; tachycardia - heart rate faster than normal
16. fibrillation - cardiac muscle does not contract correctly;  
ventricular fibrillation - blood flow is not adequate to meet needs of body
17. disruption to electrical activity  
1<sup>st</sup> degree - long PR interval; AV node and AV bundle electrical activity slows; due to infarction  
2<sup>nd</sup> degree - not enough stimulation of ventricles; ventricle contraction follows every other or every third atrial contraction  
3<sup>rd</sup> degree - complete heart block; atria beat, but ventricles do not get enough stimulation so heart rate slows  
heart enlarges and walls get thinner
18. disease of the valves; myocardial infarction; chronic hypertension
19. hypercalcemia - increased calcium; stimulates muscle cells  
hypocalcemia - decreased calcium; weaker heart beat  
hypercapnia - increased carbon dioxide; longer contractions  
hyperkalemia - increased potassium; hyperpolarization  
hypokalemia - decreased potassium; depolarizes too soon, so weaker contractions
20. inflamed lining of heart
21. heart muscle degenerates
22. males - accumulates more plaque due to lack of estrogen;  
males and females - smoking leads to atherosclerosis and arteriosclerosis;  
increased cholesterol due to diet or heredity; diabetes mellitus; chronic stress; obesity;  
genetic predisposition; sedentary lifestyle;  
fat from yellow bone marrow if it leaves the long bones
23. shows electrical activity through the heart

24. summary of EKG and activity in heart

	P WAVE	QRS COMPLEX	T WAVE
Movement of ions	Atrial depolarization	Ventricular depolarization Atrial repolarization	Ventricular repolarization
Electrical activity	SA → AV	AV → Bundle of His → bundle branches → Purkinje	
Physical activity in heart	Atrial systole (contraction)	Ventricular systole (contraction) Atrial diastole (relaxation)	Ventricular diastole (relaxation)
Pressure in chambers	Increased in atria	Increased in ventricles Decreased in atria	Decreased in ventricles

25. fast; sodium

26. slow; calcium

27. fast; potassium

28. absolute; relative

29. one heartbeat

30. atrial systole → atrial diastole → ventricular systole → ventricular diastole → all relaxed

31.	ATRIOVENTRICULAR VALVES	SEMILUNAR VALVES
Ventricular filling	Open	Closed
Isovolumetric contraction	Closed	Closed
Ventricular ejection	Closed	Open
Isovolumetric relaxation	Closed	Closed

32. isovolumetric

33. Cardiac output - amount of blood pumped from both ventricles in one minute

Heart rate - beats per minute

Stroke volume - amount of blood pumped by one ventricle during contraction.

End diastolic volume - amount of blood in ventricles before ventricular contraction (at end of ventricular relaxation)

End systolic volume - amount of blood in ventricles at end of ventricular contraction

34.  $CO \text{ (ml/min)} = HR \text{ (beats/min)} \times SV \text{ (ml/beat)}$

$$CO = \frac{75 \text{ beats}}{1 \text{ min}} \times \frac{75 \text{ ml}}{1 \text{ beat}} = 5250 \text{ ml/min} = 5.25 \text{ L/min}$$

*Total blood volume is approx. 5 L; therefore, under normal conditions, the entire volume of blood is pumped to lungs and body tissues each minute.*

35. amount of stretch on heart muscle during ventricular diastole; increased EDV increases preload; greater preload before contraction = stronger contraction; increases SV; Starling's law of the heart

36. pressure from blood in aorta and pulmonary trunk that must be overcome for semilunar valves to open; increased afterload decreases stroke volume; ESV increases; decreases SV

37.  $SV = EDV - ESV$

$$SV \text{ (avg at rest)} = EDV \text{ (120 ml/beat)} - ESV \text{ (50 ml/beat)} = 70 \text{ ml/beat (60\% of vent. vol.)}$$

38. sympathetic NS, epinephrine, norepinephrine, thyroxine increase HR and CO; parasympathetic NS decreases HR and CO; increased venous return increases HR and CO; increased EDV increases SV and CO; increased ESV decreases SV and CO; increased contractility (force of contraction) increases SV and CO