



GUYTON Q BOOK

Physiology

1. A healthy 28-year-old woman stands up from a supine position. Which of the following sets of cardiovascular changes is most likely to occur?

	Heart rate	Renal blood flow	Total peripheral resistance
A)	↑	↑	↑
B)	↑	↓	↑
C)	↑	↓	↓
D)	↑	↑	↓
E)	↓	↓	↓
F)	↓	↑	↓
G)	↓	↑	↑
H)	↓	↓	↑

1. B) Moving from a supine to a standing position causes an acute fall in arterial pressure that is sensed by arterial baroreceptors located in the carotid bifurcation and aortic arch. Activation of the arterial baroreceptors leads to an increase in sympathetic outflow to the heart, peripheral vasculature, and the kidneys and a decrease in parasympathetic outflow to the heart. The increase in sympathetic activity to peripheral vessels results in an increase in total peripheral resistance. The increase in sympathetic activity and decrease in parasympathetic outflow to the heart result in an increase in heart rate. The increase in renal sympathetic nerve activity results in a decrease in renal blood flow.

3. A 60-year-old woman has experienced dizziness for the past 6 months when getting out of bed in the morning and when standing up. Her mean arterial pressure is 130/90 mm Hg lying down and 95/60 sitting. Which of the following sets of physiological changes would be expected in response to moving from a supine to an upright position?

	Parasympathetic nerve activity	Plasma renin activity	Sympathetic activity
A)	↑	↑	↑
B)	↑	↓	↑
C)	↑	↓	↓
D)	↑	↑	↓
E)	↓	↓	↓
F)	↓	↑	↓
G)	↓	↑	↑
H)	↓	↓	↑

2. G) The increase in local metabolism during exercise causes cells to release vasodilator substances such as adenosine. The increase in tissue adenosine concentration decreases arteriolar resistance and increases vascular conductance and blood flow to skeletal muscles.

8. A 35-year-old woman visits her family practitioner for an examination. She has a blood pressure of 160/75 mm Hg and a heart rate of 74 beats/min. Further tests by a cardiologist reveal that the patient has moderate aortic regurgitation. Which of the following sets of changes would be expected in this patient?

	Pulse pressure	Systolic pressure	Stroke volume
A)	↑	↑	↑
B)	↑	↓	↑
C)	↑	↓	↓
D)	↑	↑	↓
E)	↓	↓	↓
F)	↓	↑	↓
G)	↓	↑	↑
H)	↓	↓	↑

8. A) The difference between systolic pressure and diastolic pressure is the pulse pressure. The two major factors that affect pulse pressure are the stroke volume output of the heart and the compliance of the arterial tree. In patients with moderate aortic regurgitation (due to incomplete closure of aortic valve), the blood that is pumped into the aorta immediately flows back into the left ventricle. The backflow of blood into the left ventricle increases stroke volume and systolic pressure. The rapid backflow of blood also results in a decrease in diastolic pressure. Thus, patients with moderate aortic regurgitation have high systolic pressure, low diastolic pressure, and high pulse pressure.

9. A 65-year-old man with a 5-year history of congestive heart failure is being treated with an angiotensin-converting enzyme (ACE) inhibitor. Which of the following sets of changes would be expected to occur in response to the ACE inhibitor drug therapy?

	Arterial pressure	Angiotensin II	Total peripheral resistance
A)	↑	↑	↑
B)	↑	↓	↑
C)	↑	↓	↓
D)	↑	↑	↓
E)	↓	↓	↓
F)	↓	↑	↓
G)	↓	↑	↑
H)	↓	↓	↑

9. E) Angiotensin II is a powerful vasoconstrictor. Angiotensin I is formed by an enzyme (renin) acting on a substrate called angiotensinogen. Angiotensin I is converted to angiotensin II by a converting enzyme. Angiotensin II is a powerful vasoconstrictor and sodium-retaining hormone that increases arterial pressure. Administration of an ACE inhibitor would be expected to decrease angiotensin II formation, total peripheral resistance, and arterial pressure.

11. A 55-year-old man with a history of normal health visits his physician for a checkup. The physical examination reveals that his blood pressure is 170/98 mm Hg. Further tests indicate that he has renovascular hypertension as a result of stenosis in the left kidney. Which of the following sets of findings would be expected in this man with renovascular hypertension?

	Total peripheral resistance	Plasma renin activity	Plasma aldosterone concentration
A)	↑	↑	↑
B)	↑	↓	↑
C)	↑	↓	↓
D)	↑	↑	↓
E)	↓	↓	↓
F)	↓	↑	↓
G)	↓	↑	↑
H)	↓	↓	↑

11. A) Stenosis of one kidney results in the release of renin and the formation of angiotensin II from the affected kidney. Angiotensin II stimulates aldosterone production and increases total peripheral resistance by constricting most of the blood vessels in the body.

16. The diameter of a precapillary arteriole is increased in a muscle vascular bed. A decrease in which of the following would be expected?

- A) Capillary filtration rate
- B) Vascular conductance
- C) Capillary blood flow
- D) Capillary hydrostatic pressure
- E) Arteriolar resistance

16. E) An increase in the diameter of a precapillary arteriole would decrease arteriolar resistance. The decrease in arteriolar resistance would lead to an increase in vascular conductance and capillary blood flow, hydrostatic pressure, and filtration rate.

20. A 60-year-old man visits his family practitioner for an annual examination. He has a mean blood pressure of 130 mm Hg and a heart rate of 78 beats/min. His plasma cholesterol level is in the upper 25th percentile, and he is diagnosed as having atherosclerosis. Which of the following sets of changes would be expected in this patient?

	Pulse pressure	Arterial compliance	Systolic pressure
A)	↑	↑	↑
B)	↑	↓	↑
C)	↑	↓	↓
D)	↑	↑	↓
E)	↓	↓	↓
F)	↓	↑	↓
G)	↓	↑	↑
H)	↓	↓	↑

20. B) A person with atherosclerosis would be expected to have decreased arterial compliance. The decrease in arterial compliance would lead to an increase in systolic pressure and pulse pressure.

21. While participating in a cardiovascular physiology laboratory, a medical student isolates the carotid artery of an animal and partially constricts the artery with a tie around the vessel. Which of the following sets of changes would be expected to occur in response to constriction of the carotid artery?

	Sympathetic nerve activity	Renal blood flow	Total peripheral resistance
A)	↑	↑	↑
B)	↑	↓	↑
C)	↑	↓	↓
D)	↑	↑	↓
E)	↓	↓	↓
F)	↓	↑	↓
G)	↓	↑	↑
H)	↓	↓	↑

21. B) Constriction of the carotid artery reduces blood pressure at the carotid bifurcation where the arterial baroreceptors are located. The decrease in arterial pressure activates baroreceptors, which in turn leads to an increase in sympathetic activity and a decrease in parasympathetic activity (or vagal tone). The enhanced sympathetic activity results in constriction of peripheral blood vessels including the kidneys. The enhanced sympathetic activity leads to an increase in total peripheral resistance and decrease in renal blood flow. The combination of enhanced sympathetic activity and decreased vagal tone also leads to an increase in heart rate.

27. While participating in a cardiovascular physiology laboratory, a medical student isolates an animal's carotid artery proximal to the carotid bifurcation and partially constricts the artery with a tie around the vessel. Which of the following sets of changes would be expected to occur in response to constriction of the carotid artery?

	Mean carotid sinus nerve impulses	Parasympathetic nerve activity	Total peripheral resistance
A)	↑	↑	↑
B)	↑	↓	↑
C)	↑	↓	↓
D)	↑	↑	↓
E)	↓	↓	↓
F)	↓	↑	↓
G)	↓	↑	↑
H)	↓	↓	↑

27. H) Constriction of the carotid artery decreases blood pressure at the level of the carotid sinus. A decrease in carotid sinus pressure leads to a decrease in carotid sinus nerve impulses to the vasomotor center, which in turn leads to enhanced sympathetic nervous activity and decreased parasympathetic nerve activity. The increase in sympathetic nerve activity results in peripheral vasoconstriction and an increase in total peripheral resistance.

28. A 22-year-old man enters the hospital emergency room after severing a major artery in a motorcycle accident. It is estimated that he has lost approximately 700 ml of blood. His blood pressure is 90/55 mm Hg. Which of the following sets of changes would be expected in response to hemorrhage in this man?

	Heart rate flow	Sympathetic nerve activity	Total peripheral resistance
A)	↑	↑	↑
B)	↑	↓	↑
C)	↑	↓	↓
D)	↑	↑	↓
E)	↓	↓	↓
F)	↓	↑	↓
G)	↓	↑	↑
H)	↓	↓	↑

28. A) The arterial baroreceptors are activated in response to a fall in arterial pressure. During hemorrhage, the fall in arterial pressure at the level of the baroreceptors results in enhanced sympathetic outflow from the vasomotor center and a decrease in parasympathetic nerve activity. The increase in sympathetic nerve activity leads to constriction of peripheral blood vessels, increased total peripheral resistance, and a return of blood pressure toward normal. The decrease in parasympathetic nerve activity and sympathetic outflow would result in an increase in heart rate.

30. A healthy 28-year-old woman stands up from a supine position. Moving from a supine to a standing position results in a transient decrease in arterial pressure that is detected by arterial baroreceptors located in the aortic arch and carotid sinuses. Which of the following sets of cardiovascular changes is most likely to occur in response to activation of the baroreceptors?

	Mean circulatory filling pressure	Strength of cardiac contraction	Sympathetic nerve activity
A)	↑	↑	↑
B)	↑	↓	↑
C)	↑	↓	↓
D)	↑	↑	↓
E)	↓	↓	↓
F)	↓	↑	↓
G)	↓	↑	↑
H)	↓	↓	↑

30. A) Activation of the baroreceptors leads to an increase in sympathetic activity, which in turn increases heart rate, strength of cardiac contraction, and constriction of arterioles and veins. The increase in

venous constriction results in an increase in mean circulatory filling pressure, venous return, and cardiac output.

31. A 35-year-old woman visits her family practice physician for an examination. She has a mean arterial blood pressure of 105 mm Hg and a heart rate of 74 beats/min. Further tests by a cardiologist reveal that the patient has moderate aortic valve stenosis. Which of the following sets of changes would be expected in this patient?

	Pulse pressure	Stroke volume	Systolic pressure
A)	↑	↑	↑
B)	↑	↓	↑
C)	↑	↓	↓
D)	↑	↑	↓
E)	↓	↓	↓
F)	↓	↑	↓
G)	↓	↑	↑
H)	↓	↓	↑

31. E) Pulse pressure is the difference between systolic pressure and diastolic pressure. The two major factors that affect pulse pressure are the stroke volume output of the heart and the compliance of the arterial tree. An increase in stroke volume increases systolic and pulse pressure, while an increase in compliance of the arterial tree decreases pulse pressure. Moderate aortic valve stenosis results in a decrease in stroke volume, which leads to a decrease in systolic pressure and pulse pressure.

37. Assuming that vessels A to D are the same length, which one has the greatest flow?

<u>Blood vessel</u>	<u>Pressure gradient</u>	<u>Radius</u>	<u>Viscosity</u>
A)	100	1	10
B)	50	2	5
C)	25	4	2
D)	10	6	1

37. D) The flow in a vessel is directly proportional to the pressure gradient across the vessel and to the fourth power of the radius of the vessel. In contrast, blood flow is inversely proportional to the viscosity of the blood. Because blood flow is proportional to the fourth power of the vessel radius, the vessel with the largest radius (vessel D) would have the greatest flow.

38. Which blood vessel has the highest vascular resistance?

Blood vessel	Blood flow (ml/min)	Pressure gradient (mm Hg)
A)	1000	100
B)	1200	60
C)	1400	20
D)	1600	80
E)	1800	40

38. A) Resistance of a vessel = pressure gradient \div blood flow of the vessel. In this example, vessel A has the highest vascular resistance (100 mm Hg/1000 ml/min, or 0.1 mm Hg/ml/min).

42. An increase in which of the following would be expected to decrease blood flow in a vessel?

- A) Pressure gradient across the vessel
- B) Radius of the vessel
- C) Plasma colloid osmotic pressure
- D) Viscosity of the blood
- E) Plasma sodium concentration

42. D) The rate of blood flow is directly proportional to the fourth power of the vessel radius and to the pressure gradient across the vessel. In contrast, the rate of blood flow is inversely proportional to the viscosity of the blood. Thus, an increase in blood viscosity would decrease blood flow in a vessel.

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44. A decrease in which of the following tends to increase pulse pressure?

- A) Systolic pressure
- B) Stroke volume
- C) Arterial compliance
- D) Venous return
- E) Plasma volume

44. C) The difference between systolic pressure and diastolic pressure is called the pulse pressure. The two main factors that affect pulse pressure are stroke volume and arterial compliance. Pulse pressure is directly

proportional to the stroke volume and inversely proportional to the arterial compliance. Thus, a decrease in arterial compliance would tend to increase pulse pressure.







