1. Which of the following conditions will result in a dilated, flaccid heart?

A) Excess calcium ions in the blood  
**B) Excess potassium ions in the blood**  
C) Excess sodium ions in the blood  
D) Increased sympathetic stimulation  
E) Increased norepinephrine concentration in the blood

2. Which of the following conditions at the A-V node will cause a decrease in heart rate?

A) Increased sodium permeability  
B) Decreased acetylcholine levels  
C) Increased norepinephrine levels  
**D) Increased potassium permeability**  
E) Increased calcium permeability

3. Sympathetic stimulation of the heart

A) Releases acetylcholine at the sympathetic endings  
B) Decreases sinus nodal discharge rate  
C) Decreases excitability of the heart  
**D) Releases norepinephrine at the sympathetic endings**  
E) Decreases cardiac contractility

4. What is the normal total delay of the cardiac impulse in the A-V node plus bundle?

A) 0.22 sec  
B) 0.18 sec  
C) 0.16 sec  
**D) 0.13 sec**  
E) 0.09 sec
5. Which of the following best explains how sympathetic stimulation affects the heart?

A) Permeability of the S-A node to sodium decreases
B) Permeability of the A-V node to sodium decreases
C) Permeability of the S-A node to potassium increases
D) There is an increased rate of upward drift of the resting membrane potential of the S-A node
E) Permeability of the cardiac muscle to calcium decreases

6. Which of the following structures will have the slowest rate of conduction of the cardiac action potential?

A) Atrial muscle
B) Anterior internodal pathway
C) A-V nodal fibers
D) Purkinje fibers
E) Ventricular muscle

7. If the S-A node discharges at 0.00 seconds, when will the action potential normally arrive at the epicardial surface at the base of the left ventricle?

A) 0.22 sec
B) 0.18 sec
C) 0.16 sec
D) 0.12 sec
E) 0.09 sec

8. If the S-A node discharges at 0.00 seconds, when will the action potential normally arrive at the A-V bundle (bundle of His)?

A) 0.22 sec
B) 0.18 sec
C) 0.16 sec
D) 0.12 sec
E) 0.09 sec
9. Which of the following conditions at the S-A node will cause heart rate to decrease?

A) Increased norepinephrine levels  
B) Increased sodium permeability  
C) Increased calcium permeability  
D) Increased potassium permeability  
E) Decreased acetylcholine levels

10. Which of the following are caused by acetylcholine?

A) Hyperpolarization of the S-A node  
B) Depolarization of the A-V node  
C) Decreased permeability of the S-A node to potassium ions  
D) Increased heart rate  
E) Increased permeability of the cardiac muscle to calcium ions

11. What is the membrane potential (threshold level) at which the S-A node discharges?

A) −40 mV  
B) −55 mV  
C) −65 mV  
D) −85 mV  
E) −105 mV

12. If the ventricular Purkinje fibers become the pacemaker of the heart, what is the expected heart rate?

A) 30/min  
B) 50/min  
C) 65/min  
D) 75/min  
E) 85/min
13. What is the resting membrane potential of the sinus nodal fibers?

A) −100 mV  
B) −90 mV  
C) −80 mV  
D) −55 mV  
E) −20 mV

14. In normal heart action potential of SA node

a. Is similar to the action potential of right ventricle  
b. Is similar to the action potential of right atrium  
c. Has same duration of action potential of both atria  
   d. It controls the rate of action potential of both ventricles  
e. Has same plateau as action potential of both atria

15. Maximum pressure in the left ventricle takes place during

a. PR interval  
b. PR segment  
c. ST segment  
d. T wave  
e. TP interval

16. Maximum filling of the left ventricle takes place during the first part of

a. PR interval  
b. ST segment  
c. T wave  
d. TP interval  
e. QT interval

17. QT interval is

a. From the beginning of QRS wave to the beginning of T wave  
b. From end of QRS wave to the end of T wave  
c. From the beginning of QRS wave to the end of T wave  
d. From the end QRS wave to the beginning of T wave  
e. Duration of QRS + duration of T wave
18. Maximum potassium channels open during
   a. P wave
   b. PR segment
   c. ST segment
   d. T wave
   e. QRS wave

19. In partial heart block which of the following will increase
   a. PR segment
   b. **PR interval**
   c. ST segment
   d. TP interval
   e. QT interval

20. Pumping of the left ventricle can increase with
   a. Increase strength of the stimulus
   b. Increase K ion concentration
   c. Prolong elevation of body temperature
   d. **Increase end diastolic volume within physiological limit**
   e. Decrease calcium concentration

21. In a conventional ECG recording system:
   a. Wave of depolarization moving away from the positive electrode causes an upward deflection
   b. **Wave of repolarization moving towards the negative electrode causes an upward deflection**
   c. Atrial depolarization causes a downward deflection in Lead I
   d. Wave of depolarization moving at right angles to axis of Lead I causes no deflection in Lead II
   e. A and D

22. Choose correct statement:
   a. Cardiac output continues to increase as the right atrial pressure increases
   b. Cardiac output usually increases when peripheral resistance increases
   c. **Venous return always increases when systemic filling pressure increases**
   d. Venous return always increases when right atrial pressure decreases below zero level
   e. Cardiac output can be more than venous return during exercise
Look at the following diagram and answer the following questions

23. Which letter corresponds to maximal opening of K channels?
   a. A  
   b. C  
   c. D  
   d. E  
   e. F  

24. Rapid filling of the left ventricle usually takes place during:
   a. A  
   b. B  
   c. D  
   d. E  
   e. F  

25. Aortic pressure is less than left ventricular pressure during:
   a. A  
   b. B  
   c. C  
   d. D  
   e. F
26. The end of the systolic period, is at the end of? :
   a. A.
   b. B.
   c. C.
   d. D.
   e. E.

Look to the following ECG and answer the following:

27- Rapid filling phase during the first part of? :
   a. A.
   b. B.
   c. D.
   d. E.
   e. F.

Look to the following ECG and answer the following:

28- Rapid ejection phase during the first part of? :
   a. A.
   b. B.
   c. D.
   d. E.
   e. F.
29- During which portion of the ECG are both the ventricles and the atria at resting potential
   a) TP interval
   b) ST segment
   c) PR interval
   d) QT interval

30. Choose the correct statement:
   a. Cardiac contraction increases if Na is increased
   b. Duration of the plateau of the atria is the same as that for the ventricles
   c. All parts of the conductive system have the same rate of excitation
   d. AV node has the least velocity for impulse conduction
   e. Duration of relative refractory period is the same as that of absolute refractory period

31. Which of the following has the fastest conduction of action potential?
   a. The SA node
   b. The atrial Muscle
   c. The AV node
   d. The purkinje fibers
   e. The left ventricular muscle

32. Contraction of atria happen before ventricles due to
   a. Thickness of ventricular muscles
   b. Size of ventricles
   c. Blood reach atria before ventricles
   d. Delay of action potential in AV node

33. The heart muscle work as syncytium due to
   a. Connectin with autonomic nervous system
   b. Leaky Na+ channels in their cells
   c. Gap junctions with low resistance to action potential transmission
   d. The long refractory period
   e. Na+-K+ pump
34. No tetanus in cardiac muscle due to
   a. Connectin with autonomic nervous system
   b. Leaky Na+ channels in their cells
   c. Gap junctions with low resistance to action potential transmission
   d. Na+-K+ pump
   e. The long refractory period

35. T wave in ECG represent
   a. Atrial depolarization
   b. Atrial contraction
   c. Ventricular depolarization
   d. Ventricular contraction
   e. Ventricular repolarization

36. QRS wave in ECG represent
   a. Atrial depolarization
   b. Atrial contraction
   c. Ventricular depolarization
   d. Ventricular contraction
   e. Ventricular repolarization

37. ST segment represents
   a. Atrial depolarization
   b. Atrial contraction
   c. Ventricular contraction
   d. Ventricular repolarization

38. Stroke volume is
   a. The amount of blood pumped from each ventricle in each contraction
   b. The amount of blood pumped from both ventricles in each contraction
   c. The amount of blood pumped from each ventricle in one minute
   d. The amount of blood pumped from both ventricles in one minute

39. Decrease in ventricular pressure and its blood volume fixed happened in
   a. Filling phase
   b. Ejection phase
   c. Isovolumetric contraction
   d. Isovolumetric relaxation
40. Movement of blood from ventricle into arteries happen in
   a. Filling phase
   b. Ejection phase
   c. Isovolumetric contraction
   d. Isovolumetric relaxation

41. The two distinct heart sounds, described phonetically as lub and dup, represent the:
   a. Contraction of the ventricles and the relaxation of the atria
   b. Contraction of the atria and the relaxation of the ventricles
   c. Closing of the atrioventricular and semilunar valves
   d. Surging of blood into the pulmonary artery and aorta

42. Abnormally slow conduction through the ventricles would change the shape of which of the following in an ECG tracing
   a. P wave
   b. T wave
   c. QRS complex
   d. P-R interval
   e. R-T interval

43. Re-entry phenomena is a common cause of all the following except
   a. Atrial tachycardia
   b. Ventricular tachycardia
   c. Atrial fibrillation
   d. Sinus bradycardia
   e. Ventricular fibrillation

44. Within physiological limit cardiac output will increase if all the following increase except
   a. Right atrial pressure
   b. Circulatory filling pressure
   c. Venous resistance
   d. Sympathetic stimulation
   e. Blood volume
45. The period lasting from closure of the mitral valve to opening of aortic valve is known as
   a. Isovolumetric relaxation
   b. Ejection phase
   c. Filling phase
   **d. Isovolumetric contraction**
   e. Systole

46. The venous return is mainly determined by
   a. The arterial pressure
   b. The ventricular pressure
   **c. The systemic filling pressure**
   d. The peripheral resistance
   e. The capillary pressure

A 60-year-old woman has a resting heart rate of 70 beats/min, arterial pressure is 130/85 mm Hg, and body temperature is normal. Her pressure-volume diagram of the left ventricle is shown above.

47. What is her cardiac output in milliliters per minute?
   A) 2000
   B) 3000
   C) 4000
   D) 6000
   **E) 7000**
48. When does the second heart sound occur in the ventricular pressure–volume relationship?

**A) At point D**

B) Between point A and point B  
C) Between point B and point C  
D) Between point C and point D  
E) Between point D and point A

49. What is her ventricular ejection fraction?

A) 33%  
B) 50%  
C) 60%  
D) **67%**  
E) 80%

50. In a resting adult, the typical ventricular ejection fraction has what value?

A) 20%  
B) 30%  
C) 40%  
D) **60%**  
E) 80%

51. A 30-year-old man has an ejection fraction of 0.25 and an end systolic volume of 150 ml. What is his end diastolic volume?

A) 50 ml  
B) 100 ml  
C) 125 ml  
D) **200 ml**  
E) 250 ml
52- Q wave in normal ECG develops because:
   a) Atrial depolarization
   b) Depolarization of the posteriolateral ventricular myocardium
   c) Depolarization of the base of the ventricular septum
   d) Atrial repolarization

53- Which of the following pairs are irregular in the ECG:
   a) SVT and ventricular extrasystole
   b) Atrial and ventricular extrasystole
   c) 1\textsuperscript{st} and 2\textsuperscript{nd} degree heart block
   d) Atrial fibrillation and 3\textsuperscript{rd} degree heart block

54- On normal ECG all of the following can develop at the end of QT interval except:
   a) Relaxation of atria and ventricles
   b) Repolarization of the ventricles
   c) Decrease of the ventricular pressure
   d) Contraction of the atria

55- SA node is the pace maker of the heart because:
   a) It has higher resting membrane potential
   b) It has lower resting membrane potential
   c) It has the highest velocity
   d) It has the highest concentration of gap junctions

56- During cardiac cycle:
   a. Myocardial contraction begins in the right atrium
   b. Excitation in epicardial myocardium precedes excitation of endocardium myocardium.
   c. Excitation of septum precedes excitation of the ventricular wall.
   d. Excitation of the apex occurs at the end of the cardiac cycle.
   e. Excitation of the ventricle precedes excitation of the right ventricle.
57- which one of the following statements is false regarding the PR interval:

a- from the beginning of P wave to the beginning of QRS complex

b- isoelectric line

c- represents the time for the impulse from SA node to the ventricles

d- involves opening of the slow Na-Ca channels in the atria

e- it's average duration is about 160 millisecond

58- QRS represents:

a- ventricular depolarization

b- ventricular contraction

c- atrial repolarization

d- a and b

e- a and c

59- which one of the following ECG waves, segments or intervals represents the atrial contraction plateau:

a- P wave

b- QRS complex

c- R wave

d- ST segment

e- PR segment

60- The maximum opening of slow Na-Ca channels is taking place during:

a- PR segment

b- PR interval

c- ST segment

d- U wave

e- none of the above

61- regarding TP interval which statement(s) is true:
a- it's the interval from the end of T wave to the beginning of the next P wave
b- represents the resting potential
c- during this period there is leakage of Na ions in the SA node
d- all channels in the muscle are closed
e- all of the above are true

62- prolongation of QT interval is seen in all of the following except

a- hypokalemia
b- hypocalcemia
c- **hypermagnesemia**
d- myocardial ischemia
e- when it's more than 400 milliseconds

63- action potential of the ventricles is represented by:

a- ST segment
b- QRS complex
c- **QT interval**
d- R wave
e- none of the above

64- the event that is not recorded by the ECG machine is:

a- atrial depolarization
b- **atrial repolarization**
c- ventricular depolarization
d- ventricular repolarization
e- ventricular action potential

65- which one of the following describes the U wave:

a- **represents the repolarization of the papillary muscles**
b- follows the P wave
c- usually seen in all ECG leads  
d- always physiological  
e- it's a downward deflection

66- during exercise which one of the following will be shorter:

a- ST segment  
b- QRS complex  
c- T wave  
d- P wave  
**e- PR interval**

67- the maximum opening of potassium channels is seen in:

a- QRS complex  
**b- T wave**  
c- TP interval  
d- ST segment  
e- PR interval

68- the maximum opening of fast Na channels is seen in:

**a- QRS complex**  
b- T wave  
c- TP interval  
d- ST segment  
e- PR interval

69- all of the following statements are true about ECG except:

a- composed of six limb leads and six chest leads  
b- the six limb leads are subdivided into three bipolar and three unipolar  
**c- lead II is the connection between the negative electrode in the right arm and the positive one in the left arm**
d- chest leads are positive electrodes compared with the indifferent electrode  
e- it's a recording of the electrical activity of the heart

70- which one of the following describes the correct distribution of ECG leads:

a- three unipolar and nine bipolar 
b- six unipolar and six bipolar  
c- **three bipolar and nine unipolar**  
d- twelve bipolar leads 
e- twelve unipolar leads

71- which one of the following is false regarding the bipolar leads:

a- lead I is the connection between the negative electrode in the right arm and the positive electrode in the left arm  
b- **lead II is the connection between the negative electrode in the right arm and the positive electrode in the right leg**  
c- lead III is the connection between the negative electrode in the left arm and the positive electrode in the left leg  
d- leads I,II and III are considered bipolar that will form the Einthoven’s triangle  
e- lead II is the connection between the negative electrode in the right arm and the positive electrode in the left leg

72- which one of the following isn’t true about chest leads:

a- V1: right 4th ICS at the edge of the sternum  
b- V2: left 4th ICS at the edge of the sternum  
c- **V3 : left 4th ICS at the anterior axillary line**  
d- V4: left 5th ICS at the midclavicular line  
e- V5: left 5th ICS at the anterior axillary line

73- which one of the following pairs is mismatched:

a- V1: right ventricle  
b- V2: ventricular septum
c- V3 : anteroseptal wall
d- V4 : anterior wall of the left ventricle
e- V5 : apex of the heart

74- the maximum voltage in the ECG is seen in :

a- lead I
b- lead II
c- aVF
d- V1
e- V3

75- which one of the following statements is wrong :

a- R wave is longer than S wave in all bipolar leads
b- S wave is longer than R wave in all augmented leads
c- the length of R wave is equal to that of S wave in V3 chest lead
d- QRS is narrower than P wave because of high velocity in pukinje fibers
e- QRS is longer than P wave because of the thickness of the ventricular muscles

76- which one of the following is false regarding ECG :

a- the ECG paper speed is ordinarily 25 mm/sec
b- each 1 mm (small) horizontal box corresponds to 0.04 second
c- larger boxes represent 0.20 sec
d- the height (amplitude) of a given wave or deflection, as 10 mm equals 1 mV
e- heart rate can be calculated using TP interval

77- all are true regarding the 1st heart sound except :

a- represented by R wave on the ECG
b- caused by closure of AV valves
c- represents the beginning of systole
d- represents the end of diastole

\textbf{e- caused by opening of semilunar valves}

78- the 2nd heart sound is caused by :

a- opening of AV valves
b- closure of AV valves
c- opening of semilunar valves
\textbf{d- closure of semilunar valves}
e- contraction of the left ventricle

79- which one of the following statements is true about heart sounds

a- 1st heart sound is heard during the T wave
b- 2nd heart sound is heard during the S wave
c- both heart sounds occur during the isovolumic contraction
\textbf{d- 2nd heat sound is heard during the isovolumic relaxation}
e- these sounds are pathological and can't be detected in normal heart

80- cardiac index can be increased by all of the following except :

a- stimulation of the sympathetic nervous system
b- increasing the circulatory filling pressure
c- decreasing the surface area of the body
\textbf{d- decreasing the ejection fraction}
e- increasing the venous return

90- cardiac index can eliminate the effect of all of the following except :

a- height and weight
b- weight and size
c- height and size
\textbf{d- age and gender}
e- none of the above
91- which one of the following isn't true about sinus arrhythmia:

a- sinus tachycardia is associated with small RR interval
b- respiratory arrhythmia is seen only in children
c- sick sinus syndrome might be caused by SA node fibrosis
d- sinus bradycardia is any heart rate less than 60
**e- sick sinus syndrome is tachycardia most of the time**

92- which one of the following isn't true about sick sinus syndrome:

a- also known as brady-tachy-syndrome
b- the most important sinus arrhythmia
c- caused by SA node ischemia
d- most of the time the heart rate is less than 40
**e- it's a physiological type and no treatment is needed**

93- which one of the following isn't true about paroxysmal tachycardia:

a- associated with short RR interval
b- heart rate 150-220
**c- irregular irregularity**
d- cardiac filling is reduced and cardiac output will be less
e- P wave is on top of the previous T wave

94- sawtooth appearance is seen in:

a- atrial extra-systole
b- supraventricular tachycardia
c- sick sinus syndrome
**d- atrial flutter**
e- atrial fibrillation
95- the most common arrhythmia:

a- atrial extra-systole
b- supraventricular tachycardia
c- sick sinus syndrome
d- atrial flutter

**e- atrial fibrillation**

96- the most common arrhythmia to develop in normal heart:

a- atrial extra-systole
b- supraventricular tachycardia
c- sick sinus syndrome
d- atrial flutter

**e- atrial fibrillation**

97- absent P wave is seen in:

a- atrial extra-systole
b- supraventricular tachycardia
c- sick sinus syndrome
d- atrial flutter

**e- atrial fibrillation**

98- which one of the following is irregular irregularity:

a- atrial extra-systole
b- supraventricular tachycardia
c- sick sinus syndrome
d- atrial flutter

**e- atrial fibrillation**
99- T wave may not be seen in:

a- ventricular extra-systole
b- supraventricular tachycardia
c- sick sinus syndrome
d- atrial flutter
e- atrial fibrillation

100- common cause(s) of death after MI:

a- atrial extra-systole
b- ventricular tachycardia
c- sick sinus syndrome
d- ventricular fibrillation
e- B and D

101- the most dangerous arrhythmia:

a- ventricular extra-systole
b- supraventricular tachycardia
c- sick sinus syndrome
d- atrial flutter
e- ventricular fibrillation

102- which one of the following is false about re-entry phenomenon:

a- can be developed in normal heart
b- can explain all types of arrhythmia
c- the signal returns back to the site of origin which has passed the refractory period
d- can explain the abnormal repeated excitation of the heart
e- all are true
103- which one of the following isn't true:

a- veins are 8 times more distensible than arteries
b- veins are 24 times more compliant than arteries
c- veins are the reservoir of blood
d- arteries are the reservoir of pressure
e- capillaries are associated with the highest velocity

104- the highest resistance:

a- aorta
b- arteries
c- arterioles
d- capillaries
e- veins

105- which one of the following is false:

a- normal critical closing pressure is 20 mmHg
b- critical closing pressure with sympathetic stimulation is 60 mmHg
c- if the radius doubled the flow will increase 16 times
d- delayed compliance can develop in veins only
e- highest surface area is seen in capillaries

106- all of the following is systolic murmur except:

a- aortic stenosis
b- pulmonary stenosis
c- mitral regurgitation
d- tricuspid regurgitation
e- mitral stenosis
107- which one of the following is associated with continuous murmur:

a- aortic stenosis
b- pulmonary stenosis
c- **patent ductus arteriosus**
d- tricuspid regurgitation
e- mitral stenosis

108- all of the following are true about innocent murmur except:

**a- diastolic murmur**
b- soft pitched sound
c- asymptomatic
d- position-related
e- seen with pregnancy

109- negative pressure can exist in normal situation in:

a- neck veins
b- skull veins
c- **dural sinuses**
d- neck arteries
e- neck veins

110- all of the following are vasodilators except:

a- Bradykinin
b- Histamine
c- **Endothelin**
d- indirect effect of CO2
e- H+ ions
111- edema can be developed with all except:

a- increased capillary hydrostatic pressure
b- increased interstitial colloid osmotic pressure
c- lymphatic obstruction
d- **increased negative interstitial free fluid pressure**
e- decreased plasma colloid osmotic pressure

112- At the early stage of volume loading hypertension, which of the following decrease?

a. Extracellular fluid
b. **Total peripheral resistance**
c. Blood volume
d. Cardiac output
e. None of the above
Multiple Choice
Identify the choice that best completes the statement or answers the question.

1. The systemic circulation
   a. receives more blood than the pulmonary circulation does
   b. receives blood from the left ventricle
   c. is a low pressure system compared to the pulmonary circulation
   d. receives blood from the right ventricle and is a high pressure system compared to the pulmonary circulation
   e. receives more blood than the pulmonary circulation does, and receives blood from the left ventricle.

2. Which valve(s) prevent regurgitation of blood from a right ventricle to the atrium?
   a. tricuspid
   b. mitral
   c. pulmonary
   d. tricuspid and pulmonary
   e. all of these

3. Semilunar valves
   a. prevent backflow of blood from the ventricles to the atria
   b. prevent backflow of blood from the atria to the ventricles
   c. prevent backflow of blood from the ventricles to the arterial trunks
   d. prevent backflow of blood from the arterial trunks to the ventricles
   e. none of these

4. The wall of the left ventricle is thicker than the wall of the right ventricle because the
   a. left ventricle must pump much more blood than the right ventricle so it must have stronger walls
   b. right ventricle must pump much more blood than the left ventricle so it has a larger chamber to accommodate the blood and a correspondingly thinner wall
   c. left ventricle must pump the same amount of blood into a higher-resistance, higher-pressure system
   d. right ventricle must create higher tension within its walls
   e. left ventricle must pump oxygenated blood, which requires more energy than pumping deoxygenated blood

5. Adjacent cardiac muscle cells are joined together end-to-end in the ventricles by
   a. intercalated discs
   b. sarcomeres
   c. Purkinje fibers
   d. sinoatrial nodes
   e. atrioventricular nodes
6. The primary function of the pericardial sac is to
   a. prevent excessive expansion of the heart as it fills with blood
   b. secrete a fluid that reduces friction as the heart beats
   c. serve as a reservoir for blood to be used during strenuous exercise
   d. provide oxygen and nutrients to the heart muscle
   e. catch and kill any bacteria in the blood flowing through the heart chambers

7. The chordae tendineae
   a. keep the AV valves from everting during ventricular systole
   b. hold the AV valves open during diastole
   c. hold the right and left ventricles together
   d. transmit the electrical impulse from the atria to the ventricles
   e. contract when the ventricles contract

8. The heart chamber that has the greatest workload is
   a. the right ventricle
   b. the left ventricle
   c. the left atrium
   d. the right atrium
   e. both atria

9. A lumen that contains blood with a comparatively higher concentration of oxygen is in the
   a. right ventricle
   b. inferior vena cava
   c. pulmonary artery
   d. pulmonary vein
   e. coronary veins

10. The aortic valve
    a. prevents the backflow of blood into the aorta during ventricular diastole
    b. prevents the backflow of blood into the left ventricle during ventricular diastole
    c. prevents the backflow of blood into the right ventricle during ventricular diastole
    d. closes when the first heart sound is heard
    e. none of these

11. The right half of the heart pumps blood through the ____ circuit and the left half pumps blood through the ____ circuit.
    a. systolic; diastolic
    b. coronary; pulmonary
    c. systemic; pulmonary
    d. pulmonary; systemic
    e. systemic; coronary
12. Blood returning from the lungs
   a. enters the right atrium
   b. enters the left atrium
   c. is poorly oxygenated
   d. enters the right atrium and is poorly oxygenated
   e. enters the left atrium and is poorly oxygenated

13. Choose a correct sequence of blood flow during one pass through the heart and lungs (some steps may have been omitted):
   a. right atrium bicuspid valve pulmonary vein
   b. aortic valve right ventricle lung
   c. lung pulmonary artery left atrium
   d. right ventricle bicuspid valve aortic valve
   e. none of these

14. The low-resistance pathway that permits electrical activity to pass from cell-to-cell in myocardial tissue is the
   a. desmosome
   b. septum
   c. gap junction
   d. T-tubule
   e. sarcoplasmic reticulum

15. What component of the cardiac conduction system distributes electrical signals through the papillary muscles directly?
   a. AV nodes
   b. AV bundle
   c. bundle of His
   d. Purkinje fibers
   e. SA node

16. The plateau of the cardiac action potential results from the opening of voltage-gated slow ____ channels in the plasma membrane of the ____ cell.
   a. sodium; contractile
   b. potassium; autonomic
   c. calcium; contractile
   d. chloride; pacemaker
   e. potassium; contractile

17. Which of the following statements about action potentials in the heart is correct?
   a. The rising phase of the action potential in autonomic cells is due to a rapid Ca^{2+} influx.
   b. The rising phase of the action potential in contractile cells is due to a rapid Na^{+} influx.
   c. The plateau phase of the action potential in contractile cells is due to a slow Ca^{2+} influx.
   d. The rising phase of the action potential in autonomic cells is due to a rapid Ca^{2+} influx,
      and the rising phase of the action potential in contractile cells is due to a rapid Na^{+} influx.
   e. all of these
18. On a normal ECG, a wave for repolarization of the atria is not recorded. Why?
   a. The leads are not placed in a position to pick it up.
   b. No repolarization of the atria occurs normally.
   c. It occurs simultaneously with ventricular depolarization and is masked by the QRS complex.
   d. It does not travel through body fluids.
   e. It is too small to be picked up by external recording electrodes.

19. Which of the following criteria must be met for the heart to function efficiently?
   a. Excitation and contraction of the cardiac muscle fibers of each heart chamber should be coordinated to ensure efficient pumping.
   b. The atria should be excited and contract before the onset of ventricular contraction to ensure that ventricular filling is complete.
   c. The right side of the heart should contract first to ensure that oxygenated blood is delivered to the heart before the left side contracts.
   d. Excitation and contraction of the cardiac muscle fibers of each heart chamber should be coordinated to ensure efficient pumping, and the atria should be excited and contract before the onset of ventricular contraction to ensure that ventricular filling is complete.
   e. The atria should be excited and contract before the onset of ventricular contraction to ensure that ventricular filling is complete, and the right side of the heart should contract first to ensure that oxygenated blood is delivered to the heart before the left side contracts.

20. The AV nodal delay ensures that:
   a. The atria contract and empty their contents into the ventricles prior to ventricular systole.
   b. The ventricles contract prior to atrial systole.
   c. Tetanic contractions of cardiac muscle are impossible.
   d. Ventricular diastole occurs before systole.
   e. Atrial diastole occurs before atrial systole.

21. The normal pacemaker of the heart is the
   a. SA node
   b. AV node
   c. bundle of His
   d. Purkinje system
   e. ventricular myocardium

22. The function of the atrioventricular node is to
   a. excite the left and right atrium
   b. control the heart rate
   c. prevent the atria and ventricles from contracting simultaneously
   d. repolarize the heart after systole
   e. none of these
23. The direction of the impulse through the conduction system of the heart is normally:
   a. AV node  SA node  bundle of His  Purkinje fibers
   b. AV node  bundle of His  SA node  Purkinje fibers
   c. bundle of His  AV node  Purkinje fibers  SA node
   d. SA node  AV node  bundle of His  Purkinje fibers
   e. SA node  bundle of His  Purkinje fibers  AV node

24. The QRS complex represents
   a. depolarization of the atria
   b. depolarization of the ventricles
   c. the AV nodal delay
   d. repolarization of the ventricles
   e. the time during which the heart is contracting

25. The fastest rate of autorhythmicity is normally carried out by the
   a. AV bundle
   b. AV node
   c. bundle of His
   d. Purkinje fibers
   e. SA node

26. Depolarization occurs at the AV node
   a. during the P wave
   b. between the P wave and QRS complex
   c. during the QRS complex
   d. between the QRS complex and T wave
   e. during the T wave

27. Which of the following ECG waves represents ventricular repolarization?
   a. P wave
   b. QRS complex
   c. T wave
   d. PR segment
   e. Ventricular repolarization occurs simultaneously with atrial depolarization and consequently cannot be recorded.
28. Which is the normal sequence of the spread of cardiac excitation?

1. AV node
2. SA node
3. atria
4. Purkinje fibers
5. bundle of His
6. ventricular myocardium

a. 2 3 1 5 4 6
b. 3 2 1 4 5 6
c. 2 3 1 4 5 6
d. 1 2 3 4 5 6
e. none of these

29. Extrasystole of the heart means that it
a. beats too slowly
b. fills with too much blood
c. has a complete block
d. loses blood
e. produces a premature beat

30. The SA is the heart's normal pacemaker because
a. It has the fastest rate of autorhythmicity.
b. It has both sympathetic and parasympathetic innervation.
c. It lies in the right atrium.
d. Activation of K⁺ channels occurs more rapidly in this region than elsewhere in the heart.
e. None of these.

31. Fibrillation is the
a. backflow of blood throughout the heart
b. coordinated function of nodal cells
c. failure of the heart valves to function
d. flow of blood through the heart's fibrous skeleton
e. uncoordinated excitation and contraction of cardiac cells

32. The AV node
a. is the normal pacemaker of the heart
b. is the only electrical connection between the atria and the ventricles
c. rapidly conducts the impulse from the atria to the ventricles so that they contract simultaneously
d. is not innervated by the vagus nerve
e. has the slowest rate of depolarization in the heart
33. The electrocardiogram is most useful in determining which component of cardiac output?
   a. stroke volume
   b. heart rate
   c. ejection fraction
   d. end-diastolic volume
   e. murmurs

34. An ectopic focus is the place where
   a. An abnormally excitable area of the heart initiates a premature action potential.
   b. All of the electrical impulses of the heart terminate normally.
   c. An ECG lead is attached on the outside of the chest.
   d. A heart valve is attached.
   e. The chordae tendineae attach to a valve.

35. The function of the ventricular conduction system of the heart is to
   a. spread the action potential throughout the ventricle to ensure a single, coordinated contraction of the both ventricles
   b. spread the action potential in the absence of sympathetic stimulation
   c. spread the action potential throughout the atria and ventricles
   d. slow down the original action potential so it has time to spread through the ventricles evenly
   e. spread the action potential throughout the ventricle to ensure a single, coordinated contraction of the both ventricles, and slow down the original action potential so it has time to spread through the ventricles evenly

36. The refractory period of cardiac muscle
   a. lasts almost as long as the contraction period
   b. is much longer than the refractory period in skeletal muscle
   c. prevents tetanic contraction of the heart to occur to ensure smooth, coordinated ejection of blood from the ventricles
   d. all of these
   e. lasts almost as long as the contraction period and is much longer than the refractory period in skeletal muscle

37. The membrane potential of cardiac muscle cells at rest is about ____ mV.
   a. -110
   b. -90
   c. -70
   d. -50
   e. -30
38. Why can't tetanus occur in the heart?
   a. There are no distinct motor units in the heart.
   b. There is inadequate oxygen supply via the coronary circulation to metabolically support a sustained contraction.
   c. The refractory period in cardiac muscle lasts almost as long as the contraction.
   d. The heart contracts with maximal force every beat so it is impossible to increase the strength of its contraction.
   e. Vagal stimulation slows down the heart rate to prevent summation of contractions.

39. During isovolumetric phases of the systole,
   a. The atria are contracting.
   b. All heart valves are closed.
   c. Blood is being ejected into the aorta.
   d. The ventricles can only be relaxing.
   e. The atria are contracting and all heart valves are closed.

40. The volume of blood ejected from each ventricle during a contraction is called the
   a. end-diastolic volume
   b. end-systolic volume
   c. stroke volume
   d. cardiac output
   e. cardiac reserve

41. The cardiac output is equal to
   a. (EDV - ESV) x HR
   b. heart rate x EDV
   c. the difference between the stroke volume at rest and the stroke volume during exercise
   d. the stroke volume minus the ESV
   e. heart rate x blood pressure

42. Which factor(s) would decrease cardiac output?
   a. increased venous return
   b. decreased vagal stimulation of the heart
   c. increased preload
   d. decreased preload
   e. increased venous return and increased preload

43. If the connection between the SA node and AV node becomes blocked,
   a. The QRS complex will be absent on an ECG.
   b. The ventricles will beat more slowly.
   c. The atria will beat slower.
   d. Tachycardia will occur.
   e. The QRS complex will be absent on an ECG and tachycardia will occur.
44. Which is true when your sympathetic nervous system is more active?
   a. The SA node depolarizes more rapidly.
   b. The myocardium repolarizes more rapidly.
   c. More Ca²⁺ becomes available and causes more forceful heart contractions.
   d. Norepinephrine is stimulating the heart.
   e. All of these.

45. Which of the following decreases ESV?
   a. acetylcholine
   b. preload
   c. afterload
   d. parasympathetic activity
   e. vagal activity

46. What percentage of ventricular filling is normally accomplished before atrial contraction begins?
   a. 0%
   b. 20%
   c. 70%
   d. 50%
   e. 100%

47. Vagal influences on the heart result in
   a. enhanced calcium permeability at the SA node
   b. enhanced potassium permeability at the SA node
   c. less frequent depolarization of the SA node
   d. enhanced calcium permeability at the SA node and enhanced potassium permeability at the SA node
   e. enhanced potassium permeability at the SA node and less frequent depolarization of the SA node

48. A condition in which the heart is contracting in an uncontrolled, rapid, and irregular manner:
   a. is heart block
   b. is fibrillation
   c. no need to be treated
   d. is heart block and fibrillation
   e. all of the above

49. The heart
   a. is sympathetically innervated via cardiac nerve fibers
   b. is parasympathetically innervated by vagus nerve fibers
   c. is innervated by the phrenic nerve
   d. is innervated by only the sympathetic division of the autonomic nervous system
   e. is sympathetically innervated via cardiac nerve fibers and is parasympathetically innervated by vagus nerve fibers
50. When the heart is sympathetically stimulated,
   a. ESV will increase.
   b. It is responding to acetylcholine.
   c. It is responding to norepinephrine.
   d. Ca\(^{2+}\) channels are opening in greater numbers.
   e. It is responding to norepinephrine, and Ca\(^{2+}\) channels are opening in greater numbers.

51. The second heart sound is produced by the
   a. opening of the AV valves
   b. closing of the AV valves
   c. opening of the semilunar valves
   d. closing of the semilunar valves
   e. blood rushing through the AV valves during diastole, creating a turbulent flow

52. The first heart sound
   a. occurs when the AV valves open
   b. occurs when the semilunar valves close
   c. signals the onset of ventricular diastole
   d. occurs when the AV valves close, and signals the onset of ventricular systole
   e. occurs when the semilunar valves close, and signals the onset of ventricular diastole

53. The aortic valve opens
   a. when ventricular pressure exceeds aortic pressure
   b. at the start of ventricular systole
   c. just after the isovolumetric relaxation phase
   d. just before the isovolumetric contraction phase
   e. none of these

54. During isovolumetric contraction,
   a. Rapid filling of the ventricles occurs.
   b. No blood enters or leaves the ventricles.
   c. The maximum volume of blood is ejected.
   d. The maximum rate of ejection occurs.
   e. Both the maximum volume of blood is ejected and the maximum rate of ejection occurs.

55. The period lasting from closure of the AV valve to opening of the aortic valve is known as
   a. isovolumetric ventricular contraction
   b. isovolumetric ventricular relaxation
   c. the rapid ejection phase
   d. the rapid filling phase
   e. none of these

56. A heart valve opens and closes due to
   a. being pulled by the heart muscle
   b. pressure differences on the valve's two sides
   c. Na\(^+\) and K\(^+\) fluxes during ventricular depolarization
   d. turbulent flow in the atria and ventricles
   e. none of these
57. Cardiac output
   a. is the volume of blood pumped by each ventricle during each contraction or beat
   b. is the volume of blood pumped by each ventricle per minute
   c. equals heart rate x stroke volume
   d. is the volume of blood pumped by each ventricle during each contraction or beat, and equals heart rate x stroke volume
   e. is the volume of blood pumped by each ventricle per minute, and equals heart rate x stroke volume

58. The dicrotic notch on the aortic pressure curve is due to
   a. a disturbance set up by the aortic valve closing
   b. a disturbance set up when the AV valves close
   c. elastic recoil of the aorta during ventricular diastole
   d. turbulent flow through a stenotic valve
   e. atherosclerosis in the aorta

59. An insufficient AV valve
   a. fails to open completely
   b. is not connected to chordae tendineae
   c. produces a gurgling diastolic murmur
   d. allows blood to backflow into a ventricle during diastole
   e. none of these

60. Atrial flutter is characterized by a _____ rhythm, as impulses pass from the AV node to the ventricles.
   a. 1:1
   b. 2:1
   c. 3:4
   d. 5:2
   e. 7:1

61. A whistling murmur heard between the first and second heart sound would be indicative of
   a. a stenotic AV valve
   b. an insufficient AV valve
   c. a myocardial infarction
   d. an insufficient semilunar valve
   e. No conclusions can be reached based on the information provided.

62. At rapid heart rates
   a. Systole and diastole shorten equally.
   b. Systole stays almost constant, but diastole shortens.
   c. Systole lengthens and diastole shortens
   d. Diastole lengthens and systole shortens.
   e. None of these.
63. Twelve complete ECG patterns are recorded over 10 seconds, which means the heart rate is ____ beats per
minute.
   a. 60
   b. 72
   c. 90
   d. 108
   e. 120

64. If stroke volume is 80 ml and the heart rate is 70 beats per minute, the cardiac output is
   a. 150 ml/min
   b. 560 ml/min
   c. 5,600 ml/min
   d. 8,700 ml/min
   e. none of these

65. If the cardiac output is 4,800 ml/min and the heart rate is 60 beats per minute, the stroke volume averages ____
ml.
   a. 60
   b. 70
   c. 80
   d. 120
   e. 140

66. According to the Frank-Starling law of the heart,
   a. Shortening cardiac muscle fibers prior to contraction causes a more forceful contraction.
   b. Increasing venous return increases EDV, which leads to an increased stroke volume.
   c. As cardiac output decreases, blood pools in the vasculature and increases arterial blood
      pressure.
   d. The left ventricle must pump more blood than the right ventricle since the left ventricle must
      pump blood to more regions of the body.
   e. The greater the stroke volume, the smaller the subsequent ESV, because as more blood is
      squeezed out, the heart cannot fill as completely.

67. During heart failure,
   a. The Frank-Starling curve is shifted to the left.
   b. The heart pumps out a smaller stroke volume than normal for a given EDV.
   c. A compensatory increase in sympathetic activity increases the contractility of the heart to
      normal in the early stages of the disease.
   d. All of these.
   e. The heart pumps out a smaller stroke volume than normal for a given EDV, and a
      compensatory increase in sympathetic activity increases the contractility of the heart to
      normal in the early stages of the disease.
68. The term **systole** means
   a. closure
   b. conduction
   c. contraction
   d. opening
   e. relaxation

69. Parasympathetic innervation to the heart:
   a. involves the vagus nerve
   b. decreases the rate at which the pacemaker potential reaches threshold
   c. decreases the strength of ventricular contraction
   d. all of these
   e. involves the vagus nerve and decreases the strength of ventricular contraction

70. Sympathetic stimulation of the heart
   a. increases the heart rate
   b. increases the heart's contractility
   c. shifts the Frank-Starling curve to the left
   d. involves the release of norepinephrine
   e. all of these

71. Select the incorrect statement about EDRF.
   a. Released from the endothelium.
   b. Causes vasodilation.
   c. Half life is few seconds.
   d. The main component of viagra.
   e. The most potent vasoconstrictor.

72. Increased ____ permeability of nodal cells hyperpolarizes the SA node.
   a. chloride
   b. iodide
   c. potassium
   d. sodium
   e. zinc

73. The parasympathetic nervous system has little effect on ____ activity.
   a. atrial
   b. AV node
   c. heart rate
   d. SA node
   e. ventricular

74. If the EDV were held constant, increased cardiac output could be accomplished by
   a. decreased sympathetic stimulation of the heart
   b. decreased parasympathetic stimulation of the heart
   c. decreased contractility
   d. increased length of isovolumetric contraction
   e. increased arterial blood pressure
75. Which of the following is not associated with an increase in stroke volume?
   a. increased end-diastolic volume
   b. increased contractility of the heart
   c. increased end-systolic volume
   d. increased preload
   e. increased venous return

76. Vasodilation arteries is induced by
   a. histamine
   b. endothelin
   c. nitric oxide
   d. all of these
   e. a and c

77. The cardiac muscle
   a. extracts oxygen and nutrients from the blood within its chambers
   b. receives its blood supply primarily during ventricular systole when blood is forced into the vessels supplying the heart
   c. receives its blood supply as all blood returning to the heart from the lung passes through the cardiac circulation before being pumped to the systemic circulation
   d. receives most of its blood supply during ventricular diastole by means of the coronary circulation
   e. none of these

78. A metabolic predictor of heart disease that is independent of one's cholesterol/lipid profile is
   a. HDL
   b. VLDL
   c. homocysteine
   d. methionine
   e. creatine

79. At rest, which of the following receives the most blood flow?
   a. heart muscle
   b. kidney
   c. brain
   d. skeletal muscle
   e. liver
80. Resistance
   a. is a measure of the hindrance to blood flow through a vessel caused by friction between the moving fluid and stationary vascular walls
   b. increases 16-fold when the radius of the vessel is reduced by one-half
   c. is doubled when the radius of the vessel is reduced by one-half
   d. is a measure of the hindrance to blood flow through a vessel caused by friction between the moving fluid and stationary vascular walls, and is doubled when the radius of the vessel is reduced by one-half
   e. is a measure of the hindrance to blood flow through a vessel caused by friction between the moving fluid and stationary vascular walls, and increases 16-fold when the radius of the vessel is reduced by one-half

81. Resistance increases when
   a. radius decreases
   b. length decreases
   c. viscosity decreases
   d. red blood cell count decreases
   e. none of these

82. Vasoconstriction
   a. refers to a decrease in the radius of a vessel
   b. of an arteriole decreases blood flow through that vessel
   c. of a vein increases blood flow through that vessel
   d. refers to a decrease in the radius of a vessel, and vasoconstriction of an arteriole decreases blood flow through that vessel.
   e. all of these

83. Which of the following is the correct relationship between pressure, flow, and resistance?
   a. \[ \text{flow} = \frac{\text{pressure gradient}}{\text{radius}^4} \]
   b. \[ \text{flow} \times \text{pressure gradient} = \text{resistance} \]
   c. \[ \text{flow} = \frac{\text{pressure gradient}}{\text{resistance}} \]
   d. \[ \text{pressure gradient} = \frac{\text{flow}}{\text{resistance}} \]
   e. \[ \text{pressure gradient} = \frac{\text{flow}}{\text{radius}^4} \]

84. Blood flow is affected by
   a. pressure differences
   b. the viscosity of the blood
   c. the amount of friction in the blood vessels
   d. the length and diameter of the blood vessels
   e. all of these
85. Vasoconstriction
   a. causes a decrease in resistance
   b. refers to a decrease in the radius of a vessel
   c. is due to a decrease in sympathetic activity
   d. refers to a decrease in the radius of a vessel and is due to a decrease in sympathetic activity
   e. all of these

86. The major determinant influencing resistance to blood flow is the
   a. viscosity of the blood
   b. radius of the vessel through which the blood is flowing
   c. pressure gradient in the vessel
   d. concentration of red blood cells in the blood
   e. amount of plasma protein

87. In an arteriole, if the blood vessel radius is 2 units and is then vasoconstricted to 1 unit,
   a. Blood flow decreases by half.
   b. Resistance increases 16 times.
   c. Blood flow decreases.
   d. All of these.
   e. Resistance increases 16 times and blood flow decreases.

88. The larger arteries assist with systemic blood flow to tissues by
   a. contracting their tunica intima
   b. beating their semilunar-type valves
   c. associating with large veins
   d. elastic recoil of their walls
   e. continuous vasoconstriction

89. Which is not true about blood pressure?
   a. It is maximal during ventricular systole.
   b. It decreases the farther away from the heart.
   c. It increases with increasing resistance.
   d. It decreases with increasing vessel diameter.
   e. It can be increased by direct parasympathetic activity.

90. Which of the following factors would produce the greatest change in blood flow?
   a. doubling the radius of the vessel
   b. doubling the difference in the pressure gradient within the vessel
   c. doubling the viscosity of the blood
   d. doubling the length of the vessel
   e. halving the viscosity of the blood
91. Which type of blood vessel consists of only one cell layer?
   a. arteriole
   b. artery
   c. capillary
   d. vein
   e. venule

92. The microcirculation is composed of
   a. arteries, arterioles, and capillaries
   b. arterioles, capillaries, and venules
   c. arteries, capillaries, and venules
   d. arteries, arterioles, and venules
   e. none of these

93. QT interval is
   a. From the beginning of QRS wave to the beginning of T wave
   b. From end of QRS wave to the end of T wave
   c. From the beginning of QRS wave to the end of T wave
   d. From the end QRS wave to the beginning of T wave
   e. Duration of QRS + duration of T wave

   The arteries
   a. serve as rapid-transit passageways from the heart to the organs because of their large radii
   b. act as a blood reservoir because they have the capacity to store large volumes of blood with little change in their internal pressure
   c. are the major sites of blood flow resistance in the vasculature
   d. are the site of exchange between the blood and surrounding tissues
   e. none of these

94. The major function of the arterioles is to
   a. regulate flow of blood through capillary beds
   b. distribute the cardiac output to tissues
   c. serve as a pressure reservoir
   d. convert the intermittent flow from the heart to a steady outflow
   e. regulate flow of blood through capillary beds and distribute the cardiac output to tissues

   Because of their elasticity, arteries act as a(n) ____ for maintaining blood flow during diastole.
   a. cardiac reserve
   b. venous reserve
   c. arterial capacitance
   d. lymphatic reserve
   e. pressure reservoir
97. The pressure measured in the arteries just before the next ventricular ejection of blood is
   a. systolic pressure 
   b. diastolic pressure 
   c. pulse pressure 
   d. mean pressure 
   e. none of these

98. Select the correct statement about veins.
   a. Their walls are highly muscular.
   b. Their walls consist of one layer of cells.
   c. There are only about 40 large ones in the body.
   d. They serve as a blood reservoir.
   e. They transport blood away from the heart.

99. The pulse pressure is the
   a. difference between the systolic and diastolic pressures 
   b. average pressure throughout the cardiac cycle 
   c. maximum pressure exerted in the arteries 
   d. minimum pressure exerted in the arteries 
   e. change in pressure that can be felt in an artery due to shutting of the aortic valve

100. Mean arterial pressure is:
   a. diastolic pressure + (systolic/3) 
   b. systolic pressure + (pulse pressure/3) 
   c. diastolic pressure + (pulse pressure/3) 
   d. pulse pressure - (diastolic pressure/3) 
   e. pulse pressure + (systolic pressure/3)

101. If the arterial blood pressure is recorded at 132/84, what is the mean arterial pressure?
   a. 100 mm Hg 
   b. 93 mm Hg 
   c. 108 mm Hg 
   d. 48 mm Hg 
   e. none of these

102. If the pulse pressure is 44 mm Hg and the diastolic pressure is 68 mm Hg, the systolic pressure is ____ mm Hg.
   a. 22 
   b. 24 
   c. 66 
   d. 112 
   e. 145
103. What force continues to drive blood through the vasculature during ventricular diastole?
   a. contraction of the ventricles
   b. elastic recoil of the stretched arteries
   c. sympathetic-induced vasoconstriction
   d. skeletal muscles squeezing the blood
   e. respiratory movements creating a pressure gradient that drives blood forward

104. What is the most important factor that increases blood flow through a specific tissue to meet the tissues needs?
   a. Vasoconstriction of arteries forces more blood to flow into the tissue served by those arteries.
   b. Parasympathetic-induced vasodilation of capillaries within the tissue allows more blood to flow into the tissue.
   c. Cellular products cause local vasodilation.
   d. Widespread venous vasoconstriction allows blood to dam up at the tissue level.
   e. All of these, except vasoconstriction of arteries forces more blood to flow into the tissue served by those arteries.

105. Which of the following properties does not pertain to the arterioles?
   a. Their radii remain constant.
   b. Their walls contain a thick layer of smooth muscle.
   c. They are responsible for the distribution of blood flow to the various organs.
   d. They are the major vessels that contribute to total peripheral resistance.
   e. They are richly innervated by sympathetic nerve fibers.

106. As metabolic activity of an organ or tissue increases, blood flow to that organ increases. This phenomenon is known as
   a. pressure autoregulation
   b. tissue anoxia
   c. active hyperemia
   d. hypertension
   e. atherosclerosis

107. Which local chemical changes do not occur during a period of increased cell activity?
   a. increased CO₂
   b. increased acid
   c. decreased adenosine release
   d. increased K⁺
   e. increased osmolarity

108. Which local chemical factor is not associated with vasodilation of arterioles?
   a. decreased prostaglandins in the tissue fluid
   b. increased CO₂
   c. increased acid
   d. decreased O₂
   e. histamine release
109. Increased respiration within a tissue leads to vasodilation of arterioles because
   a. Carbon dioxide levels increase.
   b. Oxygen levels decrease.
   c. Less acid is generated.
   d. All of these.
   e. Carbon dioxide levels increase and oxygen levels decrease.

110. Which statement about nitric oxide is wrong?
   a. It increases the total peripheral resistance by its action on arteriolar smooth muscle.
   b. It relaxes digestive tract smooth muscle.
   c. It is the direct mediator of penile erection.
   d. It is released as "chemical warfare" by macrophages of the immune system.
   e. It serves as a novel type of neurotransmitter in the brain.

111. Extrinsic control of arteriolar radius
   a. is accomplished primarily by the sympathetic nervous system
   b. is important in the regulation of arterial blood pressure
   c. can be overridden by local adjustments
   d. is accomplished primarily by the sympathetic nervous system and is important in the
      regulation of arterial blood pressure
   e. all of these

112. During strenuous exercise, blood flow increases to
   a. the heart because of local control factors
   b. the brain because of reflex control factors
   c. the skeletal muscles because of local control factors
   d. the heart because of local control factors and the skeletal muscles because of local control
      factors
   e. all of these

113. Most sympathetic fibers release _____ at arterioles.
   a. acetylcholine
   b. dopamine
   c. GABA
   d. glycine
   e. norepinephrine

114. The major site of sympathetic blood flow control (resistance changes) is at the
   a. arterioles
   b. capillaries
   c. metarterioles
   d. arteries
   e. veins
115. Each of the following local factors produces the relaxation of arteriolar smooth muscle except increased
   a. acid
   b. carbon dioxide
   c. osmolarity
   d. oxygen
   e. potassium

116. The myogenic response refers to vascular smooth muscle's tendency to
   a. constrict when blood flow increases
   b. relax when blood flow increases
   c. constrict when stretched
   d. dilate when stretched
   e. relax when blood flow increases and dilate when stretched

117. Which does not cause arteriolar vasodilation?
   a. decreased sympathetic stimulation
   b. local decrease in O₂
   c. histamine
   d. EDRF
   e. Angiotensin II

118. During exercise, there is not an increased blood flow to the
   a. skeletal muscles
   b. heart
   c. skin
   d. brain
   e. skin and brain

119. Which factor would reduce total peripheral resistance?
   a. adrenal medulla hormones
   b. angiotensin II
   c. red blood cell concentration
   d. anaphylactic shock
   e. cardiovascular center activity

120. Binding of epinephrine to alpha receptors causes smooth muscle
   a. relaxation in arteries
   b. relaxation in skeletal muscle arteries
   c. constriction in skeletal muscle arteries
   d. relaxation in coronary arteries
   e. none of these
121. Active hyperemia
   a. refers to the arteriolar dilation in response to local chemical changes that accompany increased metabolic activity of the tissue
   b. refers to local arteriolar mechanisms that are aimed at keeping tissue blood flow fairly constant in spite of wide deviations in mean arterial driving pressure
   c. refers to the increase in blood flow to a tissue that occurs after removal of an occlusion of its blood supply
   d. is important in maintaining an adequate pressure head to drive blood forward into a tissue
   e. none of these

122. Which of the following is not a characteristic of capillaries?
   a. thin walls
   b. short distance between adjacent vessels
   c. distensible walls
   d. slow blood velocity
   e. large total surface area

123. The largest total cross-sectional area is found in the
   a. aorta
   b. arterioles
   c. capillaries
   d. venules
   e. veins

124. Through which vessel is the velocity of blood flow the slowest?
   a. aorta
   b. arterioles
   c. capillaries
   d. venules
   e. veins

125. The velocity of blood flow in capillaries is
   a. greater than that for arterioles
   b. greater than that for veins
   c. slow enough to favor adequate exchange of nutrients and wastes
   d. greater than that for arterioles and the veins
   e. greater than that for veins and slow enough to favor adequate exchange of nutrients and wastes

126. As the total cross-sectional area of the vascular tree _____, the velocity of blood flow _____.
   a. increases; decreases
   b. increases; increases
   c. decreases; decreases
   d. increases; remains constant
   e. decreases; remains constant
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مع خالص الأماني بالتوفيق و النجاح
د حسين القاس
لاستفسار عن أسئلة
0796813066