PRINT YOUR NAME AND ID NUMBER in the space that is provided on the answer sheet, and then blacken the letter boxes below the corresponding letters of your name and ID number. You will have 4 points DEDUCTED if you fail to do this!!!!!!

WRITE YOUR TEST FORM LETTER above your name on the answer sheet.

WRITE YOUR LAB SECTION # AND TA'S NAME on the upper margin of your answer sheet.

Your exam should have 39 questions and 8 pages. Please check to make sure it is complete.

For each of the following questions, please indicate the most correct answer by blackening the corresponding letter on the accompanying answer sheet. Each correct answer is worth 2 points. Partial credit of ½ point may be available for questions that have answers such as “all the above”, “both a and b are true”, etc.

1. A muscle fiber can be innervated by multiple motor neurons.
   a) True
   b) False

2. The contraction time of a skeletal muscle is the time between initiation of stimulation and peak contraction of the muscle.
   a) True
   b) False

3. During contraction of all types of muscle cells, Ca++ initiates contraction by entering the cytoplasm of the muscle cell by the process of facilitated diffusion.
   a) True
   b) False

4. The plateau phase of the contractile cell action potential is caused by Na+ entering the cell.
   a) True
   b) False

5. The radii of arterioles can be adjusted independently to variably distribute cardiac output among organs.
   a) True
   b) False

6. Platelets contain actin and myosin.
   a) True
   b) False
7. Ischemic heart disease is
   a) Rapid but regular depolarizations and contractions
   b) Rapid irregular uncoordinated depolarizations contractions
   c) Action potentials not conducted between atria and ventricles
   d) Over excitation of non-SA node autorhythmic regions of heart
   e) **Reduced blood supply to heart**

8. The steps of synaptic transmission at a neuromuscular junction are listed below, out of order. Choose the correct order.
   1. Acetylcholine binds to receptors on muscle cell.
   2. Acetylcholine is released.
   3. A graded potential is produced on the motor end plate.
   4. An action potential is produced on the muscle cell membrane.
   5. Channels for both sodium and potassium are opened.
   7. An action potential arrives at the axon terminal.

   a) 7-5-2-1-3-4-6
   b) 7-6-2-1-5-3-4
   c) 6-7-2-1-5-3-4
   d) 4-3-5-7-2-6-1
   e) 7-6-2-1-3-5-4

9. The parasympathetic nervous system can act as a stimulus to which types of muscle cells?
   a) Single-unit smooth
   b) Cardiac autorhythmic
   c) Cardiac contractile
   d) All the above
   e) a and b only

10. In Fig 1, the muscle length that gives maximum contraction is
    a) 60 to 80
    b) 80 to 100
    c) **100 to 120**
    d) 120 to 140
    e) 140 to 160

11. The rapid depolarization of cardiac contractile cell membranes when threshold is reached is caused by Ca^{++} entering the cell.
    a) True
    b) **False**

12. Increased venous return will result in a decreased cardiac output.
    a) True
    b) **False**
13. Indicate which is the proper sequence of blood flow through the circulatory system:

1. right atrium
2. left atrium
3. right ventricle
4. left ventricle
5. pulmonary artery
6. pulmonary vein
7. lungs
8. systemic tissues
9. aorta
10. venae cavae

a) 10-1-2-3-4-5-6-7-8-9
b) 10-2-4-5-7-6-1-3-9-8
c) **10-1-3-5-7-6-2-4-9-8**
d) 10-1-2-3-4-5-7-6-9-8
e) 10-2-1-3-4-5-7-6-9-8

14. Place the sequence of a skeletal muscle contraction in order:

1. Ca\(^{++}\) binds to troponin
2. End Plate Potential becomes Action Potential on surface of membrane
3. Tropomyosin moves aside
4. Actin binds to myosin
5. Action potential moves into T tubules
6. Ca\(^{++}\) released from SR
7. Cross-bridge cycling occurs
8. Ca\(^{++}\) pumped into SR

a) 2-6-5-1-3-4-7-8
b) **2-5-6-1-3-4-7-8**
c) 2-5-6-1-4-3-7-8
d) 2-8-5-6-3-4-7-1
e) 2-5-6-3-4-1-7-8

15. Asynchronous recruitment of skeletal muscle fibers can occur during tetanus.

a) True
b) **False**

d) a and b only
e) a and c only

16. Myogenic activity can occur in

a) Single-unit smooth
b) Cardiac autorhythmic
c) Multi-unit smooth
d) **a and b only**
e) **a and c only**

17. Reducing the radius of blood vessels by half will increase blood pressure by a factor of 16.

a) True
b) **False**
18. Your hematocrit level is
   a) **The percent of whole blood that is red blood cells**
   b) The percent of whole blood that is plasma
   c) The percent of your ECF that is plasma
   d) The percent of your ECF that is interstitial fluid
   e) The percent of your total body fluids that are ECF

19. End Diastolic Volume is 150 ml/beat, End Systolic Volume is 80 ml/beat, and heart rate is 60 beats/min. What is the stroke volume? What is the cardiac output?
   a) 230 ml/beat; 290 ml/min
   b) 70 ml/beat; 1300 ml/min
   c) 20 ml/beat; 120 ml/min
   d) **70 ml/beat; 4200 ml/min**
   e) 70 ml/beat; 4900 ml/min

20. Fast oxidative fibers contain more mitochondria than fast glycolytic fibers
   a) **True**
   b) False

21. Which type(s) of muscle cell are connected by gap junctions?
   a) **Cardiac contractile**
   b) **Single-unit smooth**
   c) Multi-unit smooth
   d) All the above
   e) a and b only

22. Place the sequence of cross-bridge cycling in order:
   1. Ca++ released from SR
   2. “Power stroke” as myosin pulls actin forward
   3. ATP split into ADP and Phosphate on myosin
   4. Myosin binding site on actin exposed
   5. ADP released by myosin
   6. ATP binds myosin
   7. Actin releases myosin

   a) 1-7-6-3-5-4-2
   b) 1-3-4-5-2-7-6
   c) **1-4-2-5-6-7-3**
   d) 1-4-2-5-7-6-3
   e) 1-6-3-4-2-5-7

23. On entry into a smooth muscle cell, Ca++ binds calmodulin to initiate the sequence of events that result in cross bridge cycling.
   a) **True**
   b) False
24. Increased metabolic demands of a tissue usually leads to vasoconstriction of arterioles leading to that tissue.
   a) True  
   b) **False**

25. In a healthy person, the AV node functions as the pacemaker of the heart.
   a) True  
   b) **False**

Questions 26 and 27 refer to the following events in the cardiac cycle on the left side of the heart:
1) Atrium is in diastole  9) Ventricle is in diastole
2) Atrium is in systole  10) Ventricle is in systole
3) Atrial pressure is greater than ventricular pressure  11) Ventricular pressure is greater than aortic pressure
4) Atrial pressure is less than ventricular pressure  12) Ventricular pressure is less than aortic pressure
5) AV valve is closed  13) Aortic valve is closed
6) AV valve is open  14) Aortic valve is open
7) Blood flow is from atrium to ventricle  15) Blood flow is from ventricle to aorta
8) No blood flow from atrium to ventricle

26. Which of the following best describe the events during part C of Fig. 2?
   a) 2, 4, 6, 7, 9, 12, 14, 15  
   b) 2, 3, 6, 7, 9, 12, 13, 16  
   c) 1, 4, 5, 8, 9, 12, 13, 16  
   d) **1, 4, 5, 8, 10, 11, 14, 15**  
   e) 1, 3, 6, 7, 10, 11, 13, 15

27. Which of the following best describe the events that occur during the TP interval in an ECG?
   a) 2, 3, 6, 7, 9, 12, 13, 16  
   b) 1, 3, 6, 7, 10, 11, 13, 15  
   c) 1, 3, 6, 7, 9, 12, 14, 15  
   d) **1, 3, 6, 7, 9, 12, 13, 16**  
   e) 1, 4, 5, 8, 10, 11, 13, 15

28. When energy is needed for muscle contraction at the onset of exercise, creatine phosphate is produced from ATP and creatine and is used as energy by the muscle
   a) True  
   b) **False**

29. The leading cause of death in Western nations is
   a) Heart block  
   b) Ectopic focus  
   c) Atrial flutter  
   d) Atrial fibrillation  
   e) **Ischemic heart disease**
30. Ventricular fibrillation is
   a) Rapid but regular depolarizations and contractions of ventricles
   b) **Rapid irregular uncoordinated depolarizations contractions of ventricles**
   c) Action potentials not conducted between atria and ventricles
   d) Over excitation of non-SA node autorhythmic regions of heart
   e) Reduced blood supply to heart

31. The binding of epi and/or norepi to ______ receptors on contractile cells in the ventricles will
    increase contractile strength of ventricles by ______ the Ca++ permeability of the cells,
    ______ Ca++ movement out of the SR, ______ the rate of myosin ATPase activity and
    _____ the rate of pumping Ca++ back into the SR.
   a) Beta-2; increasing; increasing; decreasing; decreasing
   b) Beta-1; increasing; increasing; decreasing; decreasing
   c) Beta-1; decreasing; increasing; decreasing; increasing
   d) Beta-2; increasing; increasing; increasing; decreasing
   e) Beta-1; increasing; increasing; increasing; increasing

32. The velocity of blood through the capillaries is very slow in order to
   a) Increase the surface area for capillary exchange
   b) Minimize the distance over which capillary exchange occurs
   c) **Maximize time for capillary exchange**
   d) Decrease the flow rate of the blood
   e) Both c and d are correct

33. Atria and ventricles have separate cycles of systole and diastole.
   a) **True**
   b) False

34. What causes the initial phase of depolarization in cardiac autorhythmic cells?
   a) Ca++ entering the cell through Ca++ L channels
   b) Na+ entering the cell through funny channels
   c) A decrease in the leak of K+ out of the cell
   d) All the above
   e) **b and c only**

35. Thrombin is converted to fibrinogen by factor XIIIa.
   a) True
   b) **False**

36. A sarcomere is the area between two Z lines and is the functional unit of skeletal muscle.
   a) **True**
   b) False
37. If damage to the AV node slowed down conduction through this tissue, what would be observed on an ECG?
   a) a larger P wave
   b) a longer P wave
   c) **a longer PR interval**
   d) a wider QRS complex
   e) an inverted T wave

38. Bulk flow is the most important method of capillary exchange.
   a) True
   b) **False**

39. Pacemaker activity shifting to the Purkinje fibers is called
   a) Atrial flutter
   b) **Ectopic focus**
   c) Ventricular fibrillation
   d) Myocardial infarction
   e) Atrial fibrillation
Fig. 1

Resting length of muscle (%)

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Fig. 2: Blood Volume in Ventricle During Cardiac Cycle

Ventricle Volume (mL)

Time
1. Place the sequence of cross-bridge cycling in order:
   1. Ca++ released from SR
   2. “Power stroke” as myosin pulls actin forward
   3. ATP split into ADP and Phosphate on myosin
   4. Myosin binding site on actin exposed
   5. ADP released by myosin
   6. ATP binds myosin
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   a) 1-7-6-3-5-4-2
   b) 1-3-4-5-2-7-6
   c) 1-4-2-5-6-7-3
   d) 1-4-2-5-7-6-3
   e) 1-6-3-4-2-5-7

2. Indicate which is the proper sequence of blood flow though the circulatory system:
   1. right atrium  6. pulmonary vein
   2. left atrium   7. lungs
   3. right ventricle  8. systemic tissues
   4. left ventricle  9. aorta
   5. pulmonary artery  10. venae cavae

   a) 10-1-2-3-4-5-6-7-8-9
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7) Blood flow is from atrium to ventricle           15) Blood flow is from ventricle to aorta
8) No blood flow from atrium to ventricle           16) No blood flow from ventricle to aorta

3. Which of the following best describe the events during part C of Fig. 2?
   a) 2, 4, 6, 7, 9, 12, 14, 15
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   a) 2, 3, 6, 7, 9, 12, 13, 16
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   ______ Ca++ movement out of the SR, ______ the rate of myosin ATPase activity and
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   b) Beta-1; increasing; increasing; decreasing; decreasing
   c) Beta-1; decreasing; increasing; decreasing; increasing
   d) Beta-2; increasing; increasing; increasing; decreasing
   e) **Beta-1; increasing; increasing; increasing; increasing**

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Resting length of muscle (%)  
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