1) On the electrocardiogram, repolarization of the atria is represented by the:
   A) P wave
   B) QRS complex
   C) T wave
   D) PQ segment
   E) It does not appear on the EKG since it is obscured by the QRS complex.

2) Which of the following is not a structural classification of neurons?
   A) Nonpolar
   B) Multipolar
   C) Unipolar
   D) Bipolar

3) Myocardial ischemia may cause:
   A) cardiac stenosis
   B) cardiac defibrillation
   C) angina pectoris
   D) cardiac arrest

4) Which of the following statements about slow-twitch muscle fibers is false?
   A) Slow-twitch muscle fibers are smaller than fast-twitch fibers.
   B) Slow-twitch muscle fibers are anaerobic.
   C) Slow-twitch muscle fibers are fatigue resistant.
   D) Slow-twitch muscle fibers have abundant mitochondrion and myoglobin.

5) Which of the following structures allow one cardiac cell to electronically stimulate another by allowing ion flow across the intercalated disk?
   A) fascia adherens
   B) gap junctions
   C) desmosomes
   D) intercellular folds

6) The variation of stimulation needed in skeletal muscle contraction in order to have controlled movement is called a:
   A) muscle twitch.
   B) wave summation.
   C) multiple motor unit summation.
   D) graded muscle response.

7) A normal heartbeat of 70-80 beats per minute is referred to as:
   A) nodal rhythm
   B) sinus rhythm
   C) fibrillation
   D) heart block
   E) systolic rhythm

8) When an action potential arrives at the neuromuscular junction, the most immediate result is:
   A) a rise in intracellular Ca2+ levels.
   B) the formation of actin-myosin cross bridges.
   C) the depolarization of the sarcolemma.
   D) the release of acetylcholine.

9) Of the pathways listed, which correctly describes a route that blood can take in a normal mammal?
   A) right atrium > pulmonary semilunar valve > right ventricle > tricuspid valve
   B) tricuspid valve > right atrium > pulmonary semilunar valve > right ventricle
   C) left atrium > bicuspid valve > left ventricle > aortic semilunar valve
   D) right atrium > tricuspid valve > right ventricle > aortic semilunar valve
   E) left atrium > tricuspid valve > left ventricle > pulmonary semilunar valve

10) Thin myofilaments are composed chiefly of:
    A) actin.
    B) troponin.
11) If the time of ventricular filling were increased in duration:
   A) less blood would flow into the ventricles
   B) the end diastolic volume (EDV) would be greater
   C) the end systolic volume (ESV) would be greater
   D) the EDV and ESV would remain the same

12) Which of the following statements is false?
   A) A neuron cell membrane is very permeable to K+.
   B) Na+ is 40 times as concentrated in the ICF as in the ECF.
   C) The Na+/K+ pump removes 3 Na+ from the cell for every 2 K+ it pumps into the cell.
   D) The unequal distribution of ions across the cell membrane produces the membrane potential.

13) What would occur if a muscle became totally depleted of ATP?
   A) The muscle would exhibit isometric contraction.
   B) The muscle would remain in a contracted state due to an inability to break actin-myosin cross bridges.
   C) The muscle would exhibit isotonic contraction.
   D) The muscle would relax and lengthen due to an inability to sustain actin-myosin cross bridges.

14) When the atria begin depolarizing, which of the following is occurring?
   A) ventricular filling
   B) ventricular ejection
   C) atrial filling
   D) atrial ejection

15) Which of the following is a regulatory protein of muscle?
   A) actin
   B) myosin
   C) tropomyosin
   D) titin

16) Which of the following would lead to a decrease in heart rate?
   A) Norepinephrine
   B) Parasympathetic stimulation
   C) Exercise
   D) Sharply decreased blood volume

17) Derived from white blood cells, these cells in the central nervous system are often found at the site of injury of brain tissue.
   A) oligodendrocytes
   B) Schwann cells
   C) astrocytes
   D) ependymal cells
   E) microglia

18) During the depolarization phase of an action potential in a neuron:
   A) K+ ions move from inside to outside the membrane
   B) Na+ ions move from outside to inside the membrane
   C) The Na/K ATPase pumps Na into the cell
   D) K+ and Na+ ions trade places across the membrane
   E) Both K+ and Na+ move from outside to inside the membrane

19) Action potentials become weaker with distance.
   A) True
   B) False

20) The principle that states the force of contraction is dependent on the degree of stretch or contraction prior to stimulation is the:
   A) sliding filament theory
   B) muscle tone
   C) length-tension relationship
   D) summation principle

21) The most correct sequence in the cardiac conduction system is:
   A) SA node > AV bundle > AV node > bundle branches > Purkinje fibers
B) AV bundle > SA node > AV node > bundle branches > Purkinje fibers
C) Purkinje fibers > AV bundle > SA node > AV node > bundle branches
D) SA node > AV node > AV bundle > bundle branches > Purkinje fibers
E) AV bundle > AV node > bundle branches > SA node > Purkinje fibers

22) An increase in afterload will promote an immediate increase in cardiac output.
   A) True
   B) False

23) All parts of a neuron are not in the refractory period at the same time.
   A) True
   B) False

24) What is the correct sequence of the following events?
1. neurotransmitter is released
2. action potential reaches the axon terminal
3. Calcium ions enter the axon terminal
4. neurotransmitter binds to receptors on the post-synaptic cell
5. the post-synaptic cell is depolarized.
   A) 2, 3, 1, 4, 5
   B) 1, 2, 3, 4, 5
   C) 2, 1, 3, 5, 4
   D) 3, 2, 1, 5, 4

25) When does the electrical symbol become transduced into a chemical signal?
   A) when the action potential reaches the axon terminal
   B) when the neurotransmitter is released
   C) when the neurotransmitter binds to the post-synaptic cell
   D) when the post-synaptic cell is depolarized

26) What is the primary difference between the somatic nervous system and the autonomic nervous system?
   A) The somatic nervous system allows us to consciously control our skeletal muscles, and the autonomic nervous system controls activity that humans cannot consciously control, such as the pumping of the heart and the movement of food through the digestive tract.
   B) The autonomic nervous system enables us to control our involuntary muscles, while the somatic nervous system controls our glands.
   C) The autonomic nervous system allows us to consciously control our skeletal muscles, and the somatic nervous system controls activity that humans cannot consciously control, such as the pumping of the heart and the movement of food through the digestive tract.
   D) The somatic nervous system enables us to control our involuntary muscles, while the autonomic nervous system controls our glands.

27) Acetylcholinesterase:
   A) breaks down acetylcholine.
   B) activates acetylcholine.
   C) is another name for acetylcholine.
   D) helps acetylcholine bind to its receptor.

28) Which of the following membrane ion channels open and close in response to changes in the membrane potential?
   A) Chemically gated channels
   B) Non-gated channels
   C) Mechanically gated channels
   D) Voltage-gated channels

29) Which of the following statements is incorrect?
   A) The firing of the SA node stimulates both atria to contract almost simultaneously.
   B) The signal to contract is delayed at the AV node, allowing the ventricles to fill with blood.
   C) Firing signals reach the papillary muscles before the rest of the ventricular myocardium.
   D) Ventricular contraction begins at the AV valves and progresses downward toward the apex of the heart.

30) Which of the following is not true of chemical synapses?
   A) Each is comprised of an axon terminal and a receptor region.
   B) They communicate unidirectionally.
   C) They possess pre- and postsynaptic membranes separated by a synaptic cleft.
   D) They transmit nerve impulses directly from one neuron to another.
31) T tubules are extensions of the ______________ in skeletal muscle.
   A) sarcoplasmic reticulum
   B) sarcolemma
   C) junctional folds
   D) cytoskeleton
   E) thick filament

32) All of the following are structural components of the neuromuscular junction except:
   A) synaptic bulbs
   B) junctional folds
   C) basal lamina
   D) T tubules
   E) acetylcholine receptors

33) After the power stroke has occurred during skeletal muscle contraction, what must occur in order for the acto-myosin cross-bridge to be released?
   A) ATP must be cleaved
   B) myosin must be dephosphorylated
   C) ATP must bind with the myosin head
   D) calcium must bind with myosin
   E) troponin must bind with tropomyosin

34) The time lapse between the beginning of stimulus and the beginning of a twitch is called:
   A) refractory period.
   B) contraction phase.
   C) relaxation phase.
   D) latent period.

35) If you attempt to lift a heavy object but it doesn't move, what type of contraction have you performed?
   A) concentric
   B) eccentric
   C) isotonic
   D) isometric
Essay Topics

Below are 11 sample essay questions. For each, draft the response you would provide on an actual exam. Use key words and topic sentences to make an outline of a potential essay. Make sure to draw any diagrams required. Note: Most of these questions can most easily be answered with a schematic representation accompanied by brief descriptions of the drawn elements. In other words: if it helps – DRAW A PICTURE.

**Nervous System**

1) Explain how summation, EPSPs and IPSPs work to influence events at the post-synaptic neuron.

2) Explain trace the initiation, propagation and termination of the action potential through the neuron. Be sure to include refractory periods and neurotransmitters in your discussion.

3) Explain the role of myelination in signal conduction.
Muscle System
1) Explain what is meant by excitation-contraction coupling and trace the events involved.

2) Explain what events must occur on the myofibril level in order for a muscle contraction and relaxation to take place.
3) Compare and contrast type I and type II muscle fibers

4) Explain what is meant by the 'graded' nature of muscle response.

**Cardiovascular**

1) Trace the path of blood through the heart, including all valves, system designations, as well as the order of chamber contractions responsible for its movement. Please know how to answer this question on your own, I will not be going over it in the exam review.

2) Trace the electrical events involved in cardiac contraction.
3) Explain electrocardiography by drawing a normal EKG and explaining its elements, and then giving examples of cardiac abnormalities that can be detected using this diagnostic tool.

4) Discuss the effects of exercise on the heart.