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 50 questions. 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. Cells specialized for contraction and force generation form which type of primary tissue?
   a) muscle tissue
   b) nervous tissue
   c) epithelial tissue
   d) connective tissue
   e) none of the above

2. What is the primary mechanism for maintaining homeostasis?
   a) inherent control
   b) positive feedback
   c) negative feedback
   d) intrinsic control
   e) extrinsic control

3. Proteins are produced by the _______, are packaged inside transport vesicles in the _______, and are processed into final form once they reach the ________.
   a) golgi complex, rough endoplasmic reticulum, smooth endoplasmic reticulum
   b) smooth endoplasmic reticulum, rough endoplasmic reticulum, golgi complex
   c) smooth endoplasmic reticulum, golgi complex, rough endoplasmic reticulum
   d) rough endoplasmic reticulum, smooth endoplasmic reticulum, golgi complex
   e) rough endoplasmic reticulum, smooth endoplasmic reticulum, mitochondria

4. Metabolic pathway(s) that produce ATP only in the presence of oxygen is (are)
   a) Krebs cycle
   b) glycolysis
   c) oxidative phosphorylation
   d) all the above
   e) a and c only
5. Which of the following would best be able to diffuse across cell membrane?
   a) a large uncharged molecule
   b) a small uncharged molecule
   c) a large charged molecule
   d) a small charged molecule
   e) all the above can cross equally well

6. Resting membrane potential
   a) is a separation of electrical charges across a membrane
   b) persists because all passive diffusion out of the cell is balanced by passive diffusion into the cell
   c) is caused by high Na⁺ and Cl⁻ inside the cell and high K⁺ outside the cell
   d) both a and b are true
   e) both a and c are true

7. In which Figure 1 graph(s) on page 9 does an influx of Na⁺ cause the steep rising phase that occurs after threshold is reached?
   a) Fig 1a
   b) Fig 1b
   c) Fig 1c
   d) All the above
   e) Only a and b

8. _____ ensures the unidirectional movement of an action potential, and sets an upper limit to the frequency of occurrence of action potentials.
   a) Mylenation
   b) The All or None Law
   c) The refractory period
   d) Both a and c
   e) Both b and c

9. When an action potential reaches a synapse, neurotransmitters
   a) enter the pre-synaptic neuron
   b) cause exocytosis of synaptic vesicles
   c) open volted gated Ca²⁺ channels in the pre-synaptic neuron
   d) diffuse across the synapse and bind to receptors on the post-synaptic membrane
   e) both b and d

10. Simultaneous firings of several excitatory presynaptic neurons causes
    a) spatial summation
    b) temporal summation
    c) inhibition
    d) all of the above
    e) both a and b

11. The part of the brain that is the critical link between the nervous and endocrine systems is
    a) The brain stem
    b) The cerebellum
    c) The cerebral cortex
    d) The hypothalamus
    e) The basal nuclei
12. Which of the following is most involved in generating emotions?
   a) Brain stem
   b) Cerebellum
   c) Hypothalamus
   d) Thalamus
   e) Limbic system

13. When an olfactory receptor binds a chemical, it causes _____ to _____ the receptor. This creates a (n) _______ in the afferent axon.
   a) Na\(^+\) and K\(^+\); enter; action potential
   b) Na\(^+\) and Ca\(^{++}\); enter; graded potential
   c) Na\(^+\) and Ca\(^{++}\); enter; action potential
   d) Na\(^+\) and Ca\(^{++}\); exit; graded potential
   e) Ca\(^{++}\) and neurotransmitter; enter; action potential

14. Which of the following is NOT true of the afferent nervous system?
   a) it has sensory receptors
   b) it has axon terminals in the efferent nervous system
   c) it sends information to the CNS
   d) it has 6 kinds of receptors
   e) it can convert receptor potentials into action potentials

15. During a fight or flight response, _________ receptors in blood vessels leading to the GI tract bind primarily _____ which causes the blood vessels to _________.
   a) Beta-2; epi; dilate
   b) Beta-2; norepi; dilate
   c) Alpha; norepi; constrict
   d) Beta-1; epi; dilate
   e) Beta-1; norepi; dilate

16. When an action potential reaches the terminal button at a neuromuscular junction
   a) it triggers the opening of Ca\(^{++}\) channels so that Ca\(^{++}\) enters the terminal button and causes the release of acetylcholine
   b) it triggers the opening of Ca\(^{++}\) channels so that Ca\(^{++}\) enters the terminal button and causes the release of epinephrine
   c) it triggers the opening of Ca\(^{++}\) channels so that Ca\(^{++}\) leaves the terminal button and causes the release of acetylcholine
   d) it triggers the opening of Ca\(^{++}\) channels so that Ca\(^{++}\) leaves the terminal button and diffuses to the motor end plate
   e) it triggers the opening of acetylcholine channels so that Ca\(^{++}\) leaves the terminal button and diffuses to the motor end plate.

17. _______ stimulates the thyroid gland to produce the two thyroid hormones.
   a) TSH
   b) TRH
   c) T3
   d) T4
   e) Both c and d
18. Refer to Fig.2 on page 9. Menstruation occurs because ___ decline(s)
   a) 3b and 4b
   b) 3b
   c) 4b
   d) 1b and 2b
   e) 1b and 3b

19. Refer to Fig.2 on page 9. Hormone 2b negatively feeds back on
   a) The corpus luteum
   b) The follicle
   c) The hypothalamus
   d) The pituitary
   e) The hypothalamus and pituitary

20. Which of the following statements about motor units is (are) true?
   a) The number of muscle fibers in a motor unit that contract is proportional to the strength of the
      action potential in the motor neuron
   b) Anytime a muscle contracts all the motor units in the muscle are activated
   c) An action potential in a motor neuron causes a contraction in all the fibers in its motor unit
   d) Both b and c are true
   e) None of the above are true

21. The sarcoplasmic reticulum in skeletal muscle stores _____ when a muscle is relaxed and releases it
    for binding to ______ during contraction
    a) Ca++, troponin
    b) Ca++, tropomyosin
    c) Na+, tropomyosin
    d) K+, tropomyosin
    e) Na+, troponin

22. Some athletes take creatine as a performance enhancing supplement because it
   a) is used to bind actin to myosin in muscle
   b) is used to move the troponin aside to expose the binding sites on tropomyosin
   c) is used to interconvert fast-glycolytic to slow-oxidative muscle fibers
   d) is used to produce acetylcholine for action at neuromuscular junctions
   e) is used to store high energy phosphate bonds that produce ATP

23. During smooth muscle contraction, Ca++ enters the cell primarily from the _____, activates
    _________, which in turn activates _______ to phosphorylate myosin.
    a) SR; troponin; tropomyosin
    b) SR; calmodulin; myosin kinase
    c) ECF; calmodulin; myosin kinase
    d) SR; myosin kinase; calmodulin
    e) ECF; myosin kinase; calmodulin
24. Blood flow in the body goes from  
a) left ventricle to pulmonary circulation to right atria to right ventricle to systemic circulation to left atrium  
b) left atrium to pulmonary circulation to right ventricle to right atrium to systemic circulation to left ventricle  
c) right ventricle to pulmonary circulation to left atrium to left ventricle to systemic circulation to right atrium  
d) right atrium to pulmonary circulation to left ventricle to left atrium to systemic circulation to right ventricle  
e) none of the above

25. In which Figure 1 graph(s) does an influx of Ca++ cause the rising phase that occurs after threshold?  
a) Fig 1a  
b) Fig 1b  
c) Fig 1c  
d) Only b and c  
e) All the above

The following question refers to the following events in the cardiac cycle on the left side of the heart:  
1) AV valve is open  
2) AV valve is closed  
3) Aortic valve is open  
4) Aortic valve is closed  
5) Atrial pressure is higher than ventricular pressure  
6) Ventricular pressure is higher than atrial pressure  
7) Aortic pressure is higher than ventricular pressure  
8) Ventricular pressure is higher than aortic pressure  
9) Blood flow is from atrium to ventricle  
10) Blood flow is from ventricle to aorta  
11) No blood flow from atrium to ventricle  
12) No blood flow from ventricle to aorta  
13) Blood flow from vein to atrium  
14) No blood flow from vein to atrium

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

27. Which of the following effects of increased sympathetic nervous system activity on heart rate is NOT true?  
a) increasing rate of SA depolarization  
b) increasing AV nodal delay  
c) speeding up spread of action potentials through Purkinje fibers  
d) speeding up spread of action potentials through Bundle of His  
e) increasing strength of contraction of atrial and ventricular contractile cells

28. The major way that blood flow is regulated to specific organs, and one of the major ways that mean arterial blood pressure is controlled, is  
a) adjusting the radii of arteries  
b) adjusting the radii of veins  
c) adjusting the radii of arterioles  
d) all the above  
e) a and c only
29. Which of the following statements about the lymph system is NOT true? 
   a) returns excess fluid to cardiovascular system 
   b) approximately the entire plasma volume passes through the lymph every 24 hours 
   c) transports fat from GI tract 
   d) helps in defense against disease 
   e) free fluid exchange from lymph vessels to interstitial fluid 

30. Doubling the radius of an arteriole will _________ its resistance by a factor of _______.
   a) Increase; 16 
   b) Decrease; 16 
   c) Increase; 4 
   d) Decrease; 8 
   e) Increase; 8 

31. Indicate the proper sequence of events during inspiration:
   1. Inspiratory muscles contract  
   2. Inspiratory muscles relax  
   3. Thoracic cavity enlarges  
   4. Thoracic cavity decreases  
   5. Lungs expand  
   6. Lungs decrease  
   7. No pressure gradient  
   8. Pressure gradient from lungs to environment  
   9. Pressure gradient from environment to lungs  
   10. No air flow between lungs and environment  
   11. Air flow from lungs to environment  
   12. Air flow from environment to lungs
   a) 1, 3, 5, 9, 12 
   b) 3, 1, 9, 5, 12 
   c) 1, 4, 6, 8, 11 
   d) 12, 9, 5, 3, 1 
   e) 1, 4, 5, 9, 12 

32. The reason why breathing more slowly but with deeper breaths is more effective than rapid shallow breathing is because of 
   a) anatomical dead space 
   b) tidal volume 
   c) air still in lungs after maximal expiration 
   d) lung volume 
   e) peripheral chemoreceptors that monitor $P_{CO_2}$ 

33. Increased metabolism leads to a right shift in the Hb-O$_2$ saturation curve; this means 
   a) Hb delivers less O$_2$ to systemic tissues for a given P$_{O_2}$ 
   b) Hb delivers more O$_2$ to systemic tissues for a given P$_{O_2}$ 
   c) Hb picks up significantly less O$_2$ at the lungs 
   d) Hb can not pick up CO$_2$ at the systemic tissues 
   e) none of the above 

34. The most precise regulation of ventilation occurs via 
   a) peripheral chemoreceptor that monitor P$_{O_2}$ 
   b) peripheral chemoreceptors that monitor P$_{CO_2}$ 
   c) peripheral chemoreceptors that monitor H$^+$ 
   d) central chemoreceptors that monitor P$_{O_2}$ 
   e) central chemoreceptors that monitor H$^+$
35. During glomerular filtration, plasma and plasma ions are ____ passed from ____ to ____.
   a) selectively, the glomerulus, Bowman’s Capsule
   b) selectively, Bowman’s Capsule, the glomerulus
   c) non-selectively, the glomerulus, Bowman’s Capsule
   d) non-selectively, Bowman’s capsule, the glomerulus
   e) non-selectively, the afferent arteriole, the glomerulus

36. Which of the following statements about regulation of glomerular filtration rate is true?
   a) During exercise blood pressure and glomerular filtration rate increase and more urine is produced
   b) During exercise the parasympathetic causes vasoconstriction of the glomerular capillaries to reduce glomerular filtration rate and therefore reduce urine production
   c) During exercise the parasympathetic causes vasodilation of the glomerular capillaries to reduce glomerular filtration rate and therefore reduce urine production
   d) During exercise the kidney can detect an increase in blood pressure and vasoconstrict glomerular capillaries to reduce glomerular filtration rate and therefore reduce urine production
   e) Both b and d are true

37. Of the Na+ filtered into the tubular system, about________ is recovered through the process of _____.
   a) 75%; tubular reabsorption
   b) 90%; tubular reabsorption
   c) 75%; tubular secretion
   d) 99.5%; tubular reabsorption
   e) 99.5%; tubular secretion

38. Which of the following statements about K+ is true?
   a) secretion of H+ causes secretion of K+
   b) it is regulated during reabsorption
   c) increases in plasma K+ cause decreases in aldosterone production
   d) reabsorption of Na+ causes secretion of K+
   e) all the above are true except for b

39. When Na+ levels fall, the juxtaglomerular apparatus releases renin, which ultimately causes the production of angiotensin II and aldosterone, which in turn cause
   a) addition of Na+-K+-ATPase pumps to the basolateral membranes, increases in vasopressin levels, and an increase in thirst
   b) addition of Na+-K+-ATPase pumps to the basolateral membranes, decreases in vasopressin levels, and an increase in thirst
   c) addition of Na+-K+-ATPase pumps to the basolateral membranes, increases in vasopressin levels, and a decrease in thirst
   d) addition of Na+-K+-ATPase pumps to the basolateral membranes, decreases in vasopressin levels, and a decrease in thirst
   e) addition of Na+-K+-ATPase pumps to the basolateral membranes only

40. Which of the following does not occur to compensate for a fall in blood pressure below normal?
   a) cardiac output is increased
   b) total peripheral resistance is decreased
   c) heart rate is increased
   d) venous vasoconstriction occurs
   e) stroke volume is increased
41. A person can compensate for ____ by increasing ventilation rates.
   a) respiratory alkalosis
   b) metabolic acidosis
   c) metabolic alkalosis
   d) respiratory acidosis

42. An excessive loss of HCO3⁻ while CO₂ stays the same results in ____________
   a) metabolic acidosis
   b) metabolic alkalosis
   c) respiratory acidosis
   d) respiratory alkalosis

43. Which of the following is not attributable to the immune defense system?
   a) defends against pathogenic microorganisms
   b) converts foreign chemicals into compounds that can be eliminated in the urine
   c) removes worn-out cells and tissue debris
   d) identifies and destroys abnormal or mutant cells
   e) can cause allergies

44. Which of the following statements regarding T cells is incorrect?
   a) cyotoxic T cells destroy targeted cells
   b) helper T cells enhance activity of other T and B cells
   c) suppressor T cells down-regulate the immune response
   d) T cells produce antibodies which mark invaders for destruction
   e) the vast majority of T cells are helper T cells

45. How many people world-wide died of AIDS between 1981 and 2006?
   a) 1 million
   b) 5 million
   c) 15 million
   d) 20 million
   e) 30 million

46. How many adults in the US are obese?
   a) 5%
   b) 10%
   c) 20%
   d) 30%
   e) 40%

47. Disease caused by autoimmune destruction of myelin
   a) Tay Sachs
   b) ALS (Lou Gehrig’s disease)
   c) Multiple Sclerosis
   d) Parkinson’s
   e) Cystic Fibrosis
48. Disease that destroys motor neurons in brain and spinal cord
   a) Tay Sachs
   b) ALS (Lou Gehrig’s disease)
   c) Multiple Sclerosis
   d) Parkinson’s
   e) Cystic Fibrosis

49. Competitively binds with protein transporter that removes dopamine from synapse
   a) cocaine
   b) caffeine
   c) Parkinson’s disease
   d) tetanus toxin
   e) alcohol

50. Pacemaker activity shift from SA node to other area of heart
   a) atrial flutter
   b) atrial fibrillation
   c) ectopic focus
   d) heart block
   e) myocardial ischemia
1. The part of the brain most involved in regulating homeostasis is
   a) The brain stem
   b) The cerebellum
   c) The cerebral cortex
   d) The hypothalamus
   e) The basal nuclei

2. The portion of body water outside of cells that bathes most cells of the body is called ______.
   a) intracellular fluid
   b) intercellular fluid
   c) interstitial fluid
   d) plasma
   e) extracellular fluid

3. Tetanus toxin prevents the release of ____ from __ presynaptic inputs that terminate on __.
   a) Dopamine; inhibitory; motor neurons
   b) GABA; inhibitory; motor neurons
   c) Dopamine; excitatory; motor neurons
   d) GABA; inhibitory; parasympathetic neurons
   e) GABA; excitatory; motor neurons

4. Which of the following does NOT happen during a fight or flight sympathetic response?
   a) Blood flow to digestive organs is restricted by alpha receptors on blood vessels binding epinephrine and norepinephrine
   b) Blood flow to heart enhanced by beta-2 receptors on blood vessels to heart binding epinephrine and norepinephrine
   c) Heart rate increased by beta-1 receptors in heart binding epinephrine and norepinephrine
   d) Airways in lung dilated by beta-2 receptors binding epinephrine and norepinephrine
   e) Blood vessels to skeletal muscle dilated by alpha receptors binding epinephrine and norepinephrine
5. The energy from glucose metabolized in the presence of oxygen
   a) is converted to ATP by the citric acid cycle and oxidative phosphorylation only
   b) is converted to ATP by glycolysis only
   c) is converted to ATP by the citric acid cycle only
   d) is converted to ATP by glycolysis and oxidative phosphorylation only
   e) is converted to ATP by glycolysis, the citric acid cycle, and oxidative phosphorylation

6. Which of the following statements about carrier mediated transport is NOT true?
   a) no energy is required for facilitated diffusion
   b) active transport requires energy
   c) active transport can move molecules against a concentration gradient
   d) facilitated diffusion can move molecules against a concentration gradient
   e) both c and d are false

7. What is a motor unit?
   a) all the muscle fibers in a fascicle
   b) all the myofibrils in a muscle fiber
   c) a muscle fiber and all the motor neurons that innervate it
   d) a motor neuron and all the muscle fibers it innervates
   e) an interneuron and all the muscle fibers it innervates

8. Which of the following is the best description of sweet taste bud receptor function?
   a) Membrane receptors on sweet taste buds bind glucose or other sugars, which initiates a G protein system, which ultimately causes K+ channels to close, which thereby hyperpolarizes the membrane.
   b) Membrane receptors on sweet taste buds bind glucose or other sugars, which closes the K+ channels, which ultimately initiates a G protein system, which thereby depolarizes the membrane.
   c) Membrane receptors on sweet taste buds bind glucose or other sugars, which initiates a G protein system, which ultimately causes K+ channels to close, which thereby depolarizes the membrane.
   d) Membrane receptors on sweet taste buds bind acids (H+), which initiates a G protein system, which ultimately causes K+ channels to close, which thereby depolarizes the membrane.
   e) Membrane receptors on sweet taste buds bind glucose or other sugars, which hyperpolarizes the membrane, which ultimately causes K+ channels to close, which thereby initiates a G protein system.

9. Capillary exchange is facilitated by
   a) Increased flow rate of blood through capillaries
   b) Increased velocity of blood through capillaries
   c) Large surface area of capillaries
   d) b and c only
   e) a and c only

10. Which of the following best describe glomerular filtrate?
    a) It is identical to blood
    b) It is identical to plasma
    c) It is very similar to plasma except it contains no proteins or red blood cells
    d) It is very similar to plasma except it contains no proteins, red blood cells or glucose
    e) It is very similar to plasma except it contains no proteins, red blood cells, glucose or Na+
11. In which Figure 1 graph(s) does an influx of Na\(^+\) cause the steep rising phase that occurs after threshold is reached?
   a) Fig 1a
   b) Fig 1b
   c) Fig 1c
   d) All the above
   e) Only a and b

12. In which Figure 1 graph(s) does an influx of Ca\(^{++}\) play a role in threshold being reached?
   a) Fig 1a
   b) Fig 1b
   c) Fig 1c
   d) All the above
   e) Only b and c

13. In which Figure 1 graph(s) does an influx of Na\(^+\) play a role in threshold being reached?
   a) Fig 1a
   b) Fig 1b
   c) Fig 1c
   d) All the above
   e) Only a and c

14. Which Figure 1 graph(s) are action potentials produced myogenically?
   a) Fig 1a
   b) Fig 1b
   c) Fig 1c
   d) All the above
   e) Only b and c

15. Voltage-gated calcium channels in the axon terminal open in response to which of the following?
   a) initiation of an action potential in the axon hillock
   b) arrival of an action potential at the axon terminal
   c) neurotransmitter binding to receptor
   d) summation of graded potentials at the axon hillock
   e) paracines released from the post-synaptic cell

16. The part of the brain most involved in maintaining balance and enhancing muscle tone is
   a) The brain stem
   b) The cerebellum
   c) The cerebral cortex
   d) The hypothalamus
   e) The basal nuclei

17. Which of the following statements about the female sexual cycle is FALSE?
   a) It is controlled primarily by a spinal cord reflex
   b) The parasympathetic nervous system causes lubrication of the vagina
   c) The sympathetic nervous system causes vasodilatation of the vagina and clitoris
   d) Both a and b are false
   e) Both b and c are false
18. How many people died from AIDS between 1981 and 2010?
   a) 1 million
   b) 10 million
   c) 20 million
   d) 30 million
   e) 50 million

19. The function of a second messenger system is to ________.
   a) buffer a cell’s response to a ligand
   b) isolate the response to the inside of a cell
   c) keep calcium involved in these responses
   d) amplify the response of the first messenger
   e) facilitate the process of covalent modification of a protein

20. In Fig. 2, the hormone(s) produced by the corpus luteum
   a) 1a and 2a
   b) 1b and 2b
   c) 2a
   d) 3b and 4b
   e) 1b, 2b, 3b, 4b

21. In Fig. 2, the hormone(s) produced by the developing follicle
   a) 1a
   b) 3a
   c) 4a
   d) 1a, 3a, 4a
   e) 2b

22. What percent of your blood plasma is water?
   a) 10%
   b) 45%
   c) 55%
   d) 75%
   e) 90%

23. 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
Questions 24 to 26 refer to the following:

1. Skeletal  
2. Single Unit Smooth  
3. Multi Unit Smooth  
4. Cardiac Contractile  
5. Cardiac Autorhythmic

24. In what type of muscle does Ca^{++} activate calmodulin?
   a) 2
   b) 3
   c) 2 and 3
   d) 2, 3 and 5
   e) 2, 3, 4 and 5

25. What type of muscle is (are) linked by gap junctions?
   a) 2
   b) 2, 3
   c) 2, 4
   d) 2, 4, 5
   e) 2, 3, 4, 5

26. What type of muscle can generate action potentials myogenically?
   a) 2
   b) 4
   c) 2 and 3
   d) 2 and 5
   e) 2, 3 and 5

27. Imagine an experimental situation in which a cell contains only D^+ and G^- ions in equal amounts, only has channels that allow D^+ to cross the membrane, and is in a solution containing no ions. Initially, D^+ will diffuse ____ the cell, going down its ____ gradient; ultimately at equilibrium the net diffusion of D^+ will ____ because of the ____ gradient.
   a) Out of; concentration; stop; electrical
   b) Out of, electrical; stop; concentration
   c) Out of; concentration; continue; concentration
   d) Into; concentration; stop; electrical
   e) Out of; electrical; continue; concentration

28. The energy source that can be used most rapidly by contracting muscle is
   a) ATP produced from glycolysis
   b) ATP produced from Krebs cycle
   c) ATP produced from creatine phosphate
   d) ATP produced from oxidative phosphorylation
   e) Both b and d combined

29. Conduction of action potentials through which of the following is slow to allow atria to contract before the ventricles?
   a) Atria
   b) SA node
   c) AV node
   d) bundle of His
   e) Purkinje fibers
30. During part A of Fig 3
   a) the ventricle is in diastole, the atrium is in systole, the AV valve is open, the aortic valve is closed
   b) the ventricle is in diastole, the atrium is in systole, the AV value is open, the aortic valve is closed
   c) the ventricle is in systole, the atrium is in diastole, the AV valve is closed, the aortic valve is open
   d) the ventricle is in diastole, the atrium is in diastole, the AV valve is closed, the aortic valve is closed
   e) the ventricle is in systole, the atrium is systole, the AV valve is open, the aortic valve is open

31. During part B of Fig 3
   a) the ventricle is in diastole, the atrium is in systole, the AV valve is open, the aortic valve is closed
   b) the ventricle is in diastole, the atrium is in diastole, the AV value is open, the aortic valve is closed
   c) the ventricle is in systole, the atrium is in diastole, the AV valve is closed, the aortic valve is open
   d) the ventricle is in diastole, the atrium is in diastole, the AV valve is closed, the aortic valve is closed
   e) the ventricle is in systole, the atrium is systole, the AV valve is open, the aortic valve is open

32. The stroke volume that can be calculated from the information in Fig 3 is
   a) 130 ml
   b) 100 ml
   c) 70 ml
   d) 60 ml
   e) 50 ml

33. Bulk flow is most important for
   a) exchange of materials between plasma and interstitial fluid
   b) distributing fluid between ECF and ICF
   c) distributing fluid between plasma and interstitial fluid
   d) distributing fluid between interstitial fluid and the ICF
   e) regulating cardiac output

34. Which of the following statement about pressure is (are) true?
   a) \( P = R/F \) (where \( P \) = pressure, \( F \) = flow rate and \( R \) = resistance)
   b) Increasing the resistance in a vessel will decrease the pressure.
   c) Increasing the flow rate will decrease the pressure
   d) If a vessel radius is increased by a factor of 2, pressure in that vessel will decrease by 16
   e) Both b and d are true

35. A patient comes into the emergency room where you work with a spinal injury in his neck. Which of the following are most likely to occur?
   a) His heart will stop beating
   b) He will be unable to have any kind of basic breathing rhythm
   c) He will be unable to regulate the magnitude of ventilation
   d) All the above
   e) Only b and c are likely to occur
36. Indicate the proper sequence of events during inspiration:

1. Inspiratory muscles contract  7. No pressure gradient
2. Inspiratory muscles relax   8. Pressure gradient from lungs to environment
3. Thoracic cavity enlarges  9. Pressure gradient from environment to lungs
4. Thoracic cavity decreases  10. No air flow between lungs and environment
5. Lungs expand    11. Air flow from lungs to environment
6. Lungs decrease    12. Air flow from environment to lungs

a) 1, 3, 5, 9, 12  
b) 2, 3, 5, 9, 12  
c) 1, 3, 5, 8, 12  
d) 1, 4, 6, 9, 12  
e) 2, 4, 6, 9, 12

37. Solute S is excreted in the urine at a rate that is lower than the amount filtered into the tubular system. On the basis of this information, which of the following is the most precise conclusion that can justifiably be drawn regarding the kidney's processing of solute S?

a) S is definitely reabsorbed and may be secreted  
b) S is definitely secreted and may be reabsorbed  
c) S is definitely both reabsorbed and secreted  
d) S is neither reabsorbed nor secreted

38. When Na⁺ levels fall, the juxtaglomerular apparatus releases renin, which ultimately increases the production of angiotensin II which causes

a) increase in aldosterone release, decrease in ECF osmolarity, increase in vasopressin levels, increase in thirst, increase in vasoconstriction of arterioles  
b) decrease in aldosterone release, increase in ECF osmolarity, increase in vasopressin levels, increase in thirst, increase in vasoconstriction of arterioles  
c) increase in aldosterone release, increase in ECF osmolarity, decrease in vasopressin levels, decrease in thirst, increase in vasoconstriction of arterioles  
d) increase in aldosterone release, increase in ECF osmolarity, increase in vasopressin levels, increase in thirst, decrease in vasoconstriction of arterioles  
e) increase in aldosterone release, increase in ECF osmolarity, increase in vasopressin levels, increase in thirst, increase in vasoconstriction of arterioles

39. An excessive loss of HCO₃⁻ while CO₂ stays the same results in _____________

a) metabolic acidosis  
b) metabolic alkalosis  
c) respiratory acidosis  
d) respiratory alkalosis  
e) both a and c

40. Which of the following is not attributable to the immune defense system?

a) defends against pathogenic microorganisms  
b) converts foreign chemicals into compounds that can be eliminated in the urine  
c) removes worn-out cells and tissue debris  
d) identifies and destroys abnormal or mutant cells  
e) can cause allergies

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41. Which of the following statements regarding T cells is incorrect?
   a) cytotoxic T cells destroy targeted cells
   b) helper T cells enhance activity of other T and B cells
   c) suppressor T cells down-regulate the immune response
   d) T cells produce antibodies which mark invaders for destruction
   e) the vast majority of T cells are helper T cells

42. Anakin Skywalker, from the planet Tatooine, has a PO2 of 200 mm Hg in his alveoli and a PO2 of 80 mm Hg in his tissues. Assuming that Anakin’s respiratory physiology functions similar to yours, what is the PO2 of blood leaving his lung capillaries?
   a) 0 mm Hg
   b) 80 mm Hg
   c) 100 mm Hg
   d) 160 mm Hg
   e) 200 mm Hg

43. The hemoglobin-oxygen dissociation curve for Anakin exercising is presented in Figure 4. Approximately what is the percent oxygen saturation of the hemoglobin leaving Anakin’s systemic capillaries when his tissues have a PO2 of 20?
   a) 0%
   b) 10%
   c) 40%
   d) 60%
   e) 95%

44. What percent of US adults are obese?
   a) 5%
   b) 10%
   c) 20%
   d) 30%
   e) 50%

45. Homeostasis is a term which describes the process whereby the body ________.
   a) maintains a variable internal environment
   b) maintains a constant internal and external environment
   c) maintains a constant external environment
   d) maintains a constant internal environment
   e) affects the external environment

46. High levels of anabolic steroids reduces sperm count because
   a) Steroids destroy sperm
   b) Steroids cause production of inhibin
   c) Steroids negatively feedback on the hypothalamus to stop GnRH release
   d) Steroids negatively feedback on the anterior pituitary to stop LH and FSH release
   e) Both c and d are true
47. 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) Overexcitation of non-SA node autorhythmic regions of heart
   e) Reduced blood supply to heart

48. Continuous with the outer portion of the nuclear membrane, this membrane-bound structure functions in the synthesis of secretory proteins, integral membrane proteins, or proteins bound for other organelles.
   a) rough endoplasmic reticulum
   b) smooth endoplasmic reticulum
   c) mitochondria
   d) lysosome
   e) nucleolus

49. Which of the following would have a greater electrical attraction for sodium ions to enter the cell?
   a) cell with membrane potential = 0 mV
   b) cell with membrane potential = +20 mV
   c) cell with membrane potential = -50 mV
   d) cell with membrane potential = -90 mV
   e) cell with membrane potential = -70 mV

50. Disease caused by fat accumulation in neurons in the brain
   a) Tay Sachs
   b) ALS (Lou Gehrig’s disease)
   c) Multiple Sclerosis
   d) Parkinson’s
   e) Cystic Fibrosis
Fig. 2. Part a of each curve occurs before the dotted vertical line; part b occurs after.
Fig. 3. Left ventricle volume.

Figure 4
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 10 points deducted if you fail to do this!!!!!!

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

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

Your exam should have 50 questions. 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 $\frac{1}{2}$ point may be available for questions that have answers such as “all the above”, “both a and b are true”, etc.

1) Keeping the internal environment constant is the best definition of
   a) Endothermy
   b) Homeothermy
   c) Homeostasis
   d) Chemostasis

2) Most high energy molecules in a cell are made in the
   a) Golgi complex
   b) Mitochondria
   c) Ribosomes
   d) Endoplasmic reticulum

3) The special senses (seeing, hearing, etc) are part of the
   a) Afferent division of the nervous system
   b) Efferent division of the nervous system
   c) Autonomic nervous system
   d) Central nervous system

4) A beaker is separated by a membrane through which both water and Na$^+$ ions may pass. On the left side of the beaker are 1000 water molecules and 100 Na$^+$ ions; on the right side are 1000 water molecules and 200 Na$^+$ ions. Which of the following describes the net movement of molecules that will occur in this beaker?
   a) Water from left to right
   b) Water from right to left
   c) Na$^+$ from left to right
   d) Na$^+$ from right to left.

5) Which of the following is the best definition of “theory”:
   a) Speculation
   b) System of ideas held as an explanation for a group of facts
   c) Conjecture
   d) Conception of what might be true stated in a specific declarative way
6) Which of the following are involved in regulating acid-base balance in your body?
   a) Heart
   b) Kidneys
   c) Lungs
   d) Both kidneys and lungs

7) The QRS complex (the big spike) in an ECG is caused by
   a) Electrical activity that leads to the contraction of the atria
   b) Electrical activity that leads to the relaxation of the atria
   c) Electrical activity that leads to the contraction of the ventricles
   d) Electrical activity that leads to the relaxation of the ventricles

8) When you inhale, air moves into your lungs because
   a) You gulp in air
   b) Pressure inside your lungs is less than the pressure in the outside environment
   c) Pressure inside your lungs is greater than the pressure in the outside environment

9) Which of the following statements about ATP is not true?
   a) ATP is required to maintain the proper concentrations of Na⁺, Ca²⁺ and K⁺ in the ECF and ICF
   b) ATP is required for cross bridge cycling in skeletal muscle
   c) ATP is required to reabsorb glucose in the nephron
   d) ATP is required for oxygen to bind to hemoglobin
   e) ATP is required to produce creatine phosphate in skeletal muscle

10) Na⁺ passively crossing a membrane
    a) contributes to the rising phase of an action potential in a neuron
    b) enters the axon terminal to cause the release of acetylcholine
    c) contributes to the plateau phase of an action potential in a cardiac contractile cell
    d) causes Cl⁻ to be reabsorbed following an electrical gradient
    e) both a and d are correct

11) Na⁺ passively crossing a membrane
    a) contributes to pre-threshold depolarization of a cardiac auto rhythmic cell
    b) contributes to the rising phase of an action potential in a cardiac auto rhythmic cell
    c) causes depolarization of salt taste receptor membranes
    d) is released by buffers during metabolic acidosis
    e) both a and c are correct

12) The active transport of Na⁺ across a membrane
    a) contributes to the myogenic depolarization of a cardiac auto rhythmic cell prior to threshold
    b) contributes to the rising phase of an action potential in a cardiac contractile cell
    c) causes reabsorption of glucose in the proximal tubule of the nephron
    d) causes depolarization of salt taste receptor membrane
    e) a, c and d are correct
13) K⁺
   a) contributes to the falling phase of an action potential in a neuron
   b) is reabsorbed in the nephron when H⁺ is secreted
   c) is secreted in the nephron when H⁺ is secreted
   d) both a and b are correct
   e) both a and c are correct

14) K⁺
   a) enters the axon terminal to cause the release of acetylcholine
   b) is reabsorbed in the distal tubule of the nephron when Na⁺ is reabsorbed
   c) channels are blocked and cause depolarization of salt taste receptor membrane
   d) channels are blocked and cause depolarization of sweet taste receptor membrane
   e) both c and d are correct

15) The passive diffusion of Ca²⁺ across membranes
   a) contributes to the rising phase of an action potential in a cardiac contractile cell
   b) contributes to the plateau phase of an action potential in a cardiac contractile cell
   c) enters the axon terminal to cause the release of neurotransmitter
   d) both b and c are correct
   e) none of the above are correct

16) The All or None Law of action potentials states that
   a) refractory periods will occur
   b) action potentials will jump from one Node of Ranvier to the next
   c) once an action potential begins, it will be conducted the entire length of the neuron
   d) both a and b
   e) both a and c

17) A portion of the ____, which must monitor the blood, is not subject to the blood brain barrier.
   a) The brain stem
   b) The cerebellum
   c) The cerebral cortex
   d) The hypothalamus
   e) The basal nuclei

18) If a person becomes over hydrated, the ICF will become ____ because ____ moves from the ___.
   a) hypertonic; Na⁺; ICF to the ECF
   b) hypotonic; Na⁺; ECF to the ICF
   c) hypertonic; water; ECF to the ICF
   d) hypotonic; water; ECF to the ICF
   e) hypotonic; K⁺; ICF to the ECF

19) Information from chemoreceptors on your tongue is sent to the CNS via
   a) A visceral afferent
   b) A sensory afferent
   c) A somatosensory afferent
   d) A sensory efferent
   e) A visceral efferent
20) The receptors in a sour taste bud bind _____ which block _____ channels. This depolarizes the membrane because __________.
   a) Na⁺; K⁺; positive ions continue to leak into the cell but are prevented from leaking out
   b) H⁺; K⁺; positive ions continue to leak into the cell but are prevented from leaking out
   c) K⁺; Na⁺; positive ions continue to leak into the cell but are prevented from leaking out
   d) H⁺; Na⁺; positive ions continue to leak out of the cell but are prevented from leaking in
   e) H⁺; Ca²⁺; positive ions continue to leak into the cell but are prevented from leaking out

21) Blood pressure is equal to
   a) Cardiac Output divided by Resistance
   b) Cardiac Output times Resistance
   c) Resistance divided by Cardiac Output
   d) Cardiac Output plus Resistance
   e) Resistance minus Cardiac Output

22) At rest, what is the relative contribution of the sympathetic and parasympathetic nervous systems to the regulation of homeostasis?
   a) Only the sympathetic system is active.
   b) Only the parasympathetic system is active.
   c) Both systems are active but the sympathetic predominates.
   d) Both systems are active but the parasympathetic predominates.
   e) Neither system is active.

23) Which of the following statements about the endocrine system is true?
   a) The endocrine systems tends to control activities that require duration, not speed
   b) A single target cell can be influenced by more than one hormone
   c) A single hormone may be produced by more than one endocrine gland
   d) A single endocrine gland may produce more than one hormone
   e) All the above are true

24) In Graves Disease, thyroid stimulating immunoglobin causes hyperthyroidism because ______
   a) it positively feedback on the hypothalamus
   b) it positively feeds back on the pituitary
   c) it bypasses the effects of negative feedback on both the hypothalamus and pituitary
   d) it negatively feeds back on the hypothalamus and pituitary
   e) both a and b

25) and __________.
   a) causes TSH release from the pituitary
   b) causes TRH release from the hypothalamus
   c) prevents T3 and T4 release from the thyroid
   d) causes T3 and T4 release from the thyroid
   e) a, b, and d are all correct

26) ALS (Lou Gehrig's disease) is caused by the destruction of
   a) Sympathetic neurons
   b) Parasympathetic neurons
   c) Motor neurons
   d) Both a and b
   e) All the above
27) Which of the following statements about Type II diabetes is (are) true?
   a) It is the most prevalent form of diabetes in the US
   b) It is caused by too few insulin producing cells in the pancreas
   c) It can cause blindness
   d) Both a and c are true
   e) Both b and c are true

28) An End Plate Potential initiates an action potential, which propagates across the membrane and down into the T-Tubules in the muscle cell which causes the _____ to release _____ ,
   a) sarcoplasmic reticulum, K^+
   b) sarcoplasmic reticulum, Ca^{++}
   c) sarcoplasmic reticulum, Na^+
   d) troponin, Ca^{++}
   e) tropomyosin, K^+

29) which then binds to _______ and causes _____ to move aside, thereby exposing the myosin binding sites on the actin molecules. On the contact of myosin and actin, the myosin head releases _____ and phosphate, and the myosin head strokes forward.
   a) troponin; tropomyosin, ADP
   b) tropomyosin; troponin; ADP
   c) troponin; tropomyosin; ATP
   d) tropomyosin; troponin; ATP
   e) dense bodies; tropomyosin; ATP

30) How many people died from AIDS between 1981 and 2010?
   a) 1 million
   b) 10 million
   c) 20 million
   d) 30 million
   e) 50 million

31) Capillary exchange is facilitated by
   a) Reduced flow rate of blood through capillaries
   b) Reduced velocity of blood through capillaries
   c) Large surface area of capillaries
   d) b and c only
   e) All the above

32) Hormone secreted by the growing follicle in females
   a) LH
   b) FSH
   c) Progesterone
   d) GnRH
   e) Estrogen

33) Which of the following would have a greater electrical attraction for sodium ions to enter the cell?
   a) cell with membrane potential = 0 mV
   b) cell with membrane potential = +20 mV
   c) cell with membrane potential = -50 mV
   d) cell with membrane potential = -90 mV
   e) cell with membrane potential = -70 mV
34) Which of the following accurately represents the order of complexity for the components of the body, from least to most complex?
   a) tissues, cells, organs, organ systems
   b) organ systems, organs, tissues, cells
   c) cells, tissues, organs, organ systems
   d) organ systems, cells, tissues, organs
   e) cells, tissues, organ systems, organs

35) Which of the following can move a solute against its concentration gradient?
   a) passive diffusion
   b) facilitated diffusion
   c) active transport
   d) both b and c
   e) all the above

36) Pacemaker activity shifting to the Purkinje fibers is called
   a) Atrial flutter
   b) Ectopic focus
   c) Ventricular fibrillation
   d) Myocardial infarction
   e) Atrial fibrillation

37) Indicate the proper sequence of events during inspiration:

   1. Inspiratory muscles contract
   2. Inspiratory muscles relax
   3. Thoracic cavity enlarges
   4. Thoracic cavity decreases
   5. Lungs expand
   6. Lungs decrease
   7. No pressure gradient
   8. Pressure gradient from lungs to environment
   9. Pressure gradient from environment to lungs
   10. No air flow between lungs and environment
   11. Air flow from lungs to environment
   12. Air flow from environment to lungs

   a) 1, 3, 5, 9, 12
   b) 2, 3, 5, 9, 12
   c) 1, 3, 5, 8, 12
   d) 1, 4, 6, 9, 12
   e) 2, 4, 6, 9, 12

38) The part of the brain most involved in controlling the respiratory system is
   a) The brain stem
   b) The cerebellum
   c) The cerebral cortex
   d) The hypothalamus
   e) The basal nuclei

39) The latent period of muscle contraction is the
   a) time between initiation of stimulation and peak tension
   b) time between initiation of stimulation and start of contraction
   c) time between start of contraction and complete relaxation
   d) time between start of contraction and peak tension
   e) time between peak tension and complete relaxation
40) During a fight or flight response, ________ receptors in the lungs bind primarily _____ which causes the airways to _________.
   a) Beta-2; epi; dilate
   b) Beta-2; norepi; dilate
   c) Alpha; epi; constrict
   d) Beta-1; epi; dilate
   e) Beta-1; norepi; dilate

41) The primary regulator of the magnitude of ventilation in normal circumstances is
   a) the H⁺ concentration of the brain extracellular fluid monitored by the central chemoreceptors
   b) the P_{O2} of the arterial blood monitored by central chemoreceptors
   c) the P_{O2} of the arterial blood monitored by peripheral chemoreceptors
   d) the P_{CO2} of arterial blood monitored by central chemoreceptors
   e) the P_{CO2} of arterial blood monitored by peripheral chemoreceptors

42) The functional unit of the kidney is the
   a) glomerulus
   b) proximal tubule
   c) collecting ducts
   d) nephron
   e) loop of Henle

43) The ratio of HCO₃⁻ to CO₂ increasing to greater than 20 to 1 is caused by
   a) metabolic acidosis
   b) metabolic alkalosis
   c) respiratory acidosis
   d) respiratory alkalosis
   e) both b and d

44) Which of the following statements regarding T cells is incorrect?
   a) cytotoxic T cells destroy targeted cells
   b) helper T cells enhance activity of other T and B cells
   c) suppressor T cells down-regulate the immune response
   d) T cells produce antibodies which mark invaders for destruction
   e) the vast majority of T cells are helper T cells

45) Creatine phosphate is the ________ source of energy tapped by an exercising muscle. ______ is produced from creatine phosphate and _______ in the presence of the enzyme creatine phosphatase.
   a) first, ATP, Ca^{++}
   b) last, ADP, ATP
   c) first, ATP, ADP
   d) first, Ca^{++}, ADP
   e) first, ADP, ATP

46) What percent of US adults are obese?
   a) 5%
   b) 10%
   c) 20%
   d) 30%
   e) 50%
47) During smooth muscle contraction, Ca++ enters the cell primarily from the ______ via the process of ________. The Ca++ then activates ________, which in turn activates ______ to phosphorylate myosin so that cross bridge cycling between thick and thin filaments occurs. At the end of the contraction, Ca++ is removed from the cell by the process of ________.
   a) ECF; diffusion; calmodulin; myosin light chain kinase; diffusion
   b) SR; diffusion; calmodulin; myosin light chain kinase; active transport
   c) SR; active transport; tropomyosin; myosin light chain kinase; active transport
   d) ECF; diffusion; calmodulin; myosin light chain kinase; active transport
   e) ECF; diffusion; myosin light chain kinase; calmodulin; active transport

48) The __________ causes vasocongestion in the penis; the __________ causes emission of semen and the _______ causes expulsion of the semen.
   a) Parasympathetic; parasympathetic; sympathetic
   b) Parasympathetic; sympathetic; sympathetic
   c) Parasympathetic; sympathetic; parasympathetic
   d) Sympathetic; parasympathetic; sympathetic
   e) Sympathetic; sympathetic; sympathetic

Question 49 refers 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 16) No blood flow from ventricle to aorta

49) Which of the following best describe the events during part C of Fig. 1?
   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

50) Disease caused by fat accumulation in neurons in the brain
   a) Tay Sachs
   b) ALS (Lou Gehrig’s disease)
   c) Multiple Sclerosis
   d) Parkinson’s
   e) Cystic Fibrosis