1. Menstruation occurs because (Note: based on student comments, this now has 2 full credit answers)
   a) Estrogen levels decline sharply
   b) Progesterone levels decline sharply
   c) The corpus luteum disintegrates and stops producing hormones
   d) All the above are true
   e) Only a and b are true

2. Type II diabetes is caused by
   a) too few insulin producing cells in the pancreas
   b) too little circulating insulin in the plasma
   c) reduced sensitivity of insulin receptors to insulin
   d) all the above
   e) a and b only

3. 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

4. Platelets contain actin and myosin.
   a) True
   b) False

5. During contraction of all types of muscle cells, Ca²⁺ initiates contraction by entering the cytoplasm of the muscle cell by the process of facilitated diffusion.
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6. What percent of US adults are obese?
   a) 5%
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7. The function of a second messenger system is to
   a) buffer a cell's response to a ligand.
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8. The passive diffusion of Ca\(^{2+}\) across membranes
   a) contributes to the rising phase of an action potential in a cardiac contractile cell
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   e) **both b and c are correct**

9. Which of the following statements best describes homeostasis?
   a) Keeping the body in a fixed and unaltered state.
   b) Dynamic equilibrium.
   c) **Maintaining a constant internal environment.**
   d) Altering the external environment to accommodate the body’s needs
   e) Positive feedback

10. Vomiting leads to a loss of HCO\(_3^-\) from the GI tract and so leads to metabolic acidosis.
    a) True
    b) **False**

11. 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**

12. ______ can enter the brain by moving through ______.
    a) small non-polar molecules; capillary membranes
    b) small non-polar molecules; capillary pores
    c) small non-polar molecules; gap junctions
    d) small polar molecules; capillary pores
    e) small polar molecules; capillary membranes

13. The pathway that produces the most reduced coenzymes per glucose molecule is
    a) aerobic glycolysis
    b) anaerobic glycolysis
    c) the linking step
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   1. Ca\(^{++}\) binds to troponin
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16. The best description of the Graves’ disease mechanism:
   a) thyroid stimulating immunoglobin (TSI) sets up a positive feedback loop with the pituitary to cause TSH release and hence T3 and T4 release by the thyroid
   b) TSI sets up a positive feedback loop with the hypothalamus to cause TRH release and hence TSH release by the pituitary which causes unregulated T3 and T4 release by the thyroid
   c) TSI sets up a positive feedback loop with the thyroid gland to cause T3 and T4 release which cause more TSI release which causes more T3 and T4 release, etc.
   d) **TSI directly stimulates the thyroid to release T3 and T4**
   e) both a and b are true

17. If nothing else is removed from the filtrate once it reaches the late distal tubules, the urine excreted would have which of the following properties?
   a) devoid of ions and large volume
   b) high osmolarity and low volume
   c) low osmolarity and low volume
   d) **low osmolarity and large volume**
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18. 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 in the nephron
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19. 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  

20. K⁺ ion(s)  
   a) enter the axon terminal to cause the release of acetylcholine  
   b) are 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**  
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21. The contraction time of a skeletal muscle is the time between initiation of stimulation and peak contraction of the muscle.  
   a) True  
   b) False  

22. Proteins are produced by the rough endoplasmic reticulum, are packaged inside transport vesicles in the smooth endoplasmic reticulum, and are processed into final form once they reach the Golgi complex.  
   a) True  
   b) False  

23. The active transport of Na⁺ across a membrane  
   a) contributes to the myogenic depolarization of a cardiac autorhythmic 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  

24. During the ST interval, why is the aortic valve open?  
   a) Because pressure is higher in the atrium than in the ventricle  
   b) Because blood is flowing from the ventricle into the aorta  
   c) **Because pressure is higher in the ventricle than in the aorta**  
   d) Because blood is flowing into the ventricle from the atrium  
   e) Because pressure is higher in the veins than in the atrium  

25. Antibodies are produced by B lymphocytes.  
   a) True  
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   a) vasocongestion of the vagina  
   b) vasocongestion of the clitoris  
   c) reduction of the circumference of the vagina  
   d) **rhythmic contractions of pelvis muscles**  
   e) the sympathetic does not cause any of the above
27. 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

28. 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

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   a) 390,000
   b) 3.9 million
   c) 19 million
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30. What type of ion channels are necessary for the function of the axon and the axon terminal?
   a) receptor-gated
   b) mechanically-gated
   c) ligand-gated
   d) **voltage-gated**
   e) chemically-gated

31. 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

32. 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

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   a) increasing the speed at which the Na⁺-K⁺-ATPase pump acts
   b) causing more Na⁺ channels to open
   c) allowing action potentials to jump between Nodes of Ranvier instead of traveling along every part of the membrane
   d) eliminating the refractory period
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34. When a person has diabetes mellitus, they may suffer from
   a) metabolic acidosis
   b) metabolic alkalosis
   c) respiratory acidosis
   d) respiratory alkalosis
   e) both a and c

35. An increase in ECF osmolarity will result in water moving into the ICF and thereby cause cells to swell.
   a) True
   b) False

36. In an ECG, the P wave is caused by ________, the QRS complex is caused by ______ and the T wave is caused by ________.
   a) Atrial repolarization, ventricular repolarization, atrial depolarization
   b) **Atrial depolarization, ventricular depolarization, ventricular repolarization**
   c) Atrial depolarization, ventricular depolarization, atrial repolarization
   d) Ventricular depolarization, atrial repolarization, ventricular repolarization
   e) Ventricular repolarization, atrial depolarization, ventricular depolarization

37. A tidal volume of 1200 ml/breath, a respiratory rate of 5 breaths per minute & a dead space volume of 200 ml gives a pulmonary ventilation rate of ____ and an alveolar ventilation rate of ____.
   a) 6000; 5000
   b) 6000; 6000
   c) 5000; 5000
   d) 5000; 6000
   e) 500; 600

38. The descending loop of Henle is ________, whereas the ascending loop of Henle is ________.
   a) permeable to water but not permeable to Na⁺; not permeable to water and Na⁺ is actively transported out
   b) **permeable to water & permeable to Na⁺; permeable to water & Na⁺ is actively transported out**
   c) not permeable to water & not permeable to Na⁺; not permeable to water & not permeable to Na⁺
   d) not permeable to water but permeable to Na⁺; permeable to water but not permeable to Na⁺
   e) permeable to water & Na⁺ actively transported out; permeable to water but not permeable to Na⁺

39. Which of the following statements is FALSE of a rightward shift in the hemoglobin-oxygen dissociation curve?
   a) **Affinity for oxygen is increased.**
   b) A rightward shift usually occurs in active tissue.
   c) Hemoglobin unloading of oxygen is increased.
   d) Oxygen loading onto hemoglobin is decreased.
   e) It can occur as a result of an increase in temperature or acidity of the tissue.

40. If the amount of hemoglobin in your body drops by 20% your body responds by
   a) Peripheral chemoreceptors upregulating hemoglobin production
   b) Central chemoreceptors upregulating hemoglobin production
   c) The respiratory center in the medulla upregulation hemoglobin production
   d) **Doing none of the above**
   e) All the above are true except d
41. What does contraction of the diaphragm cause?
   a) decrease in the volume of the thoracic cavity and therefore a decrease in atmospheric pressure
   b) decrease in the volume of the thoracic cavity and therefore a decrease in intra-alveolar pressure
   c) **increase in the volume of the thoracic cavity and therefore a decrease in intra-alveolar pressure**
   d) decrease in the volume of the thoracic cavity and therefore an increase in intra-alveolar pressure
   e) increase in the volume of the thoracic cavity and therefore an increase in intra-alveolar pressure

42. The release of aldosterone causes, in the distal and collecting tubules, which of the following?
   a) Opening of Na\(^+\) channels on the basolateral membrane
   b) **Formation of new Na\(^+\)-K\(^+\)-ATPase pumps on the basolateral membrane**
   c) Reabsorption of K\(^+\)
   d) All the above
   e) Both a and b

43. Which of the following would you expect in a trained endurance athlete versus an untrained person?
   a) Higher maximum heart rate
   b) More mitochondria in the heart
   c) More capillaries in the heart
   d) **Increase in blood volume**
   e) All the above

44. Pacemaker activity shifting to the Purkinje fibers is called
   a) Atrial flutter
   b) **Ectopic focus**
   c) Ventricular fibrillation
   d) Myocardial infarction
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45. 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

46. Which of the following is an example of negative feedback?
   a) **When a person stands up, blood pressure decreases due to blood pooling in the feet and legs. The heart and blood vessels respond in such a way as to bring blood pressure back toward normal.**
   b) During childbirth, uterine contractions push the baby against the cervix. This pressure stimulates the release of a hormone, oxytocin, that triggers stronger uterine contractions. This cycle continues until the baby is born.
   c) When a person smells good food, his mouth waters due to the production of saliva. The saliva will help digest the food once it has been consumed.
   d) both a and c
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47. 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) 1-4-2-5-6-7-3
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48. Disease caused by autoimmune destruction of myelin
   a) Tay Sachs
   b) Muscular dystrophy
   c) Multiple Sclerosis
   d) Tetanus
   e) Cystic Fibrosis

49. The renal process(es) that is (are) non-selective
   a) Glomerular filtration
   b) Tubular reabsorption
   c) Tubular secretion
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50. 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
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6. 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.
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   e) **Beta-1; increasing; increasing; increasing; increasing**

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   b) high osmolarity and low volume
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   b) permeable to water & permeable to Na\(^+\); permeable to water & Na\(^+\) is actively transported out
   c) not permeable to water & not permeable to Na\(^+\); not permeable to water & not permeable to Na\(^+\)
   d) not permeable to water but permeable to Na\(^+\); permeable to water but not permeable to Na\(^+\)
   e) permeable to water & Na\(^+\) actively transported out; permeable to water but not permeable to Na\(^+\)

44. Which of the following statements is FALSE of a rightward shift in the hemoglobin-oxygen
   dissociation curve?
   a) **Affinity for oxygen is increased.**
   b) A rightward shift usually occurs in active tissue.
   c) Hemoglobin unloading of oxygen is increased.
   d) Oxygen loading onto hemoglobin is decreased.
   e) It can occur as a result of an increase in temperature or acidity of the tissue.
45. If the amount of hemoglobin in your body drops by 20% your body responds by
a) Peripheral chemoreceptors upregulating hemoglobin production
b) Central chemoreceptors upregulating hemoglobin production
c) The respiratory center in the medulla upregulating hemoglobin production
d) **Doing none of the above**
e) All the above are true except d

46. A tidal volume of 1200 ml/breath, a respiratory rate of 5 breaths per minute & a dead space volume of 200 ml gives a pulmonary ventilation rate of ____ and an alveolar ventilation rate of _____.
   a) 6000; 5000
   b) 6000; 6000
   c) 5000; 5000
   d) 5000; 6000
   e) 500; 600

47. 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

48. Which of the following would you expect in a trained endurance athlete versus an untrained person?
   a) Higher maximum heart rate
   b) More mitochondria in the heart
   c) More capillaries in the heart
d) **Increase in blood volume**
e) All the above

49. 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 in the nephron
e) all the above are correct

50. Disease caused by autoimmune destruction of myelin
   a) Tay Sachs
   b) Muscular dystrophy
c) **Multiple Sclerosis**
d) Tetanus
e) Cystic Fibrosis