1. An image is focused onto the back of the retina by:
   a) regulating the distance between the pupil and the retina
   b) regulating the shape of the lens of the eye
   c) regulating the size of the retina
   d) regulating the curvature of the cornea

2. Indicate which of the above statements about cortical information processing is NOT true.
   a) The size of the receptive field of each cortical neuron is fixed before birth and does not change throughout an individual's lifetime.
   b) Some neurons in the primary visual cortex respond best to bars of light.
   c) Increasing the size of a spot of light can result in a decrease in the number of action potentials observed in the corresponding cortical neuron.
   d) Cortical neurons are "oblivious" to the type of stimulus that triggers action potentials.
   e) a and d

3. The hyperpolarization of the photoreceptor produced by light of a constant intensity decreases with time because:
   a) of amplification in the intracellular messenger cascade that converts cGMP
   b) nitric oxide released by the bipolar cells inhibits the release of glutamate
   c) after rhodopsin dissociates into retinal and opsin, it takes time for retinal to be converted back into the cis form.
   d) of autobleaching
   e) B & C

4. Information from the right and left sides of our environment crosses over to the other side of the brain via axons of the:
   a) the ocular dominance columns
   b) the lateral geniculate nucleus
   c) the corpus callosum
   d) the optic chiasm
   e) C & D

5. Evidence supporting the theory of learning, “Cells that fire together, wire together”, has been found in experiments examining the change in the responses of:
   a) neurons of the frontal cortex in response to antidepressant drugs
   b) hippocampal pyramidal neurons following high frequency stimulation
   c) lateral geniculate neurons following following high frequency auditory stimulation
   d) gamma motoneurons in response to repeated rapid stretches
   e) bipolar cells responses to large circles of light

6. If you were reciting a poem out loud, which part of the brain would be likely to be the most active:
   a) the occipital lobe
   b) the hippocampal lobe
   c) Broca’s area
   d) Wernicke’s area
   e) the temporal and frontal lobes
7. Which of the following statements about transgenic mice expressing a larger than normal number of NMDA receptors is FALSE:
   a) They would exhibit a shorter escape latency in the Morris water maze test.
   b) They would spend more time exploring novel objects.
   c) They would spend more time looking for an underwater platform once it had been moved to another quadrant of the Morris water maze.
   d) They would learn faster than normal mice.
   e) All of the above statements are TRUE.

8. Which type of muscle is most likely to be responsible for peristalsis (rhythmic contraction) of the digestive tract:
   a) cardiac
   b) striated
   c) smooth
   d) skeletal
   e) voluntary

9. Rigor mortis is most directly due to:
   a) an increase in the amount of ATP due to cellular breakdown.
   b) a lack of ATP resulting in the inability to move cross-bridges
   c) insufficient oxygen supplied to the muscle fibers
   d) insufficient calcium to free-up the myosin binding sites on actin filaments
   e) a lack of ATP resulting in the inability to break the bond between actin and myosin.

10. Calcium binding to the molecule _____________________ is the switch that initiates crossbridge cycling in skeletal muscle.
    a) actin
    b) mysoin
    c) transducin
    d) troponin
    e) protease

11. Transverse tubules are filled with:
    a) cytoplasm
    b) actin
    c) extracellular fluid
    d) myosin
    e) sarcomeres

12. Which of the following statements about the myotactic reflex is FALSE:
    a) both extrafusal and intrafusal fibers are stretched
    b) the number of EPSPs in the spinal motorneuron is increased
    c) the number of IPSPs resulting from sensory neuron activity is increased
    d) contraction of extrafusal fibers is increased
    e) it is mediated by muscle spindles

13. Fab fragments
    (A) are generated by enzymatic cleavage of heavy and light chains
    (B) bind antigen
    (C) lack light chains
    (D) have no interchain disulfide bonds
    (E) bind MHC molecules
14. T-cells recognize MHC plus processed peptide:
   (A) To eliminate extracellular organisms.
   (B) To stimulate histamine release by the T-cell.
   (C) To scavenge unwanted metabolic products.
   (D) To directly kill viruses.
   (E) To recognize an intracellular infection.

15. All of the statements below about the HIV virus are TRUE. Choose the one that MOST accurately accounts for the insidious nature of the virus.
   (A) The HIV virus binds to the CD4 coreceptor.
   (B) The HIV virus lyses helper T cells.
   (C) The mutation rate of the HIV virus is 1 per 2000 nucleotides.
   (D) The HIV virus can remain dormant until helper T cells are activated.
   (E) The HIV virus masquerades as "self" (i.e., host) by packaging itself with host cell membrane.

16. In addition to RNA, the HIV virus capsid contains:
   (A) gp41 and gp120
   (B) lysozyme
   (C) reverse transcriptase
   (D) interleukins
   (E) palmitylase

17. (6 pts) "During contraction, thick and thin filaments shorten." Indicate whether this statement is TRUE or FALSE and BRIEFLY EXPLAIN your reasoning.

18. (6 pts) Explain WHY the immune system cannot rely solely on B cells to deal with all foreign particles? (Be sure to include a brief description of what B cells DO do.)
19. (12 pts) Recent work by the Human Genome Project suggests that there are only 30-40,000 potential protein coding regions in the human genome. The immune system must be able to produce antibody molecules that can respond to any of the billions of potential antigens that might enter the system. **LIST** at least **three (3)** distinct mechanisms explaining **HOW** the immune system accomplishes this feat. **Provide a brief description** of each mechanism.
20. (16 pts) GIVE one example of each kind of ion channel we learned about. Briefly DESCRIBE the role of this channel in its physiological context. [EXAMPLE: voltage-gated ion channel: voltage-gated sodium channels – located in axons where they mediate the depolarizing phase of action potentials. NOTE: you may no longer use this example.] 4 pts each (2 pts for the channel and 2 pts for the description)

neurotransmitter-gated ion channels:

voltage-gated ion channels:

mechanically-gated ion channels:

intracellular messenger-gated channels:

21. (10 pts) LIST and BRIEFLY EXPLAIN each of the four long-term changes that occur in CA1 pyramidal neurons as a consequence of Ca2+ influx through NMDA receptors during LTP.