

A. Choice: (2 points for each question)

1. The highest oxygen affinity is demonstrated by
 1. myoglobin.
 2. hemoglobin A.
 3. hemoglobin S.
 4. hemoglobin F.
2. The metabolic regulation of blood pH occurs in
 1. lung .
 2. kidneys.
 3. liver.
 4. all above.
3. Blood pressure
 1. increased as blood flows through the veins.
 2. is greatest in the capillaries
 3. increases as stroke volume decreases.
 4. is lowest in the veins.
4. Vasodilation is induced by all the following except
 1. decreased tissue metabolism.
 2. increased tissue carbon dioxide.
 3. decreased tissue oxygen.
 4. increased extracellular K^+ .
5. Which of the following is **not** true concerning blood vessels?
 1. Arteries contain more muscle than veins.
 2. Smooth muscle surrounds capillaries.
 3. Valves are found in vein but not arteries.
 4. Discontinuous capillaries create sinusoids.
6. Which of the following would be found in plasma but not in serum?
 1. amino acid
 2. fibrinogen.
 3. glucose
 4. vitamins.
7. Elevated concentrations of glucagon would result in
 1. decreased lipolysis.
 2. decreased glycogen synthesis.
 3. increased gluconeogenesis.
 4. increased lipogenesis.
8. The hormone that antagonizes the effect of insulin is
 1. glucagon
 2. thyroxin
 3. growth hormone
 4. epinephrine.

9. Fat cells are less sensitive to insulin in

1. obese individuals.
2. anorexic individuals.
3. individuals who do not exercise.
4. individuals at their optimal weight.

10. Ammonia is produced by

1. transamination
2. oxidative deamination.
3. glycogenolysis
4. the Cori cycle.

B. True(o) or false (x) : (2 points for each question)

1. The majority of energy within the body is stored as triglycerides.
2. Individuals in a positive nitrogen balance are metabolizing body tissue for energy.
3. The vena cavae returns oxygen depleted blood to the right atrium.
4. The lymphatic system is crucial in fat absorption.
5. Edema may result from increased plasma protein concentration.
6. Cardiac output increases as heart rate decreases.
7. Lung compliance increases as the amount of surfactant in the lung increases.
8. Increasing arterial blood pH increases the affinity of hemoglobin for oxygen.
9. Bile is derived from cholesterol.
10. Very-low-density lipoproteins are produced by the liver.
11. Lipids are initially transported by the lymphatic system.
12. Ablation of the thyroid gland would cause a drop in basal metabolic rate.
13. Primary energy reserves include glycogen and fat.
14. Leptin is postulated to be a satiety factor.
15. Vitamin D is fully activated by sunlight and enzymes in the liver and lung.

C. Please choose the correct answer.(questions 1 to 21)

1. When one is doing knee bending exercise, (1) making a short pause in the squatting position consumes more energy than without making a short pause, (2) straightening immediately after bending the knees consumes more energy than making a short pause at the squatting position, (3) making a short pause in the squatting position consumes the same amount of energy as straightening right away. (2%)
2. In mammals, a skeletal muscle usually consists of (1) only one of the three basic types of fibers (fast-fatiguing, fatigue-resistant and slow non-fatiguing fibers), (2) any two of these three basic types of fibers, (3) any combinations of these three types of fibers. (2%)
3. In the skeletal muscles of mammals, the rank order of the glycolytic enzyme activity in the fast-fatiguing (FF), fatigue-resistant (FR) and slow non-fatiguing (S) fibers are: (a) $FF > FR > S$, (b) $S > FR > FF$, (c) $FF > S > FR$ or (d) $S > FF > FR$. (2%)
4. The rank order of the output forces of the three basic types of muscle fibers of mammals is (1) $S > FR > FF$, (2) $FF > FR > S$, (3) $FR > S > FF$. (2%)
5. When the concentration of potassium ions of the solution surrounding a squid giant axon is raised (sodium concentration is lowered so that the ionic strength of the solution is unchanged), the electrical potential across the axon membrane is (1) raised, (2) lowered, (3) unchanged. (2%)
6. The principal excitatory neurotransmitter in the mammalian central nervous system is (1) aspartate, (2) glutamate, (3) acetylcholine. (2%)
7. The principal inhibitory neurotransmitter in the brains of mammals is (1) glycine, (2) taurine, (3) γ -aminobutyric acid. (2%)
8. When the sodium ions of the solution surrounding a squid giant axon are replaced by choline, which is positively charged and not permeable to voltage-gated sodium channels, the action potential of the axon as elicited by electric stimulation is (1) abolished, (2) increased, (3) unchanged. (2%)
9. Para-aminohippuric acid, which is removed completely by tubular secretion, is often used to estimate the (1) renal blood flow, (2) tubular secretion, (3) tubular reabsorption of the excretory organs of vertebrates. (2%)
10. The major end product of protein metabolism of teleost fish is (1) ammonia, (2) urea, (3) uric acid. (2%)
11. The major end product of the metabolism of proteins and purine of bird is (1) ammonia, (2) urea, (3) uric acid. (2%)
12. The visual information and auditory information are conveyed to the brain (1) both by action potentials, (2) the former by action potentials and the latter by electrotonic propagation, (3) the former by electrotonic propagation and the latter

by action potentials. (2%)

13. Which of the following mechanisms does not increase the conduction velocity of action potentials along an axon: (a) increasing the diameter of the axon, (b) adding myelin sheath to the axon, (c) increasing the conductance of potassium and chloride channels along the axon, (d) decreasing the conductance of potassium and chloride channels along the axon. (2%)
14. The sensory cells in the lateral line organs of fish are (1) rod cells, (2) hair cells, (3) Purkinje cells. (2%)
15. In the central nervous system of mammals, synaptic vesicles filled with neuropeptides are (1) never, (2) always, (3) often found in the same presynaptic terminals that also contain clear-cored synaptic vesicles. (2%)
16. In a skeletal muscle, the Golgi tendon organ associated to a muscle discharges more rapidly when (a) this muscle is passively stretched, (b) this muscle is stimulated to lift a load by activating the α -motor neurons in the spinal cord, or (c) the intrafusal muscle fibers are stimulated to contract. (2%)
17. Neuropeptides are usually (1) rapidly hydrolyzed after being released into extracellular space, (2) rapidly uptaken by specific transporters of neighboring cells after being released, (3) slowly hydrolyzed after being released into the extracellular space. (2%)
18. The neurotransmitters released from the preganglionic axons of sympathetic and parasympathetic nervous divisions are (1) epinephrine and acetylcholine, respectively, (2) norepinephrine and acetylcholine, respectively, (3) both acetylcholine. (2%)
19. The brain region that plays a central role in controlling endocrine function is (1) basal ganglion, (2) cerebellum, (3) hippocampus, (4) hypothalamus. (2%)
20. (1) Rod cells, (2) Cone cells, (3) Bipolar cells are responsible for the color vision of human eyes in bright light. (2%)
21. The concentrations of free intracellular calcium ions and extracellular calcium ions of a neuron in the mammalian CNS are approximately (a) ~ 0.01 mM and ~ 2 mM, (b) ~ 0.1 μ M and ~ 2 mM, (c) ~ 0.1 μ M and ~ 20 μ M, (d) ~ 1 mM and ~ 2 mM, respectively. (2%)

D. Please give brief answers. (questions 22 and 23)

22. Please list the events occurring at a neuromuscular junction and the postsynaptic muscle membrane between the arrival of an action potential from the motor neuron to the neuromuscular junction and the generation of an action potential of the muscle fiber on which the neuromuscular junction attaches. (4%)
23. What are the general methodologies by which the endocrine function is studied? (4%)