

Biology 2A03 – Integrative Physiology of Animals

Quiz # 1, January 31, 2011

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Specific Instructions: This test has **35 multiple choice questions on 8 pages**. The questions start on **page 2**. Answer all of the following 35 questions on the optical scan sheet provided. There is only one fully correct answer for each question. **This test is worth 10% of your final grade.**

NOTE: IT IS YOUR RESPONSIBILITY TO ENSURE THAT THE ANSWER SHEET IS PROPERLY COMPLETED: YOUR EXAMINATION RESULT DEPENDS UPON PROPER ATTENTION TO THESE INSTRUCTIONS.

The scanner, which reads the sheets, senses the shaded areas by their non-reflection of light. A heavy mark must be made, completely filling the circular bubble, **with an HB pencil**. Marks made with a pen or felt-tip marker will **NOT** be sensed. Erasures must be thorough or the scanner may still sense a mark. Do **NOT** use correction fluid on the sheets. Do **NOT** put any unnecessary marks or writing on the sheet.

1. Sides 1 (red side) of the form, in the top box, in pen, print your student number, name, course name, section number, instructor name and the date in the spaces provided. Then you **MUST** write your signature in the space marked SIGNATURE.
- *2. **IN THE SECOND BOX, WITH A PENCIL, MARK YOUR STUDENT NUMBER, EXAM VERSION NUMBER AND COURSE SECTION NUMBER IN THE SPACE PROVIDED AND FILL IN THE CORRESPONDING BUBBLES UNDERNEATH.**
3. Use Red side of the form for questions 1-50 and grey side of the form for questions 51-100. Answers, mark only **ONE** choice from the alternatives (1, 2, 3, 4, 5 or A, B, C, D, E) provided for each question. If there is a True/False questions, enter response of 1 (or A) as True, and 2 (or B) as False. The question number is to the left of the bubbles. Make sure that the number of the question on the scan sheet is the same as the question number on the exam paper.
4. Pay particular attention to the Marking Directions on the form.
5. Begin answering questions using the first set of bubbles, marked "1".

The image shows a detailed view of the examination answer sheet. At the top, there are fields for 'STUDENT NUMBER', 'NAME', 'SHEET #', 'SIGNATURE', 'COURSE', 'SECTION', and 'INSTRUCTOR'S NAME'. Below these fields is a grid of bubbles for marking answers, organized by question number and choice (1-5 or A-E). To the right of the grid, there are 'MARKING DIRECTIONS' and 'EXAMPLES' showing correct and incorrect ways to fill in the bubbles. The form is branded with the McMaster University logo and the text 'EXAMINATION ANSWER SHEET'.

Test continues on the next page...

1. Basal metabolic rate is defined as energy required to maintain body functions:
 - A) in a starvation state
 - B) when awake but moving
 - C) after a meal
 - D) while you are asleep
 - E) none of the above
2. The total energy stored in the body:
 - A) energy stored = ingestion – defecation – urination
 - B) energy stored = external heat produced + external work
 - C) energy stored = energy intake – (internal heat produced + external work)
 - D) energy stored = energy intake – interwebbing + myfacebooking - talking
 - E) none of the above
3. The concept of homeostasis:
 - A) refers to maintaining a stable external environment.
 - B) refers to maintaining a stable internal environment.
 - C) refers primarily to processes that operate via positive feedback.
 - D) was first described by Fick.
 - E) both A and B.
4. The four broad categories of cells include those specialized for each of the following functions *except*:
 - A) movement
 - B) synthesis of complex molecules
 - C) cover surfaces of the body or individual organs
 - D) support of body structures
 - E) conduction of electrical signals
5. Which of the following compartments holds the most body water?
 - A) plasma
 - B) interstitial fluid
 - C) intracellular fluid
 - D) extracellular fluid
 - E) blood
6. Skeletal muscle contractions are an example of a(n) _____ in a negative feedback loop regulating a disruption from normal body temperature
 - A) sensor
 - B) setpoint
 - C) error signal
 - D) compensatory response
 - E) effector

Test continues on the next page...

7. The efferent pathway of a reflex arc:
- A) is so named because it carries information towards the integrating center
 - B) is so named because it carries information away from the integrating center
 - C) may involve electrical activity in nerve fibers
 - D) both A and C
 - E) both B and C
8. Which one(s) of the following are not examples of intercellular messengers?
- A) hormones
 - B) cAMP
 - C) neurotransmitters
 - D) paracrine agents
 - E) both A and D
9. If an enzyme increases the affinity for its substrate:
- A) at any given [S] more Enzyme Substrate (ES) complexes will be formed
 - B) at any given [S] fewer ES complexes will be formed
 - C) the same number of ES complexes will be formed at a higher [S]
 - D) the V_{max} for the reaction will decrease
 - E) both A and C
10. Enzyme reactions can be modulated in which is the following way(s);
- A) law of mass action
 - B) changing enzyme concentration
 - C) changing the catalytic rate
 - D) phosphorylation of amino acid side chains
 - E) all of the above
11. Which of the following statements is FALSE concerning mitochondria:
- A) they are the site of oxidative phosphorylation
 - B) their outer membrane is impermeable to H^+
 - C) the matrix is the site of beta-oxidation of fats
 - D) the inner membrane contains ATP synthase
 - E) both A and B
12. According to Fick's Law of diffusion:
- A) the diffusion of uncharged molecules across a cell membrane occurs at a rate that is influenced by the surface area of the membrane and the magnitude of the concentration difference across it.
 - B) The net flux of uncharged molecules that cross cell membranes by diffusion is always from regions of lower concentration to regions of higher concentration
 - C) The net flux of an uncharged solute across a cell membrane will equal zero, when its concentration is the same on both sides of the membrane.
 - D) Both A and C
 - E) None of the above

Test continues on the next page...

13. Which of the following molecules is least likely to pass through the plasma membrane?

- A) fatty acid
- B) water
- C) sodium
- D) oxygen
- E) steroids

14. Which statement(s) is / are true regarding electrochemical gradients:

- A) the membrane potential describes the electrical driving force for charged ions
- B) the chemical gradient is determined by concentration differences across a membrane
- C) the net flux of an ion is determined by the balance of electrical and osmotic gradients
- D) all of the above
- E) both A and B are true

15. During secondary active transport Na^+ transport is often coupled to another molecule because:

- A) Na^+ passes easily through the lipid bilayer
- B) energy is released as Na^+ moved down its concentration gradient
- C) Na^+ binding to transporters increases the transporter's affinity for the 2nd molecule
- D) Na^+ consumes energy as it moves down its concentration gradient
- E) Both B and C are correct

16. Which of the following is true for facilitated diffusion but not for secondary active transport?

- A) a transmembrane protein is required
- B) the movement of a molecule across the membrane is subject to a transport maximum
- C) the movement of a molecule across the membrane is specific to a certain chemical
- D) a molecule is moved with its concentration gradient with the assistance of a protein carrier, and no energy is required
- E) none of the above

17. A cell (300 mOsmoles) is placed in a 200mM NaCl solution. The solution is _____ and the cell will _____.

- A) isotonic: not change size
- B) hypotonic: shrink
- C) hypotonic: swell
- D) hypertonic: shrink
- E) hypertonic: swell

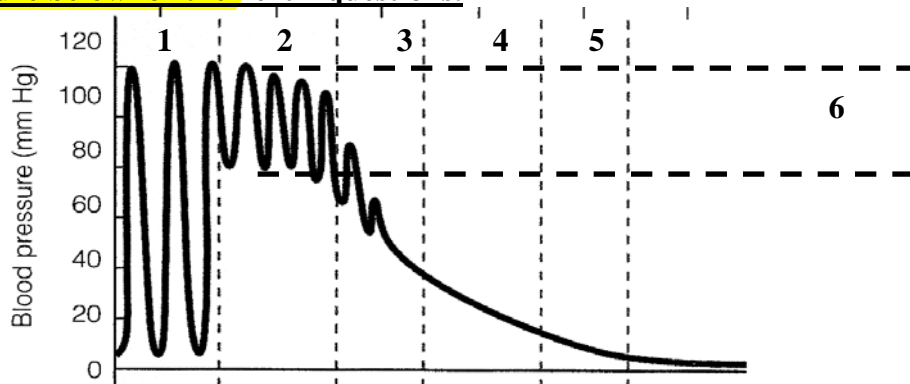
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18. Which statement(s) is / are **true** concerning the “leakiness” of cell membranes to ions:
- A) Passive leak of K^+ and Na^+ must be counteracted by active transport to maintain proper membrane potentials
 - B) Warm-blooded animals have less leaky membranes than cold-blooded animals
 - C) Active transport to counteract membrane leakiness produces heat as a byproduct
 - D) Na^+ and K^+ leak passively into the cell primarily directly through the lipid bilayer
 - E) Both A and C
19. Slow channels are identified as such because, once the receptor is bound by the ligand, the receptor must directly activate a(n) _____.
- A) G-protein
 - B) ion channel
 - C) enzyme
 - D) RNA polymerase
 - E) hormone response element
20. Which of the following is/ are **not** a protein(s) found in the red blood cells (erythrocytes)?
- A) hemoglobin
 - B) albumin
 - C) carbonic anhydrase
 - D) fibrinogen
 - E) both B and D
21. The buffy coat:
- A) is composed of plasma proteins
 - B) is composed of the cell membranes of dead erythrocytes
 - C) is composed of the major ions in blood
 - D) is composed of Willow and Spike proteins
 - E) is composed of leukocytes and blood platelet
22. Reduced oxygen delivery to _____, triggers the release of the hormone _____ simulating the production of erythrocytes by _____.
- A) liver: erythropoietin: kidney
 - B) liver: adrenaline: bone marrow
 - C) kidney: erythropoietin: bone marrow
 - D) bone marrow: erythropoietin: liver
 - E) kidney: epinephrine: bone marrow

Test continues on the next page...

23. The pulmonary circulation is able to maintain adequate flow rates with low pressures because:
- the left ventricle generates little force
 - the resistances of the pulmonary arterioles are low
 - flow in the pulmonary circuit is low
 - pulmonary arteries carry deoxygenated blood
 - Filtration is high in the pulmonary capillaries
24. With a systolic pressure of 140 mmHg and a diastolic pressure of 80mmHg, if the heart spent 20% of its time in systole and 80% of the time in diastole, what would the mean arterial pressure (MAP) be?
- 92 mmHg
 - 90 mmHg
 - 140 mmHg
 - 120 mmHg
 - 100 mmHg

Use the figure below for the next 2 questions.



25. Which statement is TRUE with regards to the blood pressure trace pictured above:
- the pressure at 1 is likely in the veins
 - the pressure at 2 is likely in the left ventricle
 - the pressure at 3 drops due to high resistance
 - the pressure fluctuation decrease between 1 and 2 is due to arterial compliance
 - both C and D are correct
26. Point 6 represents the difference in 2 pressures (depicted by the dashed lines) on the blood pressure trace above and indicates:
- the pressure oscillations in the left ventricle
 - the differences between systolic and diastolic blood pressures
 - the differences between mean arterial pressure and central venous pressure
 - the pressure oscillations in the right ventricle
 - both B and D are true

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27. Which of the following will result in vasodilation of arterioles

- A) Epinephrine (adrenaline) acting on β_2 adrenergic receptors
- B) A local decrease in pH
- C) Atrial natriuretic hormone, secreted by the heart
- D) An increase in adenosine
- E) All of the above will result in vasodilation

28. Which of the following would have the greatest effect on vascular resistance:

- A) a 25% increase in blood viscosity
- B) the vessel growing in length by 50%
- C) a 50% decrease in vessel radius
- D) a 25% increase in heart rate
- E) none of the above

29. During active hyperemia:

- A) cellular metabolism triggers extrinsic regulation of local blood flow
- B) tissue blood flow and metabolism are matched through autonomic nervous system input
- C) metabolic byproducts acts a paracrine vasodilators to increase local blood flow
- D) stretching of the arteriole triggers a vasoconstriction
- E) a lack of blood flow increases paracrine factors which cause vasodilation of blood vessels

30. Fenestrated capillaries are found in the liver because:

- A) liver is a major site of waste removal
- B) liver is not well vascularized
- C) liver produces plasma proteins
- D) liver produces red blood cells
- E) none of the above

31. According to the Starling-Landis model of capillary bulk fluid flow:

- A) capillaries have net uptake (absorption) of fluid from the interstitial space each day
- B) filtration occurs if the net filtration pressure is positive
- C) oncotic pressures change a lot from the arterial to venous end of a capillary
- D) capillaries have low oncotic pressures due to high plasma protein content
- E) both B and C

32. Capillaries are the primary site of exchange in the circulatory system because:

- A) they have a large surface area
- B) there is a higher blood velocity
- C) the diffusion barrier consists of a layer of smooth muscle cells
- D) most are within 1m of a cell
- E) all of the above

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33. Resting heart rate is set by the pacemaker cells:

- A) that they have the slowest rate of spontaneous action potentials
- B) with the highest rate of spontaneous action potentials and the actions of the parasympathetic nervous system
- C) of the AV node and the action of the sympathetic nervous system
- D) with the highest rate of spontaneous action potentials and the actions of the sympathetic nervous system
- E) situated in the aortic arch and controlled by epinephrine secretion

34. Venous compliance:

- A) is greater compared to that of the arteries
- B) helps smooth out pressure fluctuations produced by the pumping of the heart
- C) helps arteries act as a major volume reservoir of the circulatory system
- D) all them to only hold small volumes on blood
- E) both A and C

35. The heart requires conduction fibres:

- A) to speed up signals along the sympathetic nervous system
- B) to rapidly transmit action potentials generated by the pacemaker cells
- C) because gap junctions transmit action potentials too fast
- D) because gap junctions transmit action potential too slowly
- E) both B and D are correct

The END OF THE TEST.