

UNIVERSITY OF TEXAS AT ARLINGTON

DEPARTMENT OF BIOLOGY

PRINCIPLES OF ANIMAL PHYSIOLOGY

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FIRST INTRASESSIONAL EXAMINATION

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There are 57 items in this booklet. Be careful not to overlook any page in the examination booklet. You have 80 minutes to complete these questions.

During the course of the examination students will remain in their assigned seats. If assistance is needed, the student should raise his/her hand and a proctor will then attend the individual need of that student.

Upon completion of the exam, each student is to remain seated, raise her/his hand, and the exam materials will be collected by the proctors. At no time is the student to leave his/her seat and carry the exam materials to the proctors or other areas of the room.

After collection of exam materials, the student is to immediately and promptly leave the Examination Room.

NO EXTRA TIME WILL BE ALLOWED AT THE END OF THE EXAMINING PERIOD FOR ANSWERS TO BE TRANSFERRED TO THE ANSWER SHEET.

GOOD LUCK! 

DIRECTIONS: Each of the numbered items or incomplete statements in this section is followed by answers or completions of the statement. Select the ONE lettered answer or completion that is BEST in each case. Each multiple choice question is worth 1.5 points.

1. The amount of material crossing a surface in a given time (flux) depends on:

A. temperature ✓	B. mass of substance ✓	C. surface area
D. medium in which material is in ✓	<input checked="" type="radio"/> E. all of the above	

2. Lungs are to the respiratory system as the spleen is to the _____ system.

<input checked="" type="radio"/> A. lymphatic	<input checked="" type="radio"/> B. urinary	<input checked="" type="radio"/> C. digestive
D. cardiovascular	<input checked="" type="radio"/> E. both A and D ✓	

3. Hemoglobin represents which level of protein organization?

<input checked="" type="radio"/> A. primary	B. secondary structure	C. tertiary structure
<input checked="" type="radio"/> D. quaternary structure	E. None of these; hemoglobin is a polysaccharide	

4. The process by which molecules such as glucose are moved into cells along their concentration gradient with the help of membrane-bound carrier proteins is called?

<input checked="" type="radio"/> A. osmosis	<input checked="" type="radio"/> B. facilitated diffusion	<input checked="" type="radio"/> C. active transport
D. endocytosis	<input checked="" type="radio"/> E. exocytosis	

5. How does one explain the formation of ions?

<input checked="" type="radio"/> A. sharing of electrons	<input checked="" type="radio"/> B. gain or loss of electrons	<input checked="" type="radio"/> C. gain or loss of protons
D. sharing of protons	<input checked="" type="radio"/> E. gain or loss of neutrons	

6. Basic cell functions may include which of the following:

A. self-organizing ✓	B. self-regulating ✓	C. self-replicating ✓
<input checked="" type="radio"/> D. All of the above	<input checked="" type="radio"/> E. Only two of the above	

7. A solution that contains a lower solute concentration than the cytoplasm of a cell is called:

<input checked="" type="radio"/> A. merotonic	<input checked="" type="radio"/> B. hypertonic	<input checked="" type="radio"/> C. isotonic
<input checked="" type="radio"/> D. hypotonic	<input checked="" type="radio"/> E. homotonic	

8. Skin, hair, and nails are associated with the _____ system.

<input checked="" type="radio"/> A. skeletal	<input checked="" type="radio"/> B. muscular	<input checked="" type="radio"/> C. integumentary
D. endocrine	<input checked="" type="radio"/> E. both A and B	

9. Glycoproteins and proteoglycans are combinations of proteins and:

<input checked="" type="radio"/> A. carbohydrates	B. fatty acids	C. lipids
D. nucleic acids	E. none of the above	

10. In feedback-control systems, when an animal's internal conditions parallel those of the external environment they are referred to as:

<input checked="" type="radio"/> A. regulators	<input checked="" type="radio"/> B. homeostatic	<input checked="" type="radio"/> C. followers
<input checked="" type="radio"/> D. conformers	<input checked="" type="radio"/> E. reformers	

11. Which of the following cytoskeleton components are responsible for the movement of chromosomes during cell division?

<input checked="" type="radio"/> A. microfilaments	<input checked="" type="radio"/> B. intermediate filaments	<input checked="" type="radio"/> C. thick filaments
<input checked="" type="radio"/> D. microtubules	<input checked="" type="radio"/> E. basal bodies	

12. Dead skin cells are shed in thick sheets because they are held together by a thin layer of proteoglycan reinforced by intermediate filaments. Such strong intercellular connections are:
- A. gap junctions B. intermediate junctions C. tight junctions
 D. desmosomes E. junctional complexes
13. The movement of a particular amino acid across the cell membrane (along its concentration gradient) is impaired when a molecule of chemically similar to the amino acid is added to the extracellular fluid. The movement of the amino acid through the membrane is by:
- A. osmosis B. diffusion C. facilitated diffusion
 D. active transport E. pinocytosis
14. One mole of any element:
- A. has the same mass B. has the same weight
 C. has the same number of atoms D. has the same number of electrons
 E. All of the above
15. Two types of vesicular transport include:
- A. endocytosis and indocytosis B. endocytosis and exocytosis
 C. exocytosis and indocytosis D. pinocytosis and active transport
 E. diffusion and active transport
16. Which of the following are known to be second messengers?
- A. cyclic AMP B. calcium
 C. ATP D. Both cyclic AMP and calcium
 E. All of these are correct answers.
17. Diffusion of a substance across the cell membrane is influenced by all of the following, **EXCEPT**:
- A. its ability to dissolve in water B. the size of the membrane channel
 C. the charge on the ion or molecule D. the charge of the membrane
 E. its solubility in the lipid membrane
18. The mass of an atom indicates the number of:
- A. protons in the nucleus B. neutrons in the nucleus
 C. electrons in the outer shells D. protons and neutrons in the nucleus
 E. protons and electrons in an atom
19. Arrange the following list of levels of organization from the smallest to the largest level.
1. tissue 2. cell 3. organ
4. organelle 5. organism 6. organ system
- A. 2, 4, 1, 3, 6, 5
 B. 4, 2, 1, 3, 6, 5
 C. 4, 2, 1, 6, 3, 5
 D. 4, 2, 3, 1, 6, 5
 E. 2, 1, 4, 3, 5, 6
20. 9.3×10^6 red blood cells/ml were injected into a solution containing 0.401 osmolar NaCl. What would be the effect of the solution on the volume of the red blood cells, 90 minutes after injection: (normal blood osmolarity = 385 milli osmoles):
- A. The cell volume will gradually increase accompanied by a rapid decrease to its original size.
 B. The volume of the red blood cells will increase, swelling the cells.
 C. The volume of the red blood cells will decrease, shrinking the cells.
 D. The cell volume will gradually decrease accompanied by a sharp increase.
 E. The solution has no effect on the volume of the red blood cells.

21. Which of the following apply to all living membranes?

- A. large anions have difficulty passing through ✓
- B. the resistance across the membrane is extremely high as compared to the resistance of the fluid ✓
- C. unequal permeability to Na^+ and K^+ ✓
- D. maintenance of a potential difference across membrane ✓
- E. all of the above ✓

22. Osmosis depends on:

- A. random movement of water molecules until equilibrium is reached ✓
- B. random movement of solute molecules until equilibrium is reached ✓
- C. differences in water concentration between solutions ✓
- D. the amount of water inside and outside the cell ✓
- E. All of these are correct. ✓

23. The plasma membrane:

- A. appears under an electron microscope as a double dark line with a light space between ✓
- B. is composed primarily of a double layer of phospholipid molecules with proteins interspersed throughout the phospholipids in a mosaic pattern ✓
- C. separates the intracellular and extracellular fluid ✓
- D. Two of these answers are correct. ✓
- E. All of these answers are correct. ✓

24. Which of these would **NOT** be scientific?

- A. Determine differences in species composition between two parks. ✓
- B. Immunize people with different vaccines to determine the effectiveness against flu virus. ✓
- C. Send tadpoles up in the space shuttle to see how gravity affects development. ✓
- D. Use different tomatoes in spaghetti sauce to determine which produces the best taste. ✓
- E. Use different advertising methods for a product to determine which produces the best purchasing results. ✓

25. Some important generalizations about homeostatic control systems include:

- A. it is possible for everything to be maintained relatively constant ✓
- B. complete constancy of any given feature is maintained ✓
- C. stability is achieved by controlling the output only ✓
- D. all of the above ✓
- E. a change in the variable being regulated brings about responses which tend to push the variable in a direction opposite the original change ✓

26. One ml of an experimental drug diluted in a saline solution is injected into 20 pregnant mice to determine possible side effects. Which of the following is a suitable "control" for this experiment?

- A. 20 male mice injected with 1 ml of saline ✓
- B. 20 male mice injected with 1 ml of the drug ✓
- C. 20 pregnant mice injected with 2 ml of the drug ✓
- D. 20 non-pregnant mice injected with 1 ml of the drug ✓
- E. 20 pregnant mice injected with 1 ml of saline ✓

27. Inside a "cell" YOU construct, you place a 1M salt solution. You place the cell in a 1M sugar solution. What happens?

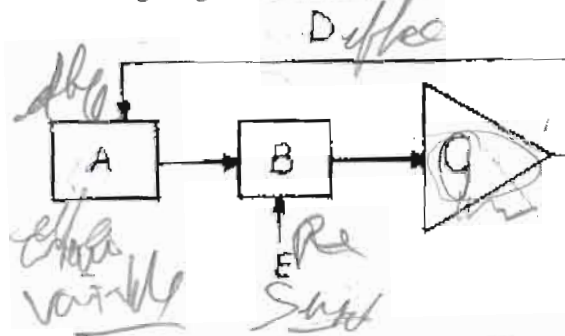
- A. Water enters the cell because there is more water outside than inside. ✓
- B. Water leaves the cell because sugar is a larger molecule than salt. ✓
- C. Water leaves and enters at the same rate. ✓
- D. Sugar diffuses in and salt diffuses out until equilibrium is reached. ✓
- E. Both C and D are correct. ✓

28. The following is a list of the steps involved in the process of secretion by the Golgi apparatus.

1. Material moves from saccule to saccule by means of transfer vesicles.
2. Exocytosis
3. Products from RER are packaged into transport vesicles.
4. Secretory vesicles are formed at the trans face.
5. Vesicles arrive at the cis saccule.
6. Enzymes modify arriving proteins and glycoproteins.

- A. 5, 6, 1, 4, 2, 3
- B. 2, 3, 5, 6, 1, 4
- C. 4, 3, 1, 6, 5, 2
- D. 3, 5, 6, 1, 4, 2
- E. 1, 3, 6, 4, 2, 5

Use the following diagram to answer the next two (2) questions



29. In the diagram above, the SENSOR is represented by what letter?

30. In the diagram above, the CONTROLLED SYSTEM is fed into which device?

31. Which of the following statements concerning gap junction is incorrect?

- A. Gap junctions are communicating junctions.
- B. At a gap junction, filaments of unknown composition extend between the plasma membranes of two closely adjacent but not touching cells, acting as "spot rivets" to anchor the cells together.
- C. Gap junctions are formed by small connecting tunnels that link two adjacent cells and permit exchange of small water-soluble particles between the cells.
- D. Gap junctions play an important role in transmission of electrical activity throughout an entire muscle mass.
- E. Connexons are an important structural component of gap junctions.

32. Compared to the extracellular fluid, cytosol contains:

- A. a higher concentration of sodium ions
- B. a relatively high concentration of dissolved proteins
- C. relatively low supplies of carbohydrates
- D. relatively few amino acids
- E. no lipids

33. Which has the greater concentration of hydrogen ions, a substance with a pH of 5 or a substance with a pH of 4?

- A. A pH of 4 is greater.
- B. A pH of 5 is greater.
- C. They are both equal; 4 and 5 are relative values.
- D. A and B
- E. none of the above

34. A chemical imbalance in a heart muscle cell can cause the heart to stop pumping blood, which in turn will cause other tissues and organs to cease functioning. This observation supports the view that:

- A. all organisms are composed of cells
- B. chemical molecules make up cells
- C. all levels of organization within an organism are interdependent
- D. all cells are independent of each other
- E. Congenital defects can be life-threatening

35. In positive feedback, the initial stimulus produces a response that:

- A. suppresses the stimulus
- B. has no effect on the stimulus
- C. interferes with the completion of the process
- D. exaggerates the stimulus
- E. impedes the stimulus

36. Calculate the net diffusive flux across the membrane, when: $A = 0.1 \text{ cm}^2$, $C_o = 3.5 \times 10^{-8} \text{ M}$, $C_i = 2.5 \times 10^{-8} \text{ M}$, and $k_d = 9.1 \times 10^{-6} \text{ cm/sec}$.

- A. $J = 9.1 \times 10^{-15} \text{ cm}^3 \text{ M/sec}$
- B. $J = -9.1 \times 10^{-14} \text{ cm}^3 \text{ M/sec}$
- C. $J = -9.1 \times 10^{-15} \text{ cm}^3 \text{ M/sec}$
- D. $J = 9.1 \times 10^{-14} \text{ cm}^3 \text{ M/sec}$
- E. $J = -9.1 \times 10^{-15} \text{ cm}^3 \text{ M/sec}$

DIRECTIONS: For each numbered word, phrase or statement, select the one lettered heading or lettered component that is most closely associated with it. Each lettered heading or component may be selected once or more than once.

Match the following lettered items to the statements listed below.

- A. Endoplasmic Reticulum
- B. Mitochondria
- C. Nucleus
- D. Golgi Apparatus
- E. None of the above

37. Site for protein synthesis: **A**

38. Contains smooth outer membrane, folded inner sheets (cristae) and an inner space (matrix):

39. Contains chromatin and genetic information: **B**

40. Responsible for concentrating and packaging proteins: **C**

Match the following lettered items to the statements listed below.

- A. Active transport
- B. Facilitated diffusion
- C. Simple diffusion
- D. Both A and B
- E. None of the above

41. Chemical specific: **D**

42. Moves substances against a concentration gradient (uphill):

43. Shows saturation kinetics: **A**

44. The plasma membrane:
- A. is composed of a bilayer of proteins
 - B. is composed of a bilayer of lipids
 - C. is composed of only carbohydrate molecules
 - D. is a complex combination of carbohydrates and proteins
 - E. is a complex combination of carbohydrates and lipids
45. In negative feedback:
- A. a change in the variable is not compensated
 - B. a disturbance brings about responses to push the disturbance opposite the original change
 - C. a change in the system causes a further increase in the disturbance
 - D. the change in the system is not limited by any set point
 - E. always bring the change to zero
46. The net diffusive flux of carbon dioxide across the membrane will be:
- A. predicted by the direction of its mediated transport system
 - B. inversely proportional to its molecular radius and weight
 - C. inversely proportional to the difference in its concentration on the two sides of the membrane
 - D. independent of its physical and chemical nature
 - E. depends on the nature of the carbon dioxide used
47. Breathing faster and deeper eliminates more carbon dioxide from the body than normal breathing. Under these circumstances:
- A. more carbon dioxide will diffuse out of the blood
 - B. more carbon dioxide will diffuse into the blood
 - C. less carbon dioxide will diffuse out of the blood
 - D. less carbon dioxide will diffuse into the blood
 - E. the rate of carbon dioxide diffusion will remain the same
48. While studying the transport of molecule B across the cell membrane, you discover that as the concentration of B in the extracellular fluid is increased, so initially is the rate of transport. If the concentration of B is increased more, the rate becomes constant (the system exhibits saturation). Which of the following statements concerning this situation is true?
- A. Cellular energy is expended in this process.
 - B. The transport process involves a carrier protein
 - C. The process is a type of endocytosis.
 - D. Osmosis must be occurring.
 - E. This is an example of an ion exchange pump.

Short-Answer Questions

Please answer these questions briefly. Label diagrams correctly, with lines pointing to the proper structures. Partial credit will be given where appropriate. Write legibly!!

You can use the back of the last page to continue any question. Number them, please.

49. What is the difference between a scientific question, a hypothesis, and a law? (6 points)

- 1) Scientific question usually is asked by researchers after observing the natural environment.
- 2) Researchers forms a hypothesis, an educated guess, and do the experiment to test it.
- 3) Hypothesis will become a law if many experiments' result support it.

50. Write two (2) forms of the Nernst equation (4 points)

$$1) E = \frac{61}{z} \log \frac{[out]}{[in]}$$

$$2) \Delta V = V_{final} - V_{initial}$$

51. Define the following terms (1 sentence). (3 points)

A. Agonist - to enhance the response

B. Antagonist - to oppose the response

C. Signal transduction - the communication process that transmits the extracellular signals into the cell by, usually, using receptors, first messenger, and 2nd messengers.

52. Name four (4) membranous organelles. (2 points)

- mitochondria
- lysosome
- Rough ER
- Nucleus

53. Write the equation for Fick's law of diffusion. (4 points)

$$\text{Fick's Law} = \frac{\Delta C \cdot P \cdot A}{\Delta x \cdot MW}$$

54. List 4 types of graded potentials. (4 points)

- synaptic graded potential
- neuromuscular graded potential
-
-

55.

The classification of chemical messengers include Eicosanoids. List the others. (4 points)

- cytokines
- paracines
- hormones
- neurotransmitters

56. List the major functions of the cell membrane. (4 points)

- to separate ICF and ECF
- to separate charges for action potential
- to regulate movement of ions and other biological substances.

57. Draw and completely label an action potential. (10 points)

Absolute Refractory Period

Relative Refractory Period

Overshoot

Depolarization

Action potential

Repolarization

Hyperpolarization

Undershoot

Threshold

Resting potential

+30
0
-50
-70
mV

Times (s)

10

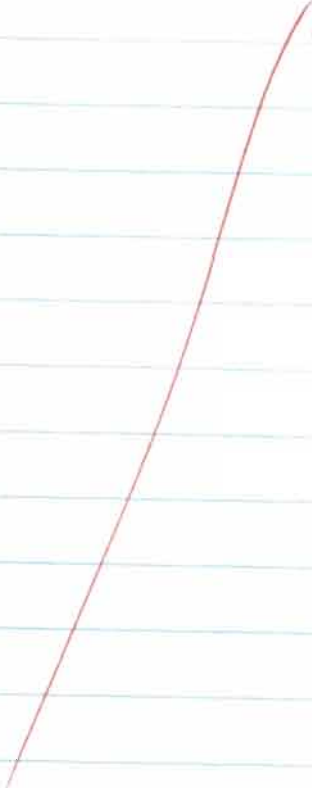
8.5

1.5

2.5

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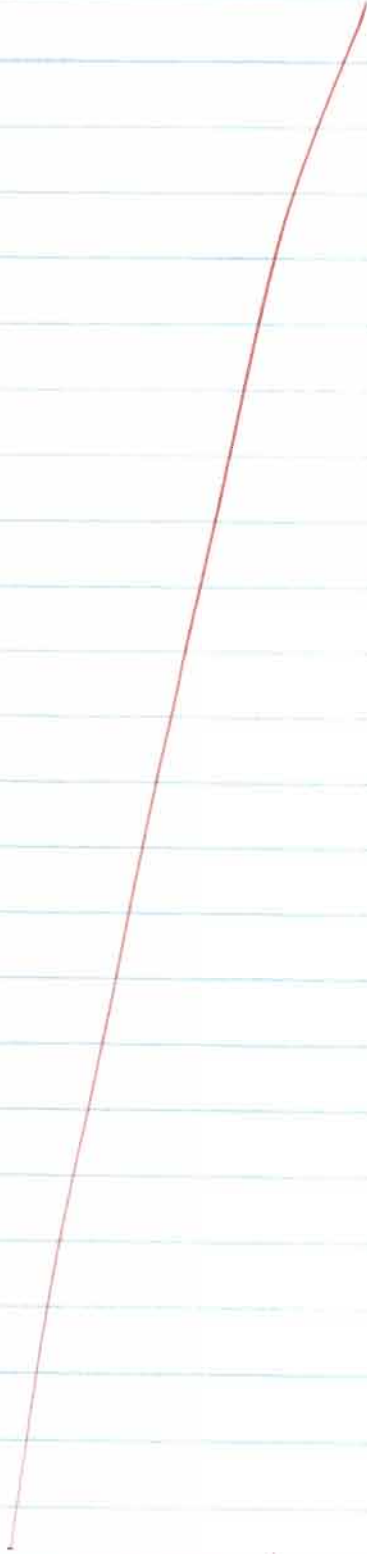
(10)

- 1) Observation
 - 2) hypothesis
 - 3) experiment
 - 4) Collect Data
 - 5) Analysis
 - 6) Replication
 - 7) Theory
 - 8) Law.
- 

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3-6

-collagens



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