

## Common Challenges- Water & Waste MYP Exam

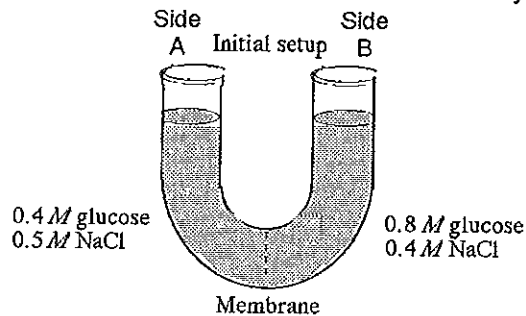
### Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.

1. Which of the following statements about xylem is *incorrect*?
  - A) It conducts material upward.
  - B) It conducts materials within dead cells.
  - C) It transports mainly sugars and amino acids.
  - D) It has a lower water potential than soil does.
  - E) No energy input from the plant is required for xylem transport.
2. What do cohesion, surface tension, and adhesion have in common with reference to water?
  - A) All increase when temperature increases.
  - B) All are produced by ionic bonding.
  - C) All are properties related to hydrogen bonding.
  - D) All have to do with nonpolar covalent bonds.
  - E) C and D only
3. Which of the following has the *lowest* (most negative) water potential?
  - A) soil
  - B) root xylem
  - C) trunk xylem
  - D) root hairs
  - E) leaf air spaces
4. At what temperature does water freeze?
  - A) 0°C
  - B) 4°C
  - C) 37°C
  - D) -100°C
  - E) -212°C

Use the figure below to answer the following questions.

The solutions in the arms of a U-tube are separated at the bottom of the tube by a selectively permeable membrane. The membrane is permeable to sodium chloride but not to glucose. Side A is filled with a solution of  $0.4\text{ M}$  glucose and  $0.5\text{ M}$  sodium chloride (NaCl), and side B is filled with a solution containing  $0.8\text{ M}$  glucose and  $0.4\text{ M}$  sodium chloride. Initially, the volume in both arms is the same.



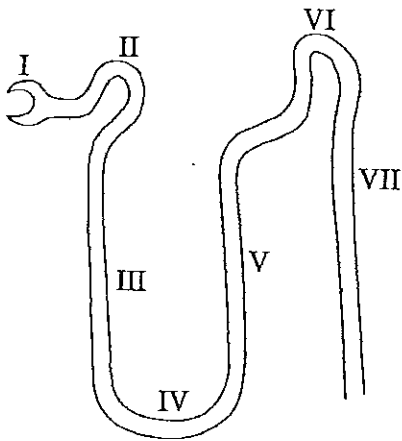
5. Which of the following statements *correctly* describes the tube after equilibrium is reached?
  - A) The concentration of NaCl is equal on both sides, the concentration of glucose is equal on both sides.
  - B) The concentration of NaCl is equal on both sides, the concentration of glucose is greater on side A.
  - C) The concentration of NaCl is greater on side A, the concentration of glucose is equal on both sides.
  - D) The concentration of NaCl is equal on both sides, the concentration of glucose is greater on side B.
  - E) The concentration of NaCl is greater on side A, the concentration of glucose is equal on both sides.
6. Celery stalks that are immersed in fresh water for several hours become stiff and hard. Similar stalks left in a salt solution become limp and soft. From this we can deduce that the cells of the celery stalks are
  - A) hypotonic to both fresh water and the salt solution.
  - B) hypertonic to both fresh water and the salt solution.
  - C) hypertonic to fresh water but hypotonic to the salt solution.
  - D) hypotonic to fresh water but hypertonic to the salt solution.
  - E) isotonic with fresh water but hypotonic to the salt solution.
7. What kinds of molecules pass through a cell membrane most easily?
  - A) large and hydrophobic
  - B) small and hydrophobic
  - C) large polar
  - D) ionic
  - E) monosaccharides such as glucose
8. Compared to a cell with few aquaporins in its membrane, a cell containing many aquaporins will
  - A) have a faster rate of osmosis.
  - B) have a lower water potential.
  - C) have a higher water potential.
  - D) have a faster rate of active transport.
  - E) be flaccid.

9. Which of the following is a nitrogenous waste that requires hardly any water for its excretion?
- A) amino acid
  - B) urea
  - C) uric acid
  - D) ammonia
  - E) nitrogen gas
10. Which of the following would likely move through the lipid bilayer of a plasma membrane most rapidly?
- A)  $\text{CO}_2$
  - B) an amino acid (central carbon surrounded by 4 groups of molecules, 2 of which are charged)
  - C) glucose (six carbon atoms, 12 hydrogen atoms, six oxygen atoms)
  - D)  $\text{K}^+$  (ion)
  - E) starch (polymer of sugar molecules)
11. The movement of a substance across a biological membrane against its concentration gradient with the help of energy input is
- A) diffusion.
  - B) active transport.
  - C) osmosis.
  - D) facilitated diffusion.
  - E) passive transport.
12. Which statement is true about marine fishes?
- A) They have large kidneys with large and numerous nephrons.
  - B) The kidneys of marine fishes excrete little urine.
  - C) Marine fishes lack kidneys.
  - D) Marine fishes secrete uric acid to conserve water.
  - E) Their kidneys produce urine at high rates.
13. Depending on salt intake and water availability, humans can produce urine that is
- A) hyperosmotic (less concentrated) to body fluids.
  - B) hypoosmotic (more concentrated) to body fluids.
  - C) isoosmotic (equally concentrated) to body fluids.
  - D) A and B are true.
  - E) A, B, and C are true.
14. Which of the following has an effect on water potential ( $\Psi$ ) in plants?
- A) air pressure
  - B) dissolved solutes
  - C) nothing, its simply defined by scientists as zero
  - D) undissolved solutes only
  - E) A and B only
15. Which of the following is true of ammonia?
- A) It is soluble in water.
  - B) It can be stored as a precipitate (it does not dissolve).
  - C) It has low toxicity relative to urea.
  - D) Only A and C are true.
  - E) Only B and C are true.

16. The slight negative charge at one end of one water molecule is attracted to the slight positive charge of another water molecule. What is this attraction called?
- A) a covalent bond
  - B) a hydrogen bond
  - C) an ionic bond
  - D) a hydrophilic bond
  - E) a hydrophobic bond
17. Organisms categorized as osmoconformers are most likely
- A) terrestrial.
  - B) marine.
  - C) amphibious.
  - D) found in freshwater streams.
  - E) found in freshwater lakes.
18. In a single molecule of water, the two hydrogen atoms are bonded to a single oxygen atom by
- A) hydrogen bonds.
  - B) nonpolar covalent bonds.
  - C) polar covalent bonds.
  - D) ionic bonds.
  - E) van der Waals interactions.
19. All of the following are functions of the mammalian kidney *except*
- A) water reabsorption.
  - B) filtration of blood.
  - C) excretion of nitrogenous waste.
  - D) regulation of salt balance in the blood.
  - E) production of urea as a waste product of sugar catabolism (breakdown).
20. A marine sea star was mistakenly placed in freshwater and it died. What is the most likely explanation for its death?
- A) The sea star was stressed and needed more time to adapt to new conditions.
  - B) The sea star is hypertonic to the freshwater, and it could not osmoregulate the additional water intake.
  - C) The osmoregulatory system of the sea star could not handle the additional ions found in the freshwater.
  - D) The contractile vacuoles used to regulate water content ruptured in the freshwater.
  - E) The cells of the sea star dehydrated and lost the ability to metabolize.
21. Which of the following statements is *correct about diffusion*?
- A) It is very rapid over long distances.
  - B) It requires an expenditure of energy by the cell.
  - C) It is a passive process in which molecules move from a region of higher concentration to a region of lower concentration.
  - D) It is an active process in which molecules move from a region of lower concentration to one of higher concentration.
  - E) It requires proteins in the cell membrane.
22. Which surrounding environment would present the greatest challenge to most bacteria?
- A) hypotonic
  - B) hypertonic
  - C) isotonic
  - D) they are equally challenging
  - E) they are unicellular, none of these would be a challenge

23. The initial response of the root cells of a tomato plant watered with seawater would be to
- A) rapidly produce organic solutes in the cytoplasm.
  - B) rapidly expand from water intake until the cells burst.
  - C) begin to plasmolyze as water is lost.
  - D) actively transport water from the cytoplasm into the vacuole.
  - E) actively absorb salts from the seawater.
24. Your laboratory partner has an open beaker of pure water. By definition, the water potential ( $\Psi$ ) of this water is
- A) not meaningful, because it is an open beaker and not plant tissue.
  - B) a negative number set by the volume of the beaker.
  - C) a positive number set by the volume of the beaker.
  - D) equal to the atmospheric pressure.
  - E) zero.
25. Which of the following is true of urea? It is
- A) insoluble in water.
  - B) more toxic to human cells than ammonia.
  - C) the primary nitrogenous waste product of humans.
  - D) the primary nitrogenous waste product of most birds.
  - E) the primary nitrogenous waste product of unicellular organisms.
26. Photosynthesis begins to decline when leaves wilt because
- A) flaccid cells are incapable of photosynthesis.
  - B)  $\text{CO}_2$  accumulates in the leaves and inhibits photosynthesis.
  - C) there is insufficient water for photosynthesis.
  - D) stomata close to conserve water, but also prevents  $\text{CO}_2$  entry into the leaf.
  - E) flaccid cells cannot absorb light.

Refer to the figure below, a diagram of a renal tubule, to answer the following questions.



27. In which region would urine become more concentrated?
- A) I
  - B) III
  - C) IV
  - D) V
  - E) VII

28. In which region would filtration occur?
- A) I
  - B) III
  - C) IV
  - D) V
  - E) VII
29. Transpiration in plants requires all of the following *except*
- A) adhesion of water molecules to walls of the xylem.
  - B) cohesion between water molecules.
  - C) evaporation of water molecules.
  - D) active transport through xylem cells.
  - E) tension (generated by pressure difference between xylem and the atmosphere).
30. Water passes *quickly* through cell membranes because
- A) the entire bilayer is hydrophilic.
  - B) it moves through hydrophobic channels.
  - C) water movement is tied to ATP hydrolysis (energy consumption).
  - D) it is a small, polar, charged molecule.
  - E) it moves through aquaporins in the membrane.
31. Which organism(s) has excretory structures known as protonephridia?
- A) flatworms
  - B) earthworms
  - C) insects
  - D) vertebrates
  - E) both C and D
32. Root hairs are most important to a plant because they
- A) anchor a plant in the soil.
  - B) store starches.
  - C) increase the surface area for absorption.
  - D) provide a habitat for nitrogen-fixing bacteria.
  - E) contain xylem tissue.
33. The value for  $\Psi$  in root tissue was found to be  $-0.15$  MPa. If you take the root tissue and place it in a solution of sucrose where the  $\Psi = -0.23$  MPa, net water flow would
- A) be from the tissue into the sucrose solution.
  - B) be from the sucrose solution into the tissue.
  - C) be in both directions and the concentrations would remain equal.
  - D) occur only as ATP was used to actively transport the water.
  - E) be impossible to determine from the values given here.
34. What is the main force by which most of the water within xylem vessels moves toward the top of a tree?
- A) active transport of ions into the stem
  - B) atmospheric pressure on roots
  - C) evaporation of water through stoma
  - D) the force of root pressure
  - E) osmosis in the root

35. What is the functional unit of the kidney?
- A) cortex
  - B) vasa recta
  - C) nephron
  - D) bladder
  - E) glomerulus
36. Which of the following statements is *false* about bulk flow?
- A) It is driven primarily by pressure potentials.
  - B) It is more effective than diffusion over distances greater than 100  $\mu\text{m}$ .
  - C) It is responsible for moving a column of water upward in plants.
  - D) Positive pressure potentials contribute to bulk flow.
  - E) Negative pressure potentials contribute to bulk flow.
37. Where and from what compound(s) is urea produced?
- A) liver from  $\text{NH}_3$  and  $\text{CO}_2$
  - B) liver from glycogen
  - C) kidneys from glucose
  - D) kidneys from glycerol and fatty acids
  - E) bladder from uric acid and  $\text{H}_2\text{O}$
38. Which organism(s) has excretory organs known as Malpighian tubules?
- A) earthworms
  - B) flatworms
  - C) insects
  - D) jellyfish
  - E) both A and B
39. Which of the following processes of osmoregulation by the human kidney is the *least* selective?
- A) salt pumping to control osmolarity
  - B)  $\text{H}^+$  pumping to control pH
  - C) reabsorption of important solutes
  - D) filtration of blood
  - E) secretion of waste
40. The digestion and metabolism of which nutrient creates the greatest need for osmoregulation by the kidneys?
- A) protein
  - B) starch
  - C) fat
  - D) oil
  - E) cellulose
41. The amount and direction of movement of water in plants can *always* be predicted by measuring which of the following?
- A) air pressure
  - B) rainfall
  - C) proton gradients
  - D) dissolved solutes
  - E) water potential ( $\Psi$ )

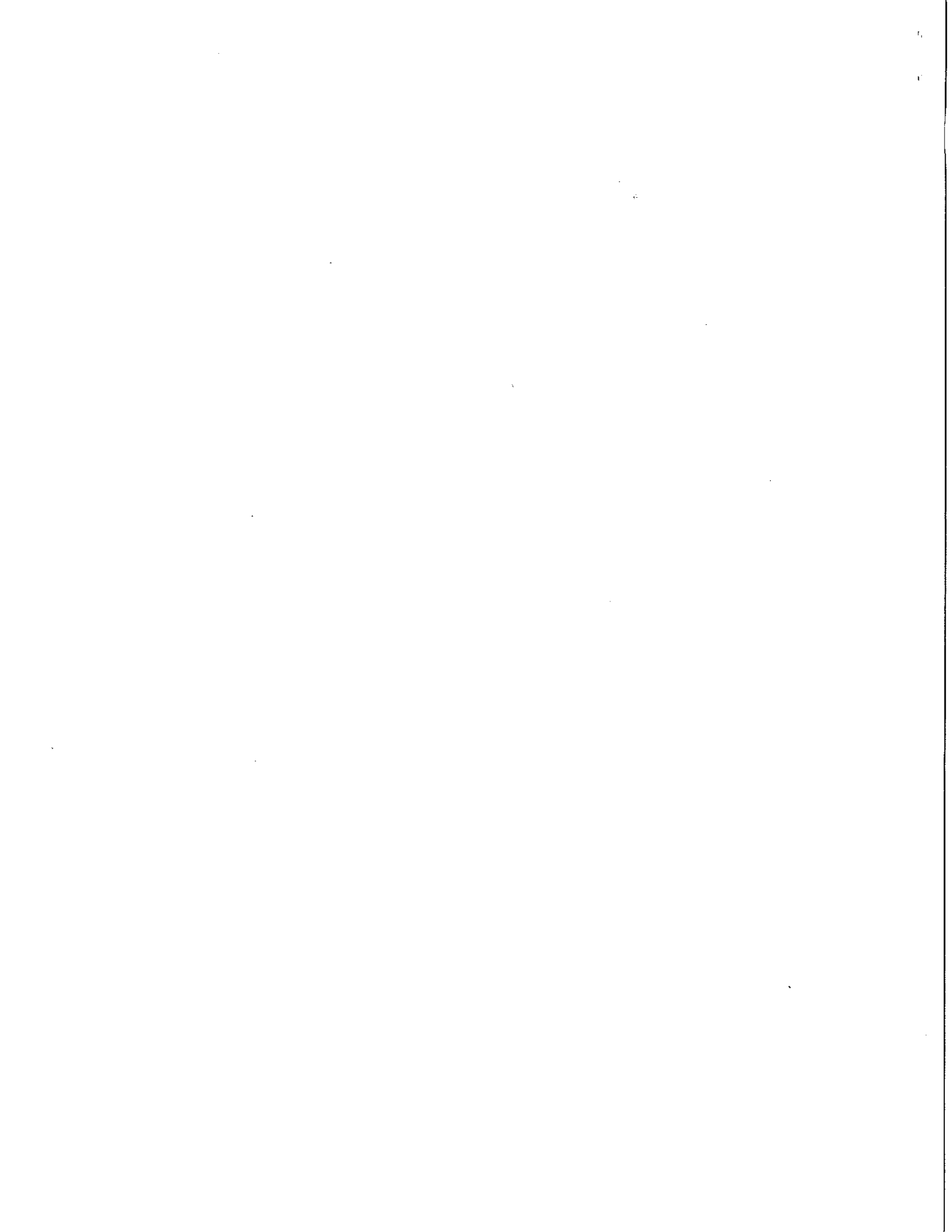
42. The advantage of excreting wastes as urea rather than as ammonia is that
- A) urea requires no energy for excretion.
  - B) urea is less toxic than ammonia.
  - C) urea requires more water for excretion than ammonia.
  - D) urea does not affect the osmolar gradient.
  - E) less nitrogen is removed from the body.
43. If  $\Psi_P = 0.3$  MPa and  $\Psi_S = -0.45$  MPa, the resulting  $\Psi$  is
- A) +0.75 MPa.
  - B) -0.75 MPa.
  - C) -0.15 MPa.
  - D) +0.15 MPa.
  - E) impossible to calculate with this information.
44. All of the following are adaptations that help reduce water loss from a plant *except*
- A) transpiration.
  - B) stomata that can be opened and closed.
  - C) deep roots.
  - D) small, thick leaves.
  - E) photosynthesis that can be partially done at night.
45. Ignoring all other factors, what kind of day would result in the greatest rate of transpiration assuming of course the stomates remain open?
- A) wet soil, cool, dry, calm night
  - B) wet soil, warm, dry, windy day
  - C) wet soil, warm, humid, windy day
  - D) dry soil, cool, humid, calm night
  - E) dry soil, very hot, dry, calm day
46. Which mechanism(s) of excreting nitrogenous wastes is/are most often used by unicellular organisms
- A) contractile vacuoles
  - B) phagocytosis
  - C) active transport
  - D) diffusion
  - E) osmosis
47. Unicellular protists and bacteria excrete nitrogenous waste in the form of
- A) urea
  - B) uric acid
  - C) ammonia
  - D) all of the above
  - E) none, they do not generate nitrogenous waste
48. When fungal cells osmoregulate by biosynthesizing organic molecules they are adding solutes to their cytoplasm in an effort to
- A) decrease water potential in order to move water out of the cell
  - B) decrease water potential in order to move water into the cell
  - C) increase water potential in order to move water out of the cell
  - D) increase water potential in order to move water into the cell
  - E) maintain the water potential to keep the net flow of water equal



Name: \_\_\_\_\_

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49. Which organisms below do not excrete nitrogenous waste?
- A) heterotrophic bacteria
  - B) pathogenic fungi
  - C) all humans
  - D) heterotrophic protists
  - E) most plants
50. Which statements accurately describe the changes in water as it freezes.
- A) water molecules move closer together and become more dense
  - B) water molecules move closer together and become less dense
  - C) water molecules move farther apart and become more dense
  - D) water molecules move farther apart and become less dense
  - E) hydrogen bonds break between water molecules and form a crystal lattice with solutes





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