THE COPPERBELT UNIVERSITY
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COURSE: MBS 210
Duration: 1 hr
Date: 16th February 2021
Student Identification Number.....
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Section A: Multiple Choice Questions (45 marks)
Choose the single best option. Each question is 1 mark.

1. A membrane transport protein has a "transporter" mechanism if:
A. it forms an open pore through which a molecule can diffuse.
B. an electrochemical gradient is necessary for transport to occur. even Conc. Gradient
C. it only allows transport "down" a concentration gradient. also active transport
D. molecules are transported in opposite directions across the membrane. Can be in same direction
E. it binds to the molecule and changes shape during transport. describes a type of transporter

2. A "passive" membrane transport protein:
A. will require a direct source of energy for the transport to occur. (Active transport.
B. can only transport a molecule 'down' a gradient.
C. is most likely to involve a 'carrier' type transport mechanism.
D. can move a molecule 'up' a gradient if a membrane potential exists. (active transport.

3. Suppose you were to treat a normal mammalian cell with a substance that inhibits the Na-K ATPase. Would be the most immediate effect upon the cell?
A. There would be no change at all.
B. The cell's osmotic balance were be disrupted, and the cell would begin to swell.
C. The cell membrane potential would immediately drop to zero.
D. The cell would very quickly run out of ATP.
E. The cell could not create an action potential.

4. Transport across a membrane is said to be 'coupled' when
A. two molecules are transported across the membrane in the same direction.
B. membrane transport is coupled to an energy source, such as ATP hydrolysis.
C. transport of one ion down its gradient provides the energy to transport another molecule against its gradient.
D. both the concentration gradient and membrane potential determine the rate of transport
across the membrane.

5. A membrane transporter is said to be 'gated' if it:
A. requires the binding of ATP to open.
B. allows molecules to pass in only one direction.
C. participates in the formation of the membrane potential
D. opens in response to a specific stimulus.

6. All of the following are functions of the cell membrane EXCEPT:
A. transmitting signals.
B. participating in energy transfer.
C. being freely permeable to all substances.
D. regulating the passage of materials.
E. participating in chemical reactions.

7. Which of the following statements concerning phospholipids is FALSE?
A. They have two distinct regions, one strongly hydrophobic and the other strongly hydrophilic.
B. They are amphipathic molecules.
C. They have cylindrical shapes that allow them to associate with water most easily as a bilayer structure.
D. They contain a polar organic group attached to a phosphate group.
E. They contain three fatty acids chains.

8. In a lipid bilayer, _____ fatty acid tails face each other within the bilayer and form
a region that excludes water.
A. hypertonic
B. hyperosmotic
C. hypotonic
D. hydrophilic
E. hydrophobic

9. A key discovery that weakened the Davson-Danielli "sandwich" model of cell membranes was that:
A. membrane proteins form a solid sheet on either side of the phospholipid bilayer.
B. membrane proteins form a solid sheet separating the phospholipid layer.
C. the phospholipids do not associate with each other in the hydrophobic region of membranes.
D. membrane proteins were not uniform and did not form flattened sheets.
E. membrane proteins occurred in regular organized patterns on the surface of membranes.

10. Who proposed the fluid mosaic model of cell membrane structure in 1972?
A. Davson and Singer
B. Frye and Edidin
C. Brown and Goldstein
D. Singer and Nicholson
E. Davson and Danielli

11. What is meant by the term "fluid mosaic model"?
A. It is the diffusion of lipid-soluble substances through the lipid bilayer.
B. It is the movement of lipids and integral proteins within the lipid bilayer.
C. It is the solubility of water in the membrane.
D. It is the method of substance transport across the membrane.
E. It is the movement of surface proteins through the membrane.

12. Cholesterol within membranes functions as a(n) _____ through its interactions with both hydrophobic and hydrophilic parts of phospholipids.
A. water blocker
B. pH buffer
C. energy source
D. temperature controller
E. fluidity buffer

13. Integral proteins:
A. are weakly bound to the surface of the membrane.
B. are strongly bound to the cytosolic surface of the membrane.
C. have no hydrophobic portions.
D. are completely embedded within the lipid bilayer.
E. are amphipathic.

14. A transmembrane protein differs from other membrane proteins because it:
A. is covalently linked to the outer surface of the plasma membrane.
B. is a glycoprotein with carbohydrates attached.
C. is attached to the inside of the membrane by an ionic bond.
D. completely extends through the membrane.
E. is completely embedded within the membrane.

15. Peripheral proteins are linked to either surface of the plasma membrane by:
A. covalent disulfide bonds.
B. associating with fatty acids through hydrophobic interactions.
C. embedding in one side of the membrane and, thus, not extending through to the other side.
D. associating with glycoproteins on the inner membrane surface.
E. bonding to integral proteins through noncovalent interactions.

16. Which of the following functions best explains the reason for the asymmetrically oriented structure of the proteins in the cell membrane?
A. These proteins are manufactured by free ribosomes.
B. Each type of protein has its own function.
C. These proteins pass through the ER membrane into the ER lumen.
D. Enzymes are needed to modify the carbohydrate chains on these proteins.
E. These proteins are initially formed by ribosomes on the rough ER.

17. Proteins that are destined to become associated with the inner surface of the plasma membrane are:
A. manufactured in the same way as protein hormones.
B. manufactured in the same way as proteins destined to become external peripheral proteins.
C. made on free ribosomes in the cytoplasm.
D. made on ribosomes located on the rough endoplasmic reticulum.
E. transported to the plasma membrane within a secretory vesicle.

18. Which of the following statements explaining the differences in number and types of peripheral proteins found on the inner and outer surfaces of cell membranes is correct?
A. The functions of the membrane differ on the inside and outside of the cell.
B. Not all proteins can pass through the membrane and, thus, more accumulate on the inside.
C. Proteins on the outside of the membrane are synthesized at a slower rate than proteins on the inside of the membrane.
D. Proteins on the outside of membrane are made extracellularly and are unable to penetrate the phospholipid bilayer and enter the cell.
E. The external peripheral proteins are weakly attached to the membrane and are readily washed away.

19. Biological membranes are normally permeable to:
A. large, hydrophilic molecules.
B. small, hydrophilic molecules.
C. large, hydrophobic molecules.
D. small, hydrophobic molecules.
E. None of these.

20. Which of the following molecules is *least* likely to cross a cellular membrane by simple diffusion?
A. carbon dioxide
B. nitrogen
C. oxygen
D. potassium ion
E. water

21. Which of the following is *not* a characteristic of *aquaporins*?
A. They are transmembrane proteins.
B. They facilitate the rapid transport of water through the plasma membrane.
C. They are located in mammalian kidney tubules.
D. They respond to specific hormones.
E. All of these are functions associated with aquaporins.

22. Simple diffusion may involve the movement of _____ through the plasma membrane down a concentration gradient.
A. small polar molecules
B. small nonpolar molecules
C. large polar molecules
D. large nonpolar molecules
E. water

23. Which of the following membrane activities does NOT require the expenditure of energy by the cell?
A. active transport
B. osmosis
C. endocytosis
D. exocytosis
E. synthesis of more membrane

24. If the concentration of solutes in a cell is less than the concentration of solutes in the surrounding fluid, then the extracellular fluid is said to be:
A. hypertonic.
B. hypotonic.
C. isotonic.
D. stable.
E. amphipathic.

25. The higher the concentration of solute in a solution, the _____ the effective water concentration and the _____ the osmotic pressure.
A. lower; lower
B. lower; higher
C. higher; higher
D. higher; lower
E. Answer cannot be determined from the information provided.

26. Solutions that are isotonic:
A. are not in dynamic equilibrium.
B. have equal concentrations of solute and water.
C. have equal concentrations of solute but not water.
D. have equal concentrations of water but not solute.
E. will exhibit a net movement of water from one solution to the other.

27. A patient who has had a severe hemorrhage accidentally receives a large transfusion of distilled water directly into a major blood vessel. You would expect this mistake to:
A. have no unfavorable effect as long as the water is free of bacteria.
B. have serious, perhaps fatal consequences because there would be too much fluid to pump.
C. have serious, perhaps fatal consequences because the red blood cells could shrink.
D. have serious, perhaps fatal consequences because the red blood cells could swell and burst.
E. have no serious effect because the kidney could quickly eliminate excess water.

28. A plant cell placed in a hypertonic solution will:
A. remain unchanged.
B. undergo lysis.
C. undergo plasmolysis.
D. swell slightly.
E. become crenated.

29. Penicillin is toxic to certain dividing bacterial cells because it prevents cell wall formation, causing the cells to burst. This indicates that the bacteria live in:
A. a hypotonic medium.
B. a hypertonic medium.
C. an isotonic medium.

a medium with a higher osmotic pressure
n the cell.
Both a hypertonic medium and a medium
th a higher osmotic pressure than the
ll.

). A wilted flower placed in a vase of water
or several hours became stiff and stood erect.
When it was placed in a salt solution, it wilted.
From this information we can say that
the cells of the flower are:
A. hypotonic to both fresh water and the salt solution.
B. hypertonic to both the 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 to fresh water but hypotonic to the salt solution.

31. Facilitated diffusion:
A. requires a transmembrane protein.
B. requires ATP.
C. can move molecules against a concentration gradient.
D. is typically used to transport small nonpolar molecules.
E. All of these.

32. Which of the following are forms of carrier-mediated transport?
A. Facilitated diffusion only
B. Carrier-mediated active transport only
C. Osmosis only
D. Both facilitated diffusion and carrier-mediated active transport
E. Facilitated diffusion, carrier-mediated active transport, and osmosis

33. Although glucose molecules constantly diffuse into a cell along their concentration gradient, equilibrium is never reached and glucose continues to enter the cell. This is a direct result of:
A. the very fast turnover rate of glucose metabolism.
B. the continuous excretion of glucose from other parts of the cell.
C. the rapid and continuous intracellular formation of glucose phosphates.
D. the active transport of glucose.
E. the ability of the cell to engulf glucose by pinocytosis.

34. Studies of glucose transport in liposomes have revealed that:
A. glucose is transported against a concentration gradient.
B. the binding of glucose triggers a conformational change in the carrier protein.
C. the transport of solutes via carrier proteins is faster than via channel proteins.
D. glucose phosphates move readily across the membrane by simple diffusion.
E. glucose moves readily across the membrane by simple diffusion.

35. A bacterium containing sodium ions at a concentration of 0.1 mM lives in a pond that contains sodium ions at 0.005 mM. Evidently, sodium ions are entering the cell by:
A. active transport.
B. endocytosis.
C. diffusion.
D. facilitated diffusion.
E. osmosis.

36. Which of the following statements about the sodium-potassium pump is true?
A. It transports hydrogen ions out of the cell.
B. It transports 3 sodium ions out of the cell in exchange for 2 potassium ions.
C. It transports 2 sodium ions out of the cell in exchange for 2 potassium ions.
D. It transports 2 sodium ions out of the cell in exchange for 3 potassium ions.
E. It transports water directly out of the cell.

37. In the mechanism of action of a proton pump, the role of ATP is to:
A. cause a proton to bind to a carbohydrate.
B. cause a cell to take up protons by endocytosis.
C. cause a cell to release protons by exocytosis.

D. transfer protons to the inside of a cell.
E. transfer protons to the outside of a cell.

38. In the cotransport of glucose and sodium ions:
A. glucose molecules are transported down their concentration gradient.
B. sodium ions are transported down their concentration gradient.
C. the transport of glucose powers the transport of sodium.
D. ATP causes a conformational change in the carrier protein.
E. an antiport carrier protein is involved.

39. A person has a genetic disease that prevents the phospholipids in the plasma membrane of the white blood cells from freely fusing with the other membranes within the cell. How would this disease affect phagocytosis?
A. Lysosomes would not be formed.
B. Facilitated diffusion would not occur.
C. Lysosomes would be formed lacking hydrolytic enzymes.
D. The phagocytic vacuole would not fuse with the lysosome.
E. Endocytosis would not occur.

40. Pinocytosis:
A. is engulfment of large particles by the cell.
B. occurs in protozoans and algae but not in more complex organisms.
C. involves the specific binding of molecules to receptors on the cell surface.
D. is the nonspecific uptake of fluids by pinching inward of the plasma membrane.
E. is movement of molecules against the concentration gradient through a permeable membrane.

41. Receptor-mediated endocytosis:
A. is a passive process.
B. involves only membrane transport proteins.
C. brings about the selective uptake of materials by enclosing them in membranous vesicles.
D. does not require energy.
E. is most likely to be found in cells that release large amounts of hormones.

42. A perinuclear clear area (Hof) in a cell with prominent cytoplasmic basophilia likely represents the intracytoplasmic location of:
A. The Golgi apparatus
B. Terminal cisternae of granular endoplasmic reticulum
C. Centriolar replication
D. Zymogen granules
E. Aggregates of lipofuscin granules

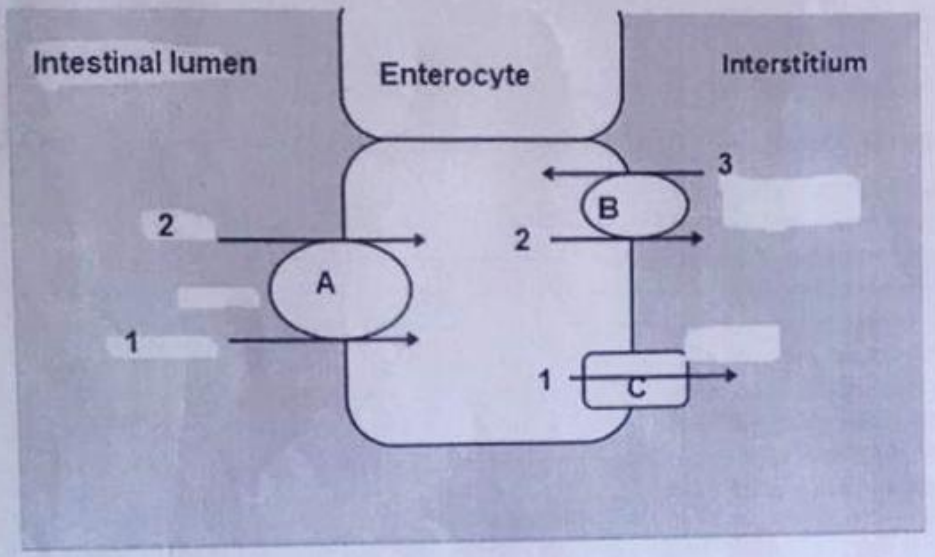
43. Myosin move along microfilaments through interaction with --------, and microtubule motors move along microtubules through interaction with -------
A. actin, myosin
B. kinesin, myosin
C. actin, tubulin
D. myosin, kinesin
E. tubulin, kinesin

44. A person has a genetic disease that prevents the phospholipids in the plasma membrane of the white blood cells from freely fusing with the other membranes within the cell. How would this disease affect phagocytosis?
A. Lysosomes would not be formed
B. Facilitated diffusion would not occur
C. Lysosomes would be formed lacking hydrolytic enzymes
D. The phagocytic vacuole would not fuse with the lysosome
E. Endocytosis would not occur

45. Primary lysosomes contain:
A. Numerous glycogen particles
B. Acid phosphatases
C. Catalase
D. Lipofuscin pigment
E. RNA

SECTION B: FILL IN THE BLANK SPACES

A. Concerning transport of glucose across the cell membrane, study the diagram below (10 marks)



1. Label the diagram above 10

A.
B.
C.

1.
2.
3.

2. State the process occurring at:

A.
B.
C.

3. State one important difference between the processes occurring at A, B and C

_____

_____

B. State the changes that would occur in the following conditions with regards to ECF volume, ECF osmolarity, ICF volume, and ICF osmolarity (5 marks)

Condition	ECF volume	ICF volume	ECF osmolarity	ICF osmolarity
Diarrhea				
Diabetes Insipidus				
SIADH				
Adrenal Insufficiency				
Uremia				

C. Explain briefly the mechanism underlying the therapeutic application of the Na+/K+ ATPase in the management of heart failure (2 marks)

D. State three reasons why infants and children are more vulnerable to develop dehydration than adults (3 marks)