

Test Bank for Understanding Pathophysiology 5th Huether

Chapter 01: Cellular Biology

Test Bank

MULTIPLE CHOICE

1. A student is observing a cell under the microscope. It is observed to have supercoiled DNA with histones. Which of the following would also be observed by the student?
 - a. A single circular chromosome
 - b. A nucleus
 - c. Free-floating nuclear material
 - d. No organelles

ANS: B

The cell described is a eukaryotic cell, so it has histones and a supercoiled DNA within its nucleus; thus, the nucleus should be observed.

A single circular chromosome is characteristic of prokaryotic cells, which do not have histones.

Free-floating nuclear material describes a prokaryotic cell, which would not have a distinct nucleus.

Eukaryotic cells have membrane bounded cellular components called organelles. No organelles describes a prokaryotic cell.

REF: p. 2

2. A nurse is instructing the staff about cellular functions. Which cellular function is the nurse describing when an isolated cell absorbs oxygen and uses it to transform nutrients to energy?
 - a. Metabolic absorption
 - b. Communication
 - c. Secretion
 - d. Respiration

ANS: D

The ability of the cell to absorb oxygen refers to the cell's function of respiration.

The ability of the cell to function within a society of cells refers to its function of communication.

The ability of the cell to take in nutrients refers to the cell's function of metabolic absorption.

The ability of the cell to synthesize new substances and secrete these elsewhere refers to the cell's function of secretion.

REF: p. 3

3. A eukaryotic cell is undergoing DNA replication. In which region of the cell would most of the genetic information be contained?
- Mitochondria
 - Ribosome
 - Nucleolus
 - Nucleus

ANS: C

The region of the cell that contains genetic material, including a large amount of ribonucleic acid, most of the DNA, and DNA-binding proteins, is the nucleolus.

The mitochondria is the site of cellular respiration.

The ribosomes are involved in manufacturing of proteins within the cell.

The nucleus contains the nucleolus, and it is the nucleolus that contains genetic material.

REF: p. 5

4. The fluid mosaic model for biologic membranes describes membrane behavior. According to this model, which of the following float singly or as aggregates in the fluid lipid bilayer?
- Peripheral membrane proteins
 - Integral membrane proteins
 - Glycoproteins
 - Cell adhesion molecules

ANS: B

Integral membrane proteins float freely in the fluid lipid bilayer.

Peripheral membrane proteins are not embedded in the layer, but reside at the surface.

Glycoproteins act as cell surface markers.

Cell adhesion molecules are on the outside of the membrane and allow cells to hook together.

REF: p. 6

5. Which of the following can bind to plasma membrane receptors?
- Oxygen
 - Ribosomes
 - Amphipathic lipids
 - Ligands

ANS: D

Ligands are specific molecules that can bind with receptors on the cell membrane.

Oxygen moves by diffusion; it does not bind to receptors.

Ribosomes make proteins and are not involved in binding.

Amphipathic lipids are a portion of the cell membrane.

REF: p. 11

6. A nurse is reviewing a report from a patient with metastatic cancer. What finding would support the diagnosis of metastatic cancer? Alterations in extracellular matrix that include:
- Decreased fibronectin
 - Increased collagen
 - Decreased elastin
 - Increased glycoproteins

ANS: A

Reduced amounts of fibronectin are found in some types of cancerous cells, allowing cancer cells to travel, or metastasize.

Collagen provides strength, and its breakdown is associated with osteoarthritis, not cancer. Elastin is found in the lungs and allows tissues to stretch; it is not associated with cancerous cells.

Decreased, not increased, glycoproteins are associated with cancerous cells.

REF: p. 8

7. Which form of cell communication is used to relate to other cells in direct physical contact?
- Cell junction
 - Gap junction
 - Desmosomes
 - Tight junctions

ANS: A

Cell junctions hold cells together and permit molecules to pass from cell to cell.

Gap junctions allow communication from the inside of one cell to the inside of another.

Desmosomes are not involved in communication, but allow cells to hold together.

Tight junctions are barriers that prevent movement of some substances and leakages of others.

REF: p. 9

8. Pancreatic beta cells secrete insulin, which inhibits secretion of glucagon from neighboring alpha cells. This action is an example of which of the following signaling types?
- Paracrine
 - Autocrine
 - Neurohormonal
 - Hormonal

ANS: A

Paracrine signaling involves the release of local chemical mediators that are quickly taken up, destroyed, or immobilized, as in the case of insulin and the inhibition of the secretion of glucagon.

When cells produce signals that they themselves respond to, autocrine signaling is used.

Neurohormonal signaling involves secretion of hormones into the bloodstream by neurosecretory hormones.

Hormonal signaling involves specialized endocrine cells that secrete hormone chemicals released by one set of cells that travel through the tissue through the bloodstream to produce a response in other sets of cells.

REF: p. 11

9. In cellular metabolism, each enzyme has a high affinity for a:
- Solute
 - Substrate
 - Receptor
 - Ribosome

ANS: B

Each enzyme has a high affinity for a substrate, a specific substance converted to a product of the reaction.

Solutes are small particles that pass through the cell membrane.

A receptor is a site on the cell wall that allows transport into the cell.

Ribosomes are located inside the cell and are not related to the work of enzymes.

REF: p. 13

10. An athlete runs a marathon, after which his muscles feel fatigued and unable to contract. The athlete asks the nurse why this happened. How should the nurse respond? A deficiency in _____ can cause impaired muscle contraction.
- GTP
 - AMP
 - ATP
 - GMP

ANS: C

The cell uses ATP for muscle contraction. when it is deficient, impaired muscle contraction results.

GTP is involved in cell signaling, not muscle contraction.

AMP is not involved in muscle contraction.

GMP is not involved in muscle contraction.

REF: p. 13

11. Which phase of catabolism produces the most ATP?
- Digestion
 - Glycolysis
 - Oxidation
 - Citric acid cycle

ANS: D

Most of the ATP is generated during the citric acid cycle.

Larger molecules are broken down into smaller units during digestion; no ATP is produced during this cycle.

During glycolysis, two molecules of ATP are produced from each glucose molecule, but the most ATP is produced during the citric acid cycle.

Oxidation is part of the glycolysis process and ATP is produced, but more ATP is produced during the citric acid cycle.

REF: p. 13

12. A nurse is teaching the staff about the three phases of cellular catabolism. Which of the following should the nurse include?
- Digestion, glycolysis and oxidation, and the citric acid cycle
 - Diffusion, osmosis, and mediated transport
 - S phase, G phase, and M phase
 - Metabolic absorption, respiration, and excretion

ANS: A

Digestion, glycolysis and oxidation, and the citric acid cycle are the three phases of cellular catabolism.

Diffusion, osmosis, and mediated transport are parts of the movement of fluids in and out of cells.

The S, G, and M phases are phases of cellular division, not catabolism.

Metabolic absorption, respiration, and excretion are functions of the cell.

REF: p. 13

13. A runner has depleted all the oxygen available for muscle energy. Which of the following will facilitate his continued muscle performance?
- Electron-transport chain
 - Aerobic glycolysis
 - Anaerobic glycolysis
 - Oxidative phosphorylation

ANS: C

When no oxygen is available, anaerobic glycolysis occurs.

The electron-transport chain is part of the citric acid cycle.

Aerobic glycolysis involves the presence of oxygen.

Oxidative phosphorylation is the mechanism by which the energy produced from carbohydrates, fats, and proteins is transferred to ATP. It is not part of muscle performance.

REF: p. 14

14. The faculty member asked the student to identify the appropriate term for the movement of small, electrically uncharged molecules through a semipermeable barrier. Which answer indicates the nursing student understood the teaching?
- Osmosis
 - Diffusion
 - Hydrostatic pressure

d. Active transport

ANS: B

Diffusion is the movement of a solute molecule from an area of greater solute concentration to an area of lesser solute concentration.

Osmosis is the movement of water across a semipermeable membrane from a region of higher water concentration to one of lower concentration.

Hydrostatic pressure is the force of fluid against a cell membrane. Within the vascular system, this pressure is the blood pressure.

In active transport, molecules move up a concentration gradient. This process requires energy.

REF: p. 15

15. A nurse is teaching a patient about fluid and electrolytes. Which of the following indicates the teaching was successful regarding electrolytes? Electrolytes are:
- Small lipid-soluble molecules
 - Large protein molecules
 - Micronutrients used to produce ATP
 - Electrically charged molecules

ANS: D

Electrolytes are electrically charged molecules.

Electrolytes are not lipid soluble.

Electrolytes are not made up of protein.

Electrolytes do not have a role in the production of ATP.

REF: p. 15

16. A nurse is reading a chart and sees the term oncotic pressure. The nurse recalls that oncotic pressure (colloid osmotic pressure) is determined by:
- Concentration of sodium
 - Plasma proteins
 - Hydrostatic pressure
 - Availability of membrane transporter proteins

ANS: B

Oncotic pressure is determined by the effect of colloids or plasma proteins.

The concentration of sodium plays a role in tonicity.

Hydrostatic pressure is the force within a vessel.

Membrane transporter proteins are involved in active transport within a concentration gradient.

REF: p. 16

17. A patient has a body fluid of 300 mOsm/kg. This lab result is measuring:
- Osmolality
 - Osmolarity

- c. Osmotic pressure
- d. Oncotic pressure

ANS: A

Osmolality measures the number of milliosmoles per kilogram of water, or the concentration of molecules per *weight* of water.

Osmolarity measures the number of milliosmoles per liter of solution, or the concentration of molecules per *volume* of solution.

Osmotic pressure is the amount of hydrostatic pressure required to oppose the osmotic movement of water.

Oncotic pressure is from plasma proteins, not body fluids.

REF: p. 16

18. In teaching a patient with cirrhosis, which information should the nurse include regarding cholesterol?
- a. Cholesterol decreases the membrane fluidity of the erythrocyte, which reduces its ability to carry oxygen.
 - b. Cholesterol decreases the membrane fluidity of erythrocytes, which reduces its ability to carry hemoglobin.
 - c. Cholesterol increases the membrane fluidity of erythrocytes, which allows binding of excess glucose.
 - d. Cholesterol increases the membrane fluidity of erythrocytes, which prolongs its life span beyond 120 days.

ANS: A

In cirrhosis, the cholesterol content of the red blood cell's plasma membrane increases, causing a decrease in membrane fluidity that seriously affects the cell's ability to transport oxygen.

In cirrhosis, for example, the cholesterol content of the red blood cell's plasma membrane increases, causing a decrease in membrane fluidity that seriously affects the cell's ability to transport oxygen, not hemoglobin; the hemoglobin carries the oxygen.

In cirrhosis, for example, the cholesterol content of the red blood cell's plasma membrane increases, causing a decrease in membrane fluidity that seriously affects the cell's ability to transport oxygen; it does not bind excess glucose.

In cirrhosis, for example, the cholesterol content of the red blood cell's plasma membrane increases, causing a decrease in membrane fluidity that seriously affects the cell's ability to transport oxygen. It does not prolong the life of the RBC and could decrease it.

REF: p. 7

19. A nurse is discussing the movement of fluid across the arterial end of capillary membranes into the interstitial fluid surrounding the capillary. Which process of fluid movement is the nurse describing?
- a. Hydrostatic pressure
 - b. Osmosis
 - c. Diffusion

d. Active transport

ANS: A

Blood reaching the capillary bed has a hydrostatic pressure of 25 to 30 mm Hg, which is sufficient force to push water across the thin capillary membranes into the interstitial space.

Osmosis involves the movement of fluid from an area of higher concentration to an area of lower concentration. It does not involve pressure or force. It is related to hydrostatic pressure.

Diffusion is the passive movement of a solute from an area of higher solute concentration to an area of lower solute concentration.

Active transport involves movement up a concentration gradient.

REF: p. 16

20. A patient who has diarrhea receives a hypertonic saline solution intravenously to replace the sodium and chloride lost in the stool. What effect will this fluid replacement have on cells?
- Cells will become hydrated.
 - Cells will swell or burst.
 - Cells will shrink.
 - Cells will divide.

ANS: C

The hypertonic saline will cause fluid to leave the intracellular space and enter the vascular space, causing cells to shrink.

Intravenous hypertonic solutions lead to cell dehydration.

Intravenous hypertonic solutions cause fluid to leave cells; thus, they would shrink, not swell.

Intravenous hypertonic solutions do not affect cellular division.

REF: p. 17

21. A nurse is teaching a patient with diabetes how glucose is transported from the blood to the cell. What type of transport system should the nurse discuss with the patient?
- Active-mediated transport (active transport)
 - Active diffusion
 - Passive osmosis
 - Passive-mediated transport (facilitated diffusion)

ANS: D

A well-known passive-mediated transport system is that for glucose in erythrocytes (red blood cells).

The transport of glucose does not require energy, so active-mediated transport is not correct.

The transport of glucose does not require energy, so active diffusion is not correct.

Osmosis involves the movement of water.

REF: p. 17

22. How are potassium and sodium transported across plasma membranes?
- By passive electrolyte channels
 - By coupled channels
 - By adenosine triphosphate enzyme (ATPase)
 - By diffusion

ANS: C

A “carrier” mechanism in the plasma membrane mediates the transport of ions and nutrients. The best-known pump is the $\text{Na}^+\text{-K}^+$ -dependent ATPase pump. Electrolyte movements require energy and do not move passively. Enzymes, not electrolytes, are passed via coupled channels. Electrolytes are not transported by diffusion.

REF: p. 17

23. Why is potassium able to diffuse easily in and out of cells?
- Because potassium has a greater concentration in the intracellular fluid (ICF)
 - Because sodium has a greater concentration in the extracellular fluid (ECF)
 - Because the resting plasma membrane is more permeable to potassium
 - Because there is an excess of anions inside the cell

ANS: C

The resting membrane is more permeable to potassium because potassium is more easily transported inward. Potassium is greater in concentration in the ICF, but this is not why it is transported more easily. Sodium does have a greater concentration, but this is not why potassium moves easily when the membrane potential is at rest. It is cations, not anions, that are involved in membrane potential activity.

REF: p. 18

24. The ion transporter that moves Na^+ and Ca^{2+} simultaneously in the same direction is an example of which of the following types of transport?
- Biport
 - Uniport
 - Antiport
 - Symport

ANS: D

When ions are transported in one direction, it is termed symport. There is no such term as biport. Uniport refers to the movement of a single molecule. Antiport refers to movement of molecules in the opposite direction.

REF: p. 17

25. During which process can lysosomal enzymes be released to degrade engulfed particles?
- Endocytosis
 - Pinocytosis
 - Phagocytosis
 - Exocytosis

ANS: C

Engulfment of particles occurs by phagocytosis.

Endocytosis involves the formation of vesicles to facilitate movement into the cell.

Pinocytosis is a type of endocytosis in which fluids and solute molecules are ingested through formation of small vesicles.

Exocytosis occurs when coated pits invaginate and internalize ligand-receptor complexes in coated vesicles.

REF: p. 20

26. A nurse is teaching the staff about cholesterol. Which information should be taught? The cellular uptake of cholesterol depends on:
- Active-mediated transport
 - The antiport system
 - Receptor-mediated endocytosis
 - Passive transport

ANS: C

The cellular uptake of cholesterol depends on receptor-mediated endocytosis.

The cellular uptake of cholesterol depends on receptor-mediated endocytosis; it is not dependent on active-mediated transport.

The cellular uptake of cholesterol depends on receptor-mediated endocytosis; it is not a part of the antiport system.

The cellular uptake of cholesterol depends on receptor-mediated endocytosis; it requires energy and is not passive in transport.

REF: p. 20

27. Some cancer drugs work during the cell cycle phase where nuclear and cytoplasmic division occurs. What is this cell cycle phase called?
- G₁
 - S
 - M
 - G₂

ANS: C

The M phase includes both nuclear and cytoplasmic division.

The G₁ phase includes the period between the M phase and the start of DNA synthesis.

The S phase include synthesis of DNA in the cell nucleus.

The G₂ phase includes RNA and protein synthesis.

REF: p. 23

28. What causes the rapid change in the resting membrane potential that initiates an action potential?
- Potassium gates open, and potassium rushes into the cell, changing the membrane potential from negative to positive.
 - Sodium gates open, and sodium rushes into the cell, changing the membrane potential from negative to positive.
 - Sodium gates close, allowing potassium into the cell to change the membrane potential from positive to negative.
 - Potassium gates close, allowing sodium into the cell to change the membrane potential from positive to negative.

ANS: B

When the threshold is reached, the cell will continue to depolarize with no further stimulation. The sodium gates open, and sodium rushes into the cell, causing the membrane potential to reduce to zero and then become positive (depolarization).

Sodium is involved in creating the action potential, not potassium.

The sodium gate must be open, not closed.

The sodium channel must be open; this is not affected by a change in the potassium gate.

REF: p. 21

29. A cell is isolated, and electrophysiology studies reveal that the resting membrane potential is -70 millivolts. The predominant intracellular ion is Na^+ , and the predominant extracellular ion is K^+ . With voltage change, which of the following would result in an action potential?
- K^+ rushing into the cell
 - Na^+ rushing into the cell
 - Na^+ rushing out of the cell
 - K^+ rushing out of the cell

ANS: A

With voltage change, potassium rushes into the cell.

Potassium, not sodium, rushes into the cell.

Potassium, not sodium, is involved in the process, and potassium moves into the cells, not out.

Potassium rushes into the cell, not out.

REF: p. 22

30. A nurse is teaching the staff about platelet-derived growth factor. Which information should the nurse include? Platelet-derived growth factor (PDGF) stimulates the production of:
- Platelets
 - Epidermal cells
 - Connective tissue cells

d. Fibroblast cells

ANS: C

Different types of cells require different growth factors; for example, PDGF stimulates the production of connective tissue cells.

The factor stimulates the production of connective tissue, not platelets.

The factor stimulates the production of connective tissue, not epidermal cells.

The factor stimulates the production of connective tissue, not fibroblast cells.

REF: p. 24

31. The phase of the cell cycle during which the centromeres split and the sister chromatids are pulled apart is referred to as:
- Anaphase
 - Telophase
 - Prophase
 - Metaphase

ANS: A

Anaphase begins when the centromeres split and the sister chromatids are pulled apart.

During telophase, the final stage, a new nuclear membrane is formed around each group of 46 chromosomes, the spindle fibers disappear, and the chromosomes begin to uncoil.

During prophase, the first appearance of chromosomes occurs.

Metaphase occurs when two centrioles located at opposite poles of the cell pull the chromosomes to opposite sides of the cell.

REF: p. 23

32. What is the role of cytokines in cell reproduction?
- Provide growth factor for tissue growth and development
 - Block progress of cell reproduction through the cell cycle
 - Restrain cell growth and development
 - Provide nutrients for cell growth and development

ANS: A

Cytokines play a major role in the regulation of tissue growth and development.

Cytokines help overcome intracellular braking mechanisms that restrain cell growth.

Cytokines promote cell growth, not restrain it.

Cytokines regulate growth; they do not provide nutrients.

REF: p. 23

33. A biopsy of the lung bronchi revealed ciliated epithelial cells that are capable of secretion and absorption. These cells are called _____ columnar epithelium.
- Simple
 - Ciliated simple
 - Stratified
 - Pseudostratified ciliated

ANS: B

Ciliated simple columnar epithelium are found in the lungs.

Simple columnar epithelium are found from the stomach to the anus.

Stratified columnar epithelium are found in the linings of epiglottis, part of pharynx, anus, and male urethra.

Pseudostratified ciliate columnar epithelium is found in the linings of large ducts of some glands (parotid, salivary), male urethra, respiratory passages, and eustachian tubes of ears.

REF: p. 26

34. The nurse would be correct in identifying the predominant extracellular cation as:
- Sodium
 - Potassium
 - Chloride
 - Glucose

ANS: A

The predominant extracellular cation is sodium.

Potassium is the predominant intracellular cation.

Chloride is an anion. Urea is a nonelectrolyte.

Glucose is a nonelectrolyte.

REF: p. 20

35. The student is reviewing functions of the cell. The student would be correct in identifying the primary function of the nerve cell as:
- Sensory interpretation
 - Conductivity
 - Maintenance of homeostasis
 - Communication

ANS: B

Conduction as a response to a stimulus is manifested by a wave of excitation; an electrical potential that passes along the surface of the cell to reach its other parts. Conductivity is the chief function of nerve cells.

Nerve cells assist with sensory interpretation, but their primary function is conductivity.

Nerve cells assist with maintenance of homeostasis, but their primary function is conductivity.

Nerve cells assist with communication, but their primary function is conductivity.

REF: p. 2

36. The student is studying for a pathophysiology exam and is trying to remember the definition of amphipathic. The student should choose which of the following to be correct?
- All cells have a membrane that is composed of lipids.
 - Cells have organelles that have specialized function.
 - Molecules are polar with one part loving water and one part hating water.

- d. Cells have receptor sites that other substances attach to and create additional functions.

ANS: C

Amphipathic means that one part is hydrophobic (uncharged, or “water hating”) and another part is hydrophilic (charged, or “water loving”).

Cells have a membrane, but this is not the definition of amphipathic.

Cells have organelles, but this is not the definition of amphipathic.

Cells have receptor sites, but this is not the definition of amphipathic.

REF: p. 3

MULTIPLE RESPONSE

1. A nurse recalls that the four basic types of tissues are (select all that apply):
- Nerve
 - Epithelial
 - Mucosal
 - Connective
 - Skeletal
 - Muscle

ANS: A, B, D, F

Nerve is one of the four basic tissue types.

Epithelial is one of the four basic tissue types

Connective is one of the four basic tissue types.

Muscle is one of the basic tissue types.

Mucosal is a type of epithelial cell and is not a basic tissue type.

Skeletal is a type of connective tissue and is not a basic tissue type.

REF: p. 24

2. Characteristics of prokaryotes include which of the following? (Select all that apply.)
- They contain no organelles.
 - Their nuclear material is not encased by a nuclear membrane.
 - They contain a distinct nucleus.
 - They contain histones.
 - They contain a cellular membrane.

ANS: A, B

The prokaryotes contain no organelles.

The prokaryotic cells do not have their nuclear materials encased by a nuclear membrane.

Prokaryotic cells are characterized by lack of a distinct nucleus.

Prokaryotes lack a class of proteins called *histones*, which in eukaryotic cells bind with DNA and are involved in the supercoiling of DNA.

Prokaryotic cells do not have a cellular membrane.

REF: p. 2