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Question: 1

Antigens on the surface of pathogens provoke an immune response due to action mediated by

A. lymphocytes
B. leukocytes
C. antibodies produced by B lymphocytes and other leukocytes
D. antibodies and erythrocytes

Answer: B

Explanation:
Leukocytes are white blood cells. Antigens on pathogens elicit a leukocyte response. Lymphocytes are a subset of leukocytes.
B-lymphocytes make and release antibodies in response to antigens on the surface of pathogens. Other leukocytes, T-cells, do not produce or release antibodies, instead carrying out the cell-mediated immune response, which is not antibody mediated. Erythrocytes are red blood cells and do not have a major role in the body's immune response, nor do they produce antibodies,

Question: 2

How do the cell junctions between epithelial cells affect the communication between neighboring cells?

A. Gap junctions allow a space between neighboring cells, preventing direct contact between neighboring cells, whereas tight junctions form a barrier to prevent fluid from entering bet'.veen the cells.
B. Tight junctions firmly attach neighboring cells, decreasing flexibility while increasing strength.
C. Adhering junctions connect cells to each other to form a barrier against fluid entering between the cells.
D. Gap junctions connect the cytoplasm between cells, allowing material to flow from one cell to another.

Answer: D

Explanation:
The names of junctions between cells are often counterintuitive. Gap junctions form a channel between the cytoplasm of neighboring cells, allowing material to flow from one cell to another.
Gap junctions do not allow a space between neighboring cells, despite the name's implication. Tight junctions form a barrier to prevent fluid from passing between neighboring cells, whereas adhering junctions cement neighboring cells together. It is not adhering junctions that form a barrier to block fluid, it is tight junctions.

Question: 3

If an experiment were designed to determine the conditions that promote gluconeogenesis, which tissue would be studied?

A. The mitochondria, because gluconeogenesis occurs in the mitochondria of a eukaryotic cell using amino acids.
B. The slow muscle fibers, because they are rich in mitochondria and may convert to alternate energy pathways such as aerobic respiration.
C. The liver because the liver is one of the cell types in which gluconeogenesis occurs in the mitochondria, using amino acids.
D. Adipose tissue because fat cells undergo oxidation to enter the Krebs cycle and the electron transport chain in order to provide the body with energy in the form of AT P.

Answer: C

Explanation:
The liver, the kidney, and the small intestine cells can use amino acids in the process of gluconeogenesis in the mitochondria. The mitochondrion is the site for gluconeogenesis, but not all cells are capable of gluconeogenesis. The muscle fibers. particularly the slow muscle fibers. are rich in mitochondria, but muscle cells are not a site for gluconeogenesis. even when an alternate energy-producing pathway is needed. Adipose tissue stores fat molecules. The energy-producing process that uses fat molecules is not gluconeogenesis, but rather oxidation and then entry into the Krebs cycle and the electron transport chain. Gluconeogenesis uses amino acids to build carbohydrate molecules for energy.

Question: 4

How does a proto-oncogene relate to an oncogene?

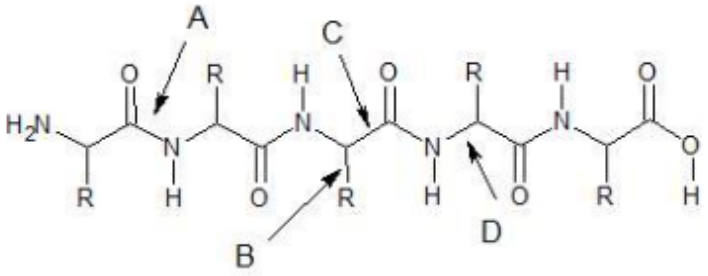
A. A proto-oncogene promotes proliferation of an oncogene.
B. A proto-oncogene is a normal gene. But if it undergoes a mutation, a proto-oncogene can become an oncogene.
C. A proto-oncogene is a protein encoded by an oncogene.
D. An oncogene codes for a mutation that can inhibit apoptosis, whereas a proto-oncogene codes for a mutation that affects mitosis.

Answer: B

Explanation:
A proto-oncogene is a normal gene that may undergo an alteration and become an oncogene. An oncogene is an abnormal gene that may cause cancer. Proto-oncogenes generally encode for cell activity related to cell death or cell division. Thus, when proto-oncogenes are altered in certain ways, cells may become cancerous.
A proto-oncogene does not promote an oncogene. although the name would make it sound so. A proto-oncogene is not a protein, although the name could be mistaken for a protein. A proto-oncogene encodes functions related to cell apoptosis and mitosis, as does an oncogene, because they are both forms of the same gene. But a proto-oncogene is normal, whereas an oncogene is Abnormal.

Question: 5

The peptide below has four labeled bonds. Which of these bonds break during hydrolysis if subjected to 6 M HCl at 110°C for 24 hours?



a. Bond A
b. Bond B
c. Bond C
d. Bond D

Answer: A

Explanation:
Bond A is the amide bond linking the amino acids together to form a peptide. For amino acid analysis, hydrolysis of peptide bonds with hydrochloric acid is preferred over hydrolysis with strong base because hydrochloric acid is much less likely to break any other bonds in a protein, leaving the individual amino acids largely intact.

Question: 6

Based on the properties listed in Table 1, the identity of the amino acid labeled as Unknown is most likely to be which of the following?

A. L-Phenylalanine
B. L-Glycine
C. L-Cysteine
D. L-Glutamic Acid

Answer: D

Explanation:
(L-Glutamic Acid). The easiest way to recognize the correct answer is by the pKa of the R group of this amino acid. Since it has a pKa of 4.25, it must be a carboxylic acid. Of the choices given, only glutamic acid has a carboxylic acid on the R group.

Question: 7

When the amino acids listed in Table 1 separate by ion exchange chromatography using a cation exchange resin, which of the amino acids is most likely to elute last from the column?

A. L-Lysine
B. L-Valine
C. L-Tryptophan

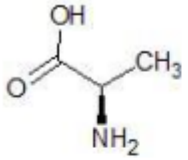
D. The amino acid labeled unknown

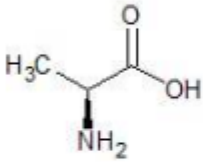
Answer: A

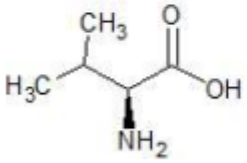
Explanation:
(L-Lysine). This question requires understanding of how cation exchange chromatography separates amino acids based on charge, as well as recognizing the charge on amino acids based on memorization of the structures or the pKa data presented in the passage.
The protonated amine groups on the amino acids carry a positive charge. These positive charges interact most strongly with the negatively charged sulfonate groups on the ion exchange beads. If you did not know that sulfonate is negatively charged, you can deduce this fact by recognizing either that it is a cation exchange resin, or that it is preloaded with positively charged sodium ions. When the positively charged amine groups interact with the negatively charge beads, the beads slow the movement of those binding amino acids down the column.
In this example, L-Lysine. with the positively charged R group (seen from the pKa of the R group in Table 1) and the positively charged a-amino group consequently carries two positive charges, while all of the other choices only carry one positive charge (from the a-amino group). Hence, L-Lysine interacts more strongly with the negatively charged beads and is the slowest of the amino acids listed to elute from a cation exchange chromatography column.

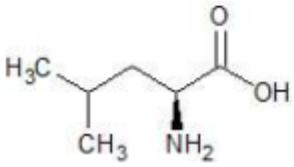
Question: 8

Which of the following is a correct representation of the structure of L-alanine (which is also correctly known as (S)-Alanine)?

a.


b.


c.


d.


Answer: B

Explanation:

Choice (b) is the stereochemical representation of L-alanine. Incorrect answers are: (a) D-alanine, (c) L-valine, and (d) L-leucine. This question requires understanding of the structure of amino acids (by memorization), as well as stereochemistry, either by memorization, or by determination using the rules of organic chemistry for R and S enantiomers. The specific rotation values given in the passage are not, by themselves, useful in figuring out structure.

Question: 9

Assume that a fluid used in an ion exchange separation of amino acids has a pH of 5. Which of the amino acids in Table 1 provides the most buffering capacity at that PH?

A. L -Alanine
B. L-Lysine
C. L-Leucine
D. The amino acid labeled unknown

Answer: D

Explanation:
Examination of the pKa values in Table 1 provides this answer. Buffering by an acid/base pair is strongest near the pKa of the acid. Of the amino acids available as choices, only unknown. with an R group pKa of 4.25 has a pKa near 5, so only it buffers at that PH. This fact is why most amino acids (except histidine) do not generally provide significant buffering in the physiologic range of pH 6-8.

Question: 10

How many valence electrons are there in the Lewis dot structure for nitrate ion?

A. 5
B. 8
C. 23
D. 24

Answer: D

Explanation:
Each of the three oxygen atoms contributes six, nitrogen contributes five, and the negative charge contributes one additional electron.

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