

Student Assessment Questions – Biochemistry Basics

Questions

1. Predict the pH of a solution of a substance with molecules that contain a carboxyl group ($-\text{COOH}$).

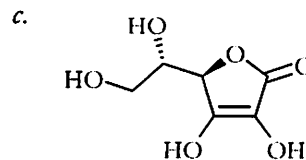
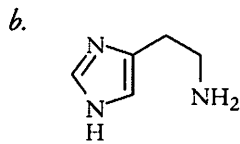
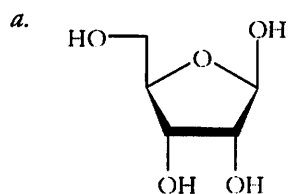
a. $\text{pH} = 7$

c. $\text{pH} > 7$

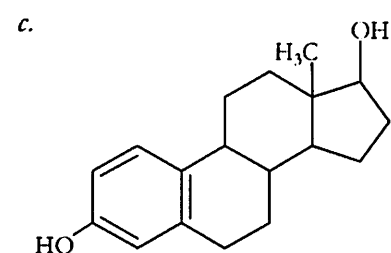
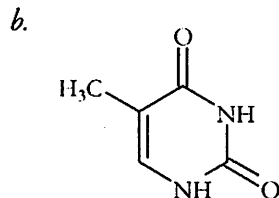
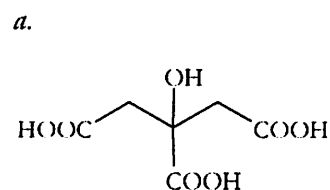
b. $\text{pH} < 7$

d. There is no way to accurately predict.

2. Which of the following molecules contains an amine group?



3. Describe the problem-solving strategy you would use to determine which of the following molecules would be found in high concentrations in fat tissue of an organism.



Student Assessment Questions – Free Energy

Questions

1. A process that releases heat energy to the surroundings is an _____ reaction, while a process that can do work is an _____ reaction.
 - a. endothermic / endergonic
 - b. exothermic / exergonic
 - c. endergonic / endothermic
 - d. exergonic / exothermic
2. A process will be spontaneous when
 - a. the total potential energy of the system decreases.
 - b. the reaction is exothermic.
 - c. the system has an increase in entropy.
 - d. the universe has an increase in entropy.
3. Provide an example of how organisms use coupled reactions to create order.

Student Assessment Questions – Protein Structure

Questions

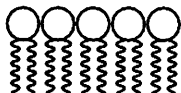
1. Which level of protein structure is formed solely by covalent bonds?
 - a. Primary.
 - b. Secondary.
 - c. Tertiary.
 - d. Quaternary.
2. Which level of protein structure is primarily formed by hydrogen bonds between regions of the carbon backbone?
 - a. Primary.
 - b. Secondary.
 - c. Tertiary.
 - d. Quaternary.
3. Draw a diagram to illustrate the difference between the secondary and tertiary structure of a protein.

Student Assessment Questions – Membrane Structure

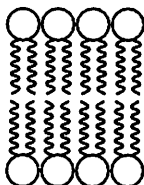
Questions

1. Which of the following diagrams shows the correct arrangement in a phospholipid bilayer?

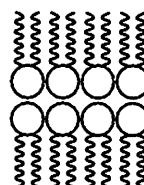
a.



b.

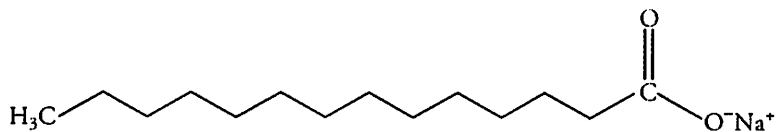


c.



2. Given that a phospholipid is polar at one end and nonpolar at the other, how can phospholipids act as a barrier between two polar solutions (like water in a vacuole and the cytoplasm of a cell)?

3. The chemical structure of a soap molecule is shown below.



- a.* Identify the hydrophilic and hydrophobic regions on the soap molecule.
b. Draw a cartoon representation of a soap molecule forming a micelle around a droplet of oil in water.

Student Assessment Questions – Enzymes and Cellular Regulation

Questions

1. What would you expect to happen if you increased the substrate concentration in the presence of a fixed amount of enzyme?
 - a.* The rate of the reaction will increase.
 - b.* The rate of the reaction will decrease.
 - c.* The rate of the reaction will remain the same.
 - d.* The rate of the reaction will increase to a point and then remain at a maximum level.
2. Although the water around Antarctica is nearly zero degrees Celsius all year long, the ocean is teeming with fish. Predict how the optimum temperature for the functioning of enzymes in these animals might differ from those found in temperate and equatorial waters.
3. Describe the factors that affect enzyme activity. Explain how these different factors affect the enzyme on a molecular level.

Student Assessment Questions – The Free Energy Carrier

Questions

1. Which of the following is an exergonic reaction?
 - a. Hydrolysis of ATP.
 - b. Combining ADP and a phosphate group.
 - c. Phosphorylation of ADP.
 - d. Converting AMP to ADP.
2. Explain what is meant by hydrolysis.

3. What are the three components of an ATP molecule?

Student Assessment Questions – Cellular Respiration—An Overview

Questions

1. Which of the following sequences correctly describes cellular respiration?
 - a. Link reaction → Krebs cycle → glycolysis → oxidative phosphorylation
 - b. Krebs cycle → glycolysis → oxidative phosphorylation → link reaction
 - c. Glycolysis → Krebs cycle → oxidative phosphorylation → link reaction
 - d. Glycolysis → link reaction → Krebs cycle → oxidative phosphorylation
2. Which of the following reactions is an oxidation reaction?
 - a. $\text{Glucose} + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$
 - b. $\text{NAD}^+ + 2\text{e}^- + \text{H}^+ \rightarrow \text{NADH}$
 - c. $\frac{1}{2}\text{O}_2 + 2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2\text{O}$
 - d. $\text{ADP} + \text{P}_i \rightarrow \text{ATP}$
3. Refer to the overall chemical reactions for a cellular respiration reaction. Under each reactant or product, describe the phase where that substance is either used or produced during cellular respiration.
$$\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$$

Student Assessment Questions – Glycolysis and the Krebs Cycle

Questions

- In glycolysis, _____ is oxidized and _____ is reduced.
 - glucose NAD^+
 - pyruvate NAD^+
 - glucose NADH
 - pyruvate NADH
- Which of the following represents a decrease in potential energy?
 - $\text{NAD}^+ \rightarrow \text{NADH}$
 - $\text{ADP} \rightarrow \text{ATP}$
 - glucose \rightarrow pyruvate
 - oxaloacetate \rightarrow citrate
- List in order the molecules that contain the carbon atoms that were originally in glucose at the start of cellular respiration.

Student Assessment Questions – Oxidative Phosphorylation

Questions

1. Explain the role of oxygen in oxidative phosphorylation and why, in the absence of oxygen, a cell makes a vastly reduced quantity of ATP.
2. In the chemiosmotic model, _____ ions diffuse from the intermembrane space to the inner membrane space (matrix). As a result ADP is converted to ATP.
 - a. Calcium
 - b. Chloride
 - c. Phosphorus
 - d. Potassium
 - e. Hydrogen
3. In the electron transport chain reactions, when do the electrons have the highest potential energy?
 - a. As they leave NADH (or FADH₂).
 - b. As they enter the third embedded protein complex.
 - c. As they combine with oxygen to form water.

Student Assessment Questions – Photosynthesis

Questions

- To produce one glucose molecule the Calvin cycle must turn
 - Once.
 - Twice.
 - Three times.
 - Six times.
- A scientist studying photosynthesis places a plant in an environment where all of the carbon dioxide contains the radioactive isotope ^{18}O . She can then use the radiation from that isotope to determine where those oxygen atoms from the carbon dioxide ended up after photosynthesis. Predict which products contained the ^{18}O isotope.

I. Water	II. Glucose	III. Oxygen	IV. ATP
----------	-------------	-------------	---------

 - I only
 - III only
 - I and II
 - II and IV
- What products are produced during the light-dependent reaction?

Student Assessment Questions – Cellular Communication

Questions

1. In human females, follicle stimulating hormone (FSH) is released from the pituitary gland. One of its many functions is to regulate the reproductive cycle in the ovaries and uterus including the cyclic production of estrogen. What type of cell communication does this represent?
 - a. Autocrine.
 - b. Juxtacrine.
 - c. Paracrine.
 - d. Endocrine.
2. Ligand is another name for which molecule in a cellular communication pathway?
 - a. Signaling molecule.
 - b. Receptor protein.
 - c. Cellular membrane.
 - d. Carrier protein.
3. The bacteria species *Vibrio fischeri* resides in the ocean. In dense populations, the bacteria produce a bioluminescent protein. Propose a method of cellular communication that could be used by the bacteria to signal the production of this protein in dense populations.

Student Assessment Questions – Signal Transduction Pathways

Questions

1. Which step below would be the final step in a signal transduction pathway?
 - a.* Phosphorylation of proteins.
 - b.* Activation of a protein.
 - c.* Change in gene expression.
 - d.* Binding a ligand to a receptor.
2. What is the role of protein kinase in a signal transduction pathway?
3. Describe the process of amplification as it applies to the signal transduction pathway.

Student Assessment Questions – Gene Expression—Transcription

Questions

1. A possible sequence of nucleotides in DNA that would code for the mRNA sequence 3' AUG CCA UUG 5' would be
 - a. 3' TAC GGT AAC 5'
 - b. 5' TAC GGT AAC 3'
 - c. 3' UAC GGU AAC 5'
 - d. 5' UAC GGU AAC 3'
2. The processing of pre-mRNA involves
 - a. the removal of introns.
 - b. the addition of a methyl cap.
 - c. the addition of a poly-A tail.
 - d. all of the above.
3. Summarize the steps of DNA transcription.

Student Assessment Questions – Gene Expression—Translation

Questions

1. A possible sequence of nucleotides in DNA that would code for the polypeptide sequence Phe-Leu-Ile-Val would be
 - a. 3' AAA-AAT-ATA-ACA 5'
 - b. 5' TTG-CTA-CAG-TAG 3'
 - c. 3' AAA-GAA-TAA-CAA 5'
 - d. 3' AAC-GAC-GUC-AUA 5'
 - e. 5' AUG-CTG-CAG-TAT 3'
2. Which of the following statements correctly describes the relationship between a codon and anticodon?
 - a. The codon on mRNA is complementary to the anticodon on tRNA.
 - b. The codon on mRNA is identical to the anticodon on tRNA.
 - c. The codon on tRNA is complementary to the anticodon on mRNA.
 - d. The codon on tRNA is identical to the anticodon on mRNA.
3. Explain why it is advantageous for an organism to have several codons that code for the same amino acid.

Student Assessment Questions – Genetic Mutations

Questions

1. Which of the following is NOT true of a substitution mutation?
 - a. One nucleotide in one codon is incorrect.
 - b. It changes several amino acids in the polypeptide sequence.
 - c. It might result in a *stop* codon in the wrong place.
 - d. It might not lead to a change in an amino acid.
2. Which of the following best describes the affect of an insertion mutation in DNA?
 - a. Only one amino acid in the polypeptide sequence is affected.
 - b. The amino acid sequence is affected from the mutation onward.
 - c. All amino acids in the polypeptide sequence are affected.
 - d. There may be no change to the polypeptide sequence.
3. Describe how neutral, positive, and negative mutations could affect a population through evolution.