

MSUM BIOL 111 Survey -- Spring 2015

Q1: Many types of houseplants droop when they have not been watered and quickly "straighten up" after watering. The reason that they change shape after watering is because

- A. Water reacts with, and stiffens, their cell walls.
- B. Water is used to generate energy that moves the plant.
- C. Water changes the concentration of salts within the plant.
- D. Water enters and expands their cells.

Q2: Imagine an ADP molecule inside a bacterial cell. Which best describes how it would manage to "find" an ATP synthase so that it could become an ATP molecule?

- A. It would follow the hydrogen ion flow.
- B. The ATP synthase would grab it.
- C. Its electronegativity would attract it to the ATP synthase.
- D. It would be actively pumped to the right area.
- E. Random movements would bring it to the ATP synthase.

Q3: How is genetic drift like molecular diffusion?

- A. Both are the result of directed movements.
- B. Both involve passing through a barrier.
- C. Both involve random events without regard to ultimate outcome.
- D. They are not alike. Genetic drift is random; diffusion typically has a direction.

Q4. A covalent bond is likely to be polar if

- A. the two atoms sharing electrons are the same element.
- B. it is between two atoms that are both very strong electron acceptors.
- C. one of the two atoms sharing the electrons is much more electronegative.
- D. the two atoms sharing electrons are equally electronegative.

Q5. Which of the following statements is NOT true of chemical bonds?

- A. Both ionic and covalent bonds involve electrons in the outer shell.
- B. An atom involved in an ionic bond has an unequal number of electrons and protons.
- C. Salts are covalently bonded.
- D. The atoms in a molecule of water (H₂O) are covalently bound together.

Q6. The key properties of water molecules important for the existence of cells on earth include

- A. its relatively large molecular weight.
- B. its ability to act as a solvent for nonpolar molecules, but not for polar molecules.
- C. its ability to form hydrogen bonds.
- D. the fairly equal sharing of electrons between its atoms.

Q7. Pure, freshly-distilled water has a pH of 7. This means that the concentration of

- A. OH⁻ ions in the water is 7 times the concentration of H⁺ ions in the water.
- B. OH⁻ ions and H⁺ ions in the water is zero.
- C. H⁺ ions in the water equals the concentration of OH⁻ ions in the water.
- D. H⁺ ions in the water is 7 times the concentration of OH⁻ ions in the water.

Three important groups of biological compounds (proteins, nucleic acids, polysaccharides) are large macromolecules. The table to the right shows examples of compounds that act as building blocks on the left and the resulting macromolecules on the right.

Building blocks	Macromolecule
glucose amino acids nucleotides	starch protein DNA

Q8: When starch dissolves in water glucose is formed.

- A. True B. False C. Don't know

Q9: When starch breaks down to form glucose covalent bonds are broken and made.

- A. True B. False C. Don't know

Q10. The building blocks of DNA are called _____.

- A. Amino acids
B. Nitrogenous bases
C. Nucleotides
D. Nucleic acids

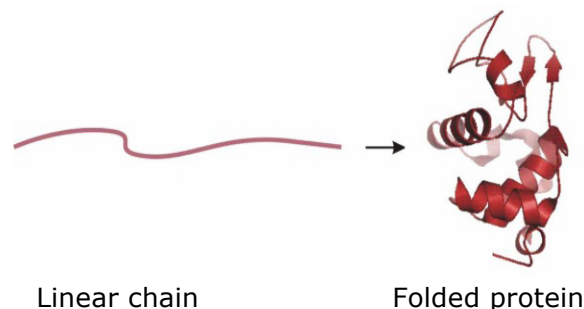
Q11. A long chain of carbon atoms with hydrogen atoms attached, ending in the acidic group -COOH would be a(n)

- A. amino acid.
B. fatty acid.
C. nucleic acid.
D. monosaccharide.

Q12. According to Chargaff's rule, if the DNA of a species contains 20% adenine, what percent of guanine will it contain?

- A. 10 %
B. 20%
C. 30%
D. 40 %

The enzyme lysozyme is a single polypeptide chain of 129 amino acids. The linear chain folds in the cell to form the biologically active enzyme as depicted to the right.



Q13: All active lysozyme molecules have the same basic shape.

- A. True B. False C. Don't know

Q14: The folded molecule and the linear chain interconvert rapidly in the cell.

- A. True B. False C. Don't know

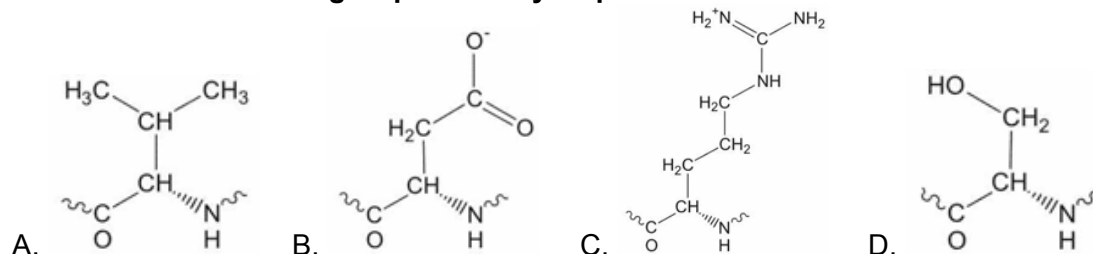
Q15: When the linear chain folds up covalent bonds break.

- A. True B. False C. Don't know

Q16: The enzyme ribonuclease is a typical globular protein. The hydrophobic amino acid R-groups in the ribonuclease clump together because of strong interactions between them.

- A. True B. False C. Don't know

Q17: The amino acid R group that is hydrophobic is:



Q18: The R group of amino acid A. is unable to form hydrogen bonds.

- A. True B. False C. Don't know

Q19: In which way are plants and animals different in how they obtain energy?

- A. Animals use ATP; plants do not.
 B. Plants capture energy from sunlight; animals capture chemical energy.
 C. Plants store energy in sugar molecules; animals do not.
 D. Animals can synthesize sugars from simpler molecules; plants cannot.

Q20: In which way are plants and animals different in how they use energy?

- A. Plants use energy to build molecules; animals cannot.
 B. Animals use energy to break down molecules; plants cannot.
 C. Animals use energy to move; plants cannot.
 D. Plants use energy directly, animals must transform it.

Q21. The reactions of photosynthesis may be summarized as:

- A. $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
 B. $6\text{CO} + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{H}_2\text{O}$
 C. $12\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_{12}\text{H}_{12}\text{O}_6 + 6\text{H}_2\text{O}$
 D. $6\text{CO} + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$

Q22. If you have a molecule of glucose, what is the maximum net ATP gain you could expect from aerobic cellular respiration?

- A. 38 ATP
 B. 76 ATP
 C. 4 ATP
 D. 18 ATP

Q23. A biologist is studying the reactants in the overall equation for cellular respiration. He or she would be studying which of the following molecules?

- A. Glucose and water
 B. Carbon dioxide and water
 C. Oxygen and glucose
 D. Carbon dioxide and glucose

Q24. As a result of glycolysis, one molecule of glucose is broken into two molecules of

- A. pyruvate.
 B. NADH.
 C. acetyl CoA.
 D. ATP.

Q25. What role do NADH and FADH₂ play in the process of cellular respiration?

- A. They help break down glucose.
- B. They carry electrons to the electron transport chain.
- C. They oxidize pyruvate.
- D. They produce ATP.

Q26. The first molecule to enter the citric acid cycle is

- A. oxygen.
- B. glucose.
- C. acetyl-CoA.
- D. pyruvate.

Q27: How does a molecule bind to its correct partner and avoid “incorrect” interactions?

- A. The two molecules send signals to each other.
- B. The molecules have sensors that check for "incorrect" bindings.
- C. Correct binding results in lower energy than incorrect binding.
- D. Correctly bound molecules fit perfectly, like puzzle pieces.

Q28: Once two molecules bind to one another, how could they come back apart again?

- A. A chemical reaction must change the structure of one of the molecules.
- B. Collisions with other molecules could knock them apart.
- C. The complex will need to be degraded.
- D. They would have to bind to yet another molecule.

Q29. A chemical reaction has reached equilibrium when

- A. the concentration of the products equals the concentration of the reactants.
- B. the rate of the forward reaction equals the rate of the reverse reaction.
- C. both the forward and reverse reactions have halted.
- D. no reactants remain.

Myoglobin plays an important role in oxygen storage in muscle. Under physiological conditions the equilibrium between Mb and MbO₂ is reached very rapidly.

Q30: Myoglobin binds oxygen (O₂) and is able to release it chemically unchanged.

- A. True
- B. False
- C. Don't know

Q31: Each oxygen molecule remains bound to a myoglobin molecule until it is needed.

- A. True
- B. False
- C. Don't know

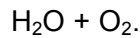
Q32. Two molecules A and B have a $K_D = 10^{-6}$ M (1 μ M) for AB complex formation. When both molecules are at 10^{-5} M (10 μ M) the proportion of A and B in an AB complex will be

- A. >50%.
- B. <50%.
- C. <10%.
- D. >90%.

Q33. In the periodic table, which elements typically have similar properties?

- A. those in the same rows
- B. those in the same columns
- C. those related diagonally
- D. those with similar molecular weight

Catalase is found in the blood and catalyzes H₂O₂ decomposition in the reaction $2\text{H}_2\text{O}_2 \rightarrow 2$



Q34: Catalase is used up in the reaction.

- A. True B. False C. Don't know

Q35: Catalase provides the energy to make the reaction proceed faster.

- A. True B. False C. Don't know

Q36: Catalase reduces the free energy change (ΔG) for the reaction.

- A. True B. False C. Don't know

Q37: Catalase lowers the activation energy of the reaction but does not change the reaction mechanism (pathway).

- A. True B. False C. Don't know

Q38: What makes DNA a good place to store information?

- A. The hydrogen bonds that hold it together are very stable and difficult to break
B. The bases always bind to their correct partner.
C. The sequence of bases does not greatly influence the structure of the molecule.
D. The overall shape of the molecule reflects the information stored in it.

Q39: A new DNA strand elongates only in the 5' to 3' direction because

- A. The polarity of the DNA molecule prevents addition of nucleotides at the 3' end.
B. DNA polymerase begins adding nucleotides at the 5' end of the template.
C. Okazaki fragments prevent elongation in the 3' to 5' direction.
D. DNA polymerase can only add nucleotides to the free 3' end.

Q40: When we want to know whether a specific molecule will pass through a biological membrane, we need to consider ...

- A. the specific types of lipids present in the membrane.
B. the degree to which the molecule is water soluble.
C. whether the molecule is actively repelled by the lipid layer.
D. whether the molecule is harmful to the cell.

Q41: Lipids can form structures like micelles and bilayers because of ...

- A. their inability to bond with water molecules.
B. their inability to interact with other molecules.
C. their ability to bind specifically to other lipid molecules.
D. the ability of parts of lipid molecules to interact strongly with water.

The standard free energy of hydrolysis of ATP (ΔG°) is -35.7 kJ/mol at pH 7.

Q42: The reaction is spontaneous under standard conditions.

- A. True B. False C. Don't know

Q43: An enzyme will catalyze the reaction by reducing the ΔG° .

- A. True B. False C. Don't know

Q44: From this value of ΔG° we can tell that the hydrolysis will occur rapidly at pH 7.

- A. True B. False C. Don't know

The conversion of ATP to ADP and Pi in the cell is able to drive thermodynamically unfavorable processes such as glucose to glucose-6-phosphate.

Q45: ATP is able to drive the reaction because energy from the conversion of ATP to ADP makes the overall reaction favorable.

- A. True B. False C. Don't know

Q46: The breaking of the bond between Pi and ADP releases energy.

- A. True B. False C. Don't know

A student sets up an experiment in which she makes a pure phospholipid membrane and measures the rate at which different molecules are able to diffuse across the membrane.

Q47: The molecule that will diffuse the most slowly across the membrane is:

- A. Glucose $C_6H_{12}O_6$
B. Benzene C_6H_6
C. Indole C_8H_7N
D. Sodium ion Na^+

Q48. Which is the process by which a protein is constructed in the cytoplasm of eukaryotic cells?

- A. translation
B. transcription
C. transposition
D. transformation

Q49. Each amino of a protein is encoded with ____ bases in the messenger RNA..

- A. 2
B. 3
C. 4
D. 20

Q50. Transcription of part of a DNA molecule with a nucleotide sequence of AAACAACTT results in a mRNA molecule with the complementary sequence of

- A. TTTGTTGCC.
B. UUUGUUGAA.
C. TTTGAAGCC.
D. AAACAACTT.