

# Valley Forge Science Olympiad - Protein Modeling Event

School Name: \_\_\_\_\_ School Number: \_\_\_\_\_

January 7, 2011

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) Which of the following contains a carboxyl and an amino group? 1) \_\_\_\_\_  
A) vinegar  
B) fats  
C) ATP  
D) sugars  
E) amino acids
- 2) Which of the following statements about dehydration synthesis is *false*? 2) \_\_\_\_\_  
A) Electrons are shared between atoms of the joined monomers.  
B) H<sub>2</sub>O is formed as the monomers are joined.  
C) One monomer loses a hydrogen atom, and the other loses a hydroxyl group.  
D) Covalent bonds are formed between the monomers.  
E) Animal digestive systems utilize this process to break down food.
- 3) Which list below consists of *only* polymers? 3) \_\_\_\_\_  
A) proteins, lipids, nucleotides, sugars  
B) sugars, amino acids, nucleic acids, lipids  
C) proteins, lipids, nucleic acids, amino acids  
D) proteins, lipids, nucleic acids, polysaccharides  
E) polysaccharides, lipids, amino acids, nucleic acids
- 4) Which of the following statements about enzymes is *false*? 4) \_\_\_\_\_  
A) They are monomers used to build proteins.  
B) They function as chemical catalysts.  
C) They regulate virtually all chemical reactions in a cell.  
D) They are produced by cells.  
E) They increase the rate of chemical reactions.
- 5) Amino acids can be distinguished from one another by 5) \_\_\_\_\_  
A) the number of alpha carbons present in the amino acid molecules  
B) the type of bond between the R group and the rest of the amino acid molecule.  
C) the chemical properties of their amino and carboxyl groups.  
D) the chemical properties of their R groups.  
E) the number of R groups found on the amino acid molecules.
- 6) Proteins differ from one another because 6) \_\_\_\_\_  
A) each protein contains its own unique sequence of sugar molecules.  
B) the number of nitrogen atoms in each amino acid varies.  
C) the sequence of amino acids in the polypeptide chain differs from protein to protein.  
D) the peptide bonds linking amino acids differ from protein to protein.  
E) the number of nucleotides found in each protein varies from molecule to molecule.

7) Peptide bonds

- A) link amino acids.
- B) bind monosaccharides.
- C) are used to form amino acids.
- D) form between fatty acids.
- E) are formed by a hydrolysis reaction.

7) \_\_\_\_\_

8) The primary structure of a protein is

- A) an  $\alpha$  helix or a pleated sheet.
- B) maintained by hydrogen bonds.
- C) composed of two or more polypeptide chains.
- D) composed of irregular folds.
- E) the amino acid sequence of the polypeptide chain.

8) \_\_\_\_\_

9) Which of the following is an example of secondary structure in a protein?

- A) an alpha helix
- B) a globular shape
- C) a fibrous shape
- D) the joining of two polypeptide chains
- E) a particular amino acid sequence

9) \_\_\_\_\_

10) The tertiary structure of a polypeptide refers to

- A) the amino acids of which it is made.
- B) the overall three-dimensional structure.
- C) the presence of pleated sheets.
- D) its size.
- E) the number of R groups it contains.

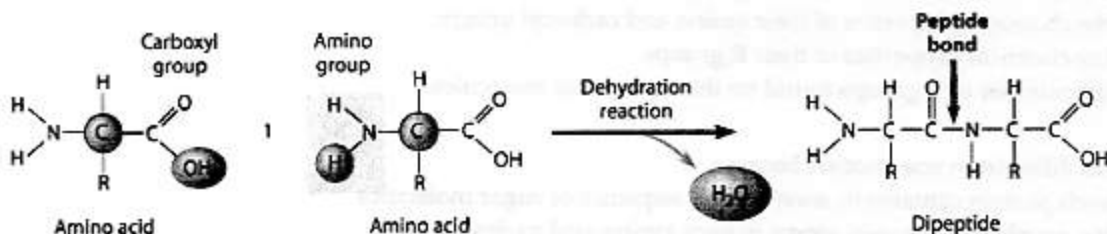
10) \_\_\_\_\_

11) A protein containing more than one polypeptide chain exhibits the \_\_\_\_\_ level of protein structure.

- A) secondary
- B) infinite
- C) primary
- D) tertiary
- E) quaternary

11) \_\_\_\_\_

12)



12) \_\_\_\_\_

How are these two amino acids attached together?

- A) amino group to carboxylic acid group
- B) carboxylic acid group to carboxylic acid group
- C) through a hydrolysis reaction
- D) carbon atom to carbon atom
- E) amino group to amino group

- 13) Which of the following examples is classified as a metabolic pathway? 13) \_\_\_\_\_
- A) protein synthesis
  - B) spontaneous combustions
  - C) cell lysis
  - D) osmosis
  - E) passive diffusion
- 14) When an enzyme catalyzes a reaction, 14) \_\_\_\_\_
- A) it raises the activation energy of the reaction.
  - B) it is used once and discarded.
  - C) it acts as a reactant.
  - D) it becomes a product.
  - E) it lowers the activation energy of the reaction.
- 15) The active site of an enzyme is 15) \_\_\_\_\_
- A) the region of a substrate that is changed by an enzyme.
  - B) the region of an enzyme that attaches to a substrate.
  - C) the region of the enzyme composed of only a few specific nucleic acids.
  - D) the highly changeable portion of an enzyme that adapts to fit the substrates of various reactions.
  - E) the region of a product that detaches from the enzyme.
- 16) Which of the following statements regarding enzymes is *true*? 16) \_\_\_\_\_
- A) Enzymes catalyze specific reactions.
  - B) Enzymes are inorganic.
  - C) All enzymes depend on protein cofactors to function.
  - D) An enzyme's function is unaffected by changes in pH.
  - E) Enzymes are the reactants in a chemical reaction.
- 17) Heating inactivates enzymes by 17) \_\_\_\_\_
- A) changing the enzyme's three-dimensional shape.
  - B) inducing the addition of amino acids.
  - C) removing phosphate groups from the enzyme.
  - D) breaking the covalent bonds that hold the molecule together.
  - E) causing enzyme molecules to stick together.
- 18) The directions for each amino acid in a polypeptide are indicated by a codon that consists of \_\_\_\_\_ nucleotide(s) in an RNA molecule. 18) \_\_\_\_\_
- A) 5                      B) 1                      C) 2                      D) 4                      E) 3
- 19) A base substitution mutation in a gene does not always result in a different protein. Which of the following factors could account for this? 19) \_\_\_\_\_
- A) the double-ring structure of adenine and guanine
  - B) the fact that some amino acids are specified from more than one codon
  - C) the fact that such mutations are usually accompanied by a complementary deletion
  - D) a correcting mechanism that is part of the mRNA molecule
  - E) the fact that the mutation affects only the sequence of the protein's amino acids, so the protein stays the same

- 20) Which of the following takes place during translation? 20) \_\_\_\_\_  
A) the conversion of genetic information from the language of proteins to the language of enzymes  
B) the conversion of genetic information from the language of nucleic acids to the language of proteins  
C) DNA replication  
D) the conversion of genetic information from DNA nucleotides into RNA nucleotides  
E) the addition of nucleotides to a DNA template
- 21) Which of the following is a function of tRNA? 21) \_\_\_\_\_  
A) recognizing the appropriate anticodons in mRNA  
B) helping to translate codons into nucleic acids  
C) joining to several types of amino acid  
D) joining to only one specific type of amino acid  
E) transferring nucleotides to rRNA
- 22) Which of the following cofactor levels drop as stem cells begin to differentiate? 22) \_\_\_\_\_  
A) Sep14                      B) rfp                      C) Sox2                      D) Oct4
- 23) A homeotic gene 23) \_\_\_\_\_  
A) serves as a master control gene that functions during embryonic development by controlling the developmental fate of groups of cells.  
B) represses gene transcription and promotes mRNA translation.  
C) produces a product that controls the transcription of other genes.  
D) is found only in adult somatic cells.  
E) turns on the genes necessary for synthesis of proteins.
- 24) CAU is the codon for 24) \_\_\_\_\_  
A) histidine                      B) arginine                      C) valine                      D) isoleucine
- 25) Di-sulfide bridges result in which level of protein structure? 25) \_\_\_\_\_  
A) primary                      B) secondary                      C) tertiary                      D) quaternary
- 26) Which level of potency allows a cell to differentiate to any cell EXCEPT those needed to support or develop a fetus? 26) \_\_\_\_\_  
A) omnipotent                      B) totipotent                      C) multipotent                      D) pluripotent
- 27) Which of the following amino acids interacts with the zinc atom in a zinc finger protein? 27) \_\_\_\_\_  
A) cysteine                      B) glutamic acid                      C) valine                      D) leucine
- 28) What is the name of a protein that binds to DNA to promote protein synthesis? 28) \_\_\_\_\_  
A) replication factor                      B) translation factor  
C) transcription factor                      D) promoter gene
- 29) Induced pluripotent stem cells are also called 29) \_\_\_\_\_  
A) adult stem cells                      B) multipotent stem cells  
C) Howenkowa stem cells                      D) omnipotent stem cells

ESSAY. Write your answer in the space provided.

30) Name and sketch (roughly) the two types of secondary structures that were part of your prebuild model.