

This exam consists of 54 questions over 7 pages. Please check to see that all the pages are present before you begin. Use a #2 pencil and bubble in all answers. The answer to question 33 is D. Your score will be posted on the UIC Blackboard site as soon as they are in. There is a Periodic Table at the end of the exam. Good Luck!

- Which of the following statement (A-D) about the process of science is FALSE? If statements A-D are true, then choose E
A. Science is an evolving field - the state of our knowledge is constantly changing
B. Scientists seek to prove their hypotheses to be true
C. Scientific hypothesis are based upon previous knowledge
D. Theories and models are compilations of linked hypotheses used to explain larger-scale phenomena
E. All of the above statements about the process of science are TRUE
- C^{12} and C^{14} differ in the number of
A. Electrons B. Protons **C. Neutrons** D. B & C
- Which of the following bonds is the most difficult to break (i.e. has the most energy)?
A. C-H B. NaCl C. The hydrogen bond joining two adjacent water molecules
- Using the periodic table, how many covalent bonds can Nitrogen typically form?
A. 2 **B. 3** D. 4 D. 5 E. 6
- Which of the following elements is the most electronegative?
A. C B. N C. O **D. F** E. Ne
- How many of the below molecules would you expect to dissolve in water?
NaCl Glucose ($C_6H_{12}O_6$) $C_{12}H_{26}$ Phospholipid Triglyceride
A. 0 B. 1 C. 2 **D. 3** E. 4
- All of the below are properties of water EXCEPT:
A. Solid water (ice) is more dense than liquid water, and both are more dense than water vapor
B. Water is both an acid and a base
C. Water has strong adhesive and cohesive properties
D. Water has a very high boiling point and heat of vaporization for a molecule of its size
E. Water has a high specific heat capacity
- In which of the below bonds is Carbon the most oxidized?
A. C-C B. C-H C. C-N **D. C-O**

9. The molecule below is a(n)

A. Polysaccharide B. Lipid **C. Protein** D. Nucleic Acid E. ATP

10. Which of the following groupings contains both pyrimidines?

A. A & G B. A & T C. C & G **D. C & T** E. A & C

11. Which of the following statements (A-D) about lipids is FALSE. If statements A-D are all true, then choose E.

- A. Triglycerides are composed of a glycerine backbone joined to three fatty acid chains
- B. Lipids are used in energy storage, insulation, and in membrane construction
- C. Triglyceride lipids are typically non-polar molecules
- D. Phospholipids and cholesterol are two of the most common components of a biological membrane
- E. All of the above statements about lipids are TRUE**

12. Which of the below is not an example of a sugar (mono/polysaccharide)

A. Glucose B. Cellulose C. Starch D. Sucrose
E. Testosterone

13. An alpha helix is an example of a protein _____ structure

A. Primary **B. Secondary** C. Tertiary D. Quaternary

14. Hyrdolysis is:

- A. The process through which monomers are joined together to form a polymer
- B. The process through which amino acids are joined to make a protein
- C. The process through which polymers are degraded**
- D. The process through which water is removed from a cell
- E. None of the above

15. Which of the following statements (A-D) about proteins is FALSE. If statements A-D are all true, then choose E.

- A. The sequence of amino acids in a protein is the primary structure
- B. Amino acids are joined together by peptide bonds to form a protein
- C. Amino acids may be non-polar, polar, or charged
- D. The manner in which actin subunits are joined to form a microfilament is an example of protein tertiary structure**
- E. All of the above statements about proteins are TRUE

16. How many total electrons are in a Na⁺ ion?

A. Zero **B. 10** C. 11 D. 12 E. None of the above

17. ATP is most similar to what type of molecule?
A. Amino acid B. Sugar **C. Nucleotide** D. Tri-glyceride
18. The arrangement of tubulin subunits in a microtubule is an example of protein _____ structure?
A. Primary B. Secondary C. Tertiary **D. Quaternary**
19. Which of the following reactions would you expect to be endergonic?
A. Protein synthesis B. Digestion of fats C. Paper burning
D. ATP hydrolysis E. Gasoline combustion
20. Which of the following statements (A-D) about enzymes is FALSE. If statements A-D are all true, then choose E.
A. Enzymes are not consumed in a reaction
B. Enzymes bind temporarily to the substrates, forming an enzyme-substrate complex
C. Enzymes lower the activation energy of both the forward and reverse reactions
D. Enzymes can be allosterically regulated
E. All of the above statements are TRUE
21. During feedback inhibition:
A. The substrate concentration remains constant
B. The products of the reaction sequence inhibit one of the enzymes in the sequence
C. The products of the reaction are competitive inhibitors of one of the enzymes in the reaction
D. The products of the reaction are destroyed by secondary enzymes
E. None of the above
22. In which of the following organisms would you expect to have the highest temperature optimum (T_{opt}) of a peroxidase enzyme?
A. A bear B. An alligator C. A parrot **D. A cactus**
23. If the pH of the stomach is 1.5, what do you predict the pH optimum of pepsin, an enzyme secreted by the stomach to digest proteins?
A. 0 B. 1.0 **C. 1.5** D. 2.5 E. 7.0
24. Which of the following graphs best represents enzyme activity as a function of pH?

Graph C

25. Which of the following statements (A-D) about the enzyme system that converts threonine to isoleucine is FALSE? If statements A-D are true, then choose E.
- A. This system is an example of negative feedback
 - B. Threonine deaminase has both an active site and an allosteric site
 - C. The concentration of isoleucine can affect the activity of threonine deaminase
 - D. The enzyme threonine deaminase has two conformations, both of which will bind to the substrate, threonine**
 - E. All of the above statements about the enzyme system that converts threonine to isoleucine are TRUE
26. Allosteric inhibition utilizes:
- A. Competitive inhibitors
 - B. Non-competitive inhibitors**
27. Which of the following is NOT found in all cells?
- A. DNA
 - B. Ribosomes
 - C. Cytoplasm
 - D. Enzymes
 - E. Endoplasmic reticulum**
28. Which of the cell types below possess organelles?
- A. Bacteria
 - B. Archaeans
 - C. Eukaryotes**
 - D. B & C
 - E. A, B, & C
29. Which of the cell types below possess a cell wall?
- A. Bacteria
 - B. Plant cells
 - C. Animal cells
 - D. A & B**
 - E. A, B, & C
30. What is the function of the Golgi bodies?
- A. Synthesis of ribosomes
 - B. Protein synthesis
 - C. Protein packaging and distribution**
 - D. Membrane synthesis
 - E. None of the above
31. Which of the following cell structures is NOT part of the endomembrane system?
- A. Outer nuclear membrane
 - B. Rough endoplasmic reticulum
 - C. Central vacuole
 - D. Cell wall**
 - E. Plasma membrane
32. The figure to the left is an example of
- A. The cytoskeleton
 - B. A cilia or a flagella**
 - C. A ribosome
 - D. A motor protein
 - E. None of the above

42. Which of the following molecules and/or ions would show the slowest rate of diffusion across a biological membrane?
 A. Water **B. Cl⁻** C. O₂ D. Glucose E. C₁₂H₂₆
43. The concentration of osmotically active solutes is 0.5 M in a cell. It is placed in sea water with a concentration of osmotically active solutes at 1.0 M. The sea water is ____ to the cytoplasm
 A. **Hypertonic** B. Hypotonic C. Isotonic
44. The above cell will _____ in the above sea water.
 A. expand **B. shrink** C. remain the same size
45. What cell structures are responsible for the creation and maintenance of turgor pressure in plant cells?
 A. Plasma membrane B. Cell Wall C. Central vacuole
D. B & C E. A, B, and C
46. Which of the following systems can carry a molecule across a membrane against its concentration gradient?
 A. Osmosis B. Diffusion C. Facilitated diffusion
D. Active Transport E. C & D
47. Which of the following statements (A-D) about the Na⁺/K⁺ pump is FALSE? If statements A-D are true, then choose E.
 A. The Na⁺/K⁺ pump is an example of an active transport system
B. The Na⁺/K⁺ pump transports 3 Na⁺ and 2 K⁺ in the same direction across the membrane
 C. The Na⁺/K⁺ pump has two configurations, one which can bind to Na⁺ and the other which can bind to K⁺
 D. The Na⁺/K⁺ pump has the ability to become phosphorylated
 E. All of the above statements about the Na⁺/K⁺ pump are TRUE
48. The H⁺/Sucrose pump utilizes two components - an active transport H⁺ pump and a H⁺/Sucrose facilitated diffusion carrier protein
 A. **True** B. False
49. During the transport of glucose across a membrane by facilitated diffusion carrier protein, glucose can be transported against its concentration gradient
 A. True **B. False**
50. Which of the following methods of transport require carrier proteins?
 A. Osmosis B. Facilitated Diffusion C. Active Transport
D. B & C E. A, B & C

51. What is the induced fit model of enzyme-substrate binding?
- A. The enzyme has an active site that perfectly fits the substrates
 - B. The enzyme has an active site that can perfectly fit substrates, but competitive inhibitors have an imperfect fit
 - C. The enzyme has an active site that the substrates do not perfectly fit into - a small conformation change takes place that strains the bonds of the substrate**
 - D. The enzyme has an active site that requires ATP energy expenditure in order to bind to the substrate
 - E. None of the above
52. What is the function of the bacterial cell wall?
- A. Cell to cell communication
 - B. The cell wall prevents the bacteria from exploding**
 - C. It is sticky and allows bacteria to stick to each other
 - D. It causes disease
 - E. None of the above
53. Ribosomes:
- A. Contain two subunits, a small subunit and a large subunit
 - B. May be free or associated with the endoplasmic reticulum
 - C. Are involved in protein synthesis
 - D. Are found in all cells
 - E. All of the above are true**
54. Please indicate why you are taking this course. Fill in the circle for **every answer** which applies to you.
- A. You are a Biological Sciences major or minor, or a Biochemistry major.
 - B. You are in a pre-health curriculum (pre-med, pre-pharm, pre-dent, pre-nursing, etc.).
 - C. You are an LAS student and are taking it to fulfill the Natural Sciences requirement.
 - D. You are in a non-LAS major which requires this course (i.e. Movement Sciences, Bioengineering, etc.).

A Portion of the Periodic Table