

This exam consists of 52 questions over 7 pages (the last page of which has the periodic table). Please check to see that all the pages are present before you begin. Use a #2 pencil and bubble in all answers. Your score will be posted on the UIC Blackboard site as soon as they are in. You will gain four extra credit points if you bubble in your last name first. Good Luck!

1. I was playing around with the Hadron Collider and I accidentally knocked a proton out of the nucleus of a nitrogen atom. What will happen to the nitrogen atom?
A. It will become an ion
B. It will become an isotope
C. It will become Carbon
D. It will become Oxygen
E. It will become a black hole and destroy the world
2. How many covalent bonds would you expect Selenium (Se, atomic number 34) to make?
A. 0 B. 1 **C. 2** D. 3 E. 4
3. What is the difference between Cl and Cl⁻?
A. The number of protons
B. The number of neutrons
C. The number of electrons
D. A & B
E. B & C
4. Which element is the most electronegative?
A. Li B. B C. C **D. O** E. Ne
5. Which of the following statements (A - D) about water is FALSE? If statements A-D are true, then choose E.
A. Water is a very polar molecule - most of the unique properties of water are due to this fact
B. Water has a very high heat of vaporization
C. Water has a high specific heat capacity, which is largely responsible for the "Lake Effect" you hear about so much when they show the weather on the TV news
D. Water has a strong surface tension
E. All of the above statements about water are TRUE
6. Which solution is most basic (alkaline)?
A. Lemon juice (pH 2) B. Coffee (pH 5) C. Pure water (pH 7)
D. Milk of Magnesia (pH 10.5) **E. Bleach (pH 12.5)**
7. To which molecule/ion would water be most attracted?
A. C₆H₁₄ B. H₂O C. NH₃ D. CH₂OH **E. H⁺**
8. In which molecule is the carbon most reduced?
A. CH₄ B. HCN C. CO₂ D. CH₃OH
9. What type of bond joins two amino acids in a protein?
A. Amino bond **B. Peptide bond** C. Protein bond D. James Bond

10. The molecule below is an example of a(n):

- A. Protein B. Nucleotide C. Lipid **D. Polysaccharide**

11. Which of the following are purines?

- A. Adenine B. Guanine C. Cytosine D. Thymine
E. A & B

12. There are twenty amino acids found in proteins. What distinguishes these molecules from each other?

- A. The location of their carboxyl and their amino groups
B. Their ability for form peptide bonds
C. The composition of their R-groups
D. The number of carbon atoms in their backbone
E. None of the above

13. What is responsible for the stabilization of a protein secondary structure?

- A. The sequence of amino acids in the protein
B. Polar bonds that form between the carboxyl and amino groups of the protein backbone.
C. Polar bonds formed between the R-groups
D. The arrangement of protein subunits in the functional protein
E. None of the above

14. Which of the following statements (A-D) about phospholipids is FALSE? If statements A-D are true, then choose E

- A. Phospholipids are a form a glyceride
B. Phospholipids are amphipathic molecules
C. Phospholipids will spontaneously form a lipid bilayer when placed in water
D. Phospholipids are the primary component of a biological membrane
E. All of the above statements about phospholipids are TRUE.

15. The formation of a phosphodiester bond joining the nucleotides in a DNA chain is an example of what type of reaction?

- A. Condensation** B. Hydrolysis C. Nucleophilic
D. Monomeric E. None of the above

16. ATP most closely resembles what type of molecule?

- A. A nucleotide** B. An amino acid C. A steroid
D. A glyceride E. A disaccharide

17. Which of the following graphs represents the relationship between reaction speed as a function of ambient temperature in an enzyme-catalyzed reaction?

A

B

C

D

18. All of the organisms below contain a version of the enzyme carboxylic anhydrase. In which organism would you expect to find the enzyme with the lowest T_{opt} ?

- A. An archaean found in a hot spring
- B. A Human**
- C. An oak tree
- D. A Fly
- E. A snake

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

- A. Enzymes temporarily bind to the substrates, forming an enzyme-substrate complex
- B. Enzymes function by lowering the activation energy of a reaction
- C. Enzymes catalyze both the forward and reverse reactions, but they always catalyze the forward reaction more**
- D. Enzymes can saturate - at this point, adding more substrate will not increase enzyme activity
- E. All of the above statements about enzymes are TRUE

20. What is a competitive inhibitor to an enzyme-catalyzed reaction?

- A. A molecule not involved in an enzyme catalyzed reaction but can bind to the active site of the enzyme**
- B. A molecule which destroys one of the substrates of an enzyme-catalyzed reaction
- C. A molecule which binds to an allosteric site of an enzyme, turning it off
- D. A molecule which binds to an allosteric site of an enzyme, turning it on
- E. None of the above

21. 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 feedback inhibition
- B. Isoleucine can bind to the active site of threonine deaminase**
- C. The concentration of isoleucine can affect the activity of threonine deaminase
- D. The enzyme threonine deaminase has two conformations, only one 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

22. When a substrate binds to an enzyme:
- A. It is a perfect fit
 - B. It is an induced fit**
 - C. It must be guided into the active site by allosteric ligands
 - D. It requires ATP hydrolysis
 - E. None of the above
23. Which of the following is NOT a component of the Cell Theory of Life?
- A. All organisms are composed of cells
 - B. The cell is the structural unit of life - units smaller than cells are not alive
 - C. Cells arise by division of preexisting cells - spontaneous generation does not exist
 - D. Cells can be cultured to produce more cells
 - E. All of the above are components of the Cell Theory of Life**
24. What is the function of an Nuclear Localization Signal (NLS)?
- A. It aids nucleoli in ribosome synthesis
 - B. It marks proteins for destruction by the lysosome
 - C. It marks proteins for import or export from the nucleus**
 - D. It helps enzymes find the nucleus
 - E. None of the above
25. All of the following cell structures are part of the endomembrane system except:
- A. Chloroplast**
 - B. Plant central vacuole
 - C. Outer nuclear membrane
 - D. Plasma membrane
 - E. Lysosome

Matching - Use the key below to answer questions 26-31. Answers may be used once, more than once, or not at all

- | | | |
|-----------------|-----------------|--------------------|
| A. Mitochondria | B. Ribosomes | C. Golgi Apparatus |
| D. Lysosome | E. Cytoskeleton | |

26. This organelle produces ATP **A**
27. Proteins are packaged and distributed here **C**
28. This is the site of protein synthesis **B**
29. This serves as a track for the movement of vesicles **E**
30. Rough ER has these associated with it **B**
31. This is where old and broken organelles become recycled **D**
32. What is the function of the sugars which are added to proteins in the endoplasmic reticulum?
- A. They serve to stabilize the proteins
 - B. They are important in the final secondary and tertiary structures of the protein
 - C. They label the proteins for distribution within and out of the cell**
 - D. They mark the proteins for destruction within the lysosome and peroxisome
 - E. None of the above
33. Plant cells contain functional mitochondria
- A. True**
 - B. False

34. Which of the following is NOT evidence in support of the endosymbiosis theory of the origin of the mitochondria and chloroplast?
- A. Mitochondria and chloroplasts are approximately the size of a prokaryotic cell
 - B. Mitochondria and chloroplasts have naked DNA
 - C. Mitochondria and chloroplasts have eukaryotic ribosomes**
 - D. Mitochondria and chloroplasts divide in a process very similar to binary fission
 - E. All of the above are evidence in support of the endosymbiosis theory of the origin of the mitochondria and chloroplasts.
35. 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

Matching - use the key below for questions 36 to 38.

A. Archaeans B. Prokaryotes C. Eukaryotes

36. These cells lack organelles
- A. A only B. B only C. C only **D. A & B** E. B & C
37. These cells typically live in extreme environments
- A. A only** B. B only C. C only D. A & B E. B & C
38. These cells contain a nucleus
- A. A only B. B only **C. C only** D. A & B E. B & C
39. Which of the following will decrease the fluidity of a lipid bilayer?
- A. Increasing the concentration of unsaturated fatty acids in the lipid bilayer
 - B. Increasing the concentration of saturated fatty acids in the lipid bilayer
 - C. Increasing the concentration of cholesterol in the lipid bilayer
 - D. A & C
 - E. B & C**
40. Most integral proteins have this/these in their structure:
- A. Glycolipids **B. Numerous alpha helices** C. Disulfide bridges
 - D. An active site E. None of the above
41. What is true about the factors (antigens) which determine the ABO blood type?
- A. They are steroids
 - B. They are proteins
 - C. They are glycolipids**
 - D. They are randomly determined in children - the parents' genetics does not play a role
 - E. They are not associated with the plasma membrane at all

42. Someone with an AB blood type can receive a blood transfusion from all of the below blood types EXCEPT:
 A. Type A B. Type B C. Type AB D. Type O
E. A person with blood type AB can receive a blood transfusion from all of the above blood types
43. Which group of molecules can most easily diffuse across a biological membrane?
 A. O_2 , CO_2 B. Na^+ , Cl^-
 C. Glucose, sucrose D. H_2O , glycerol

Use the key below to answer questions 44 - 46

- I. Simple diffusion II. Osmosis III. Ion Channels
 IV. Facilitated diffusion V. Active transport

44. Which of the above processes involve carrier proteins?
 A. I, II B. V only C. IV, V **D. III, IV, V** E. III, IV
45. Which of the above can transport molecules down their concentration gradient?
 A. I, II B. I, II, III C. I, II, III, IV
D. I, II, III, IV, V E. V only
46. Which of the above can transport molecules against their concentration gradient?
 A. I, II **B. V only** C. IV, V D. III, IV, V E. III, IV
47. How do plant leaves defy gravity and stick out?
 A. **Turgor pressure** B. An internal "skeleton" of cellulose
 C. The bark supports the leaves D. Fibers and sclerids
 E. None of the above
48. How can the facilitated diffusion carrier protein in the H^+ /Sucrose transport system carry sucrose against its concentration gradient?
 A. It can't, it is a facilitated diffusion carrier protein and they must always transport molecules down their concentration gradient
 B. It utilizes ATP energy
C. It is a symport so if the total gradient of the H^+ and sucrose is greater outside the cell, sucrose can be carried against its gradient.
 D. None of the above
49. 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 requires the hydrolysis of ATP to operate
 B. The Na^+/K^+ pump has two configurations, one which can bind to Na^+ and the other which can bind to K^+
 C. The Na^+/K^+ pump transports three Na^+ out of the cell and two K^+ into the cell
 D. The Na^+/K^+ pump is an example of an integral protein
E. All of the above statements about the Na^+/K^+ pump are TRUE

50. 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
51. 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
52. What do dynein, kinesin, and myosin have in common?
- A. They are all enzymes
 - B. They are all components of the nucleus
 - C. They are all motor proteins**
 - D. They are involved in protein synthesis
 - E. None of the above

A Portion of the Periodic Table