BIOS 100 - Fall, 2007pm **Name:**
Exam I, 19 Sept, 2007
Michael Muller, Instructor **TA:**

This exam consists of 53 questions over 7 pages (plus page 8 which has a 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. Good Luck!

1. Which of the following is NOT a part of the process of science?
   A. Asking questions about the natural world around us
   B. Developing hypotheses to test these questions
   C. Developing models and theories to explain the natural world
   D. Using data to prove your hypothesis are true
   E. All of the above are part of the process of science

2. How many protons are in the nucleus of ^{14}C?
   A. 5 **B. 6** C. 7 D. 8 E. 14

3. How many neutrons are in the nucleus of ^{14}C?
   A. 5 B. 6 C. 7 **D. 8** E. 14

4. What kind of bonds would you expect to find in a crystal of table salt?
   A. Covalent bonds **B . Ionic bonds** C. Polar Bonds

5. What happens when you pour an oil such as vegetable oil into a cup of water?
   A. The water molecules break the covalent bonds joining the carbons and hydrogens together
   B. The water molecules dissolve the ions associated with the vegetable oil
   C. The vegetable oil will form micelles
   D. The vegetable oil will not dissolve in the water
   E. None of the above

6. Ions differ in the number of _____ in the atom or molecule.
   A. Protons B. Neutrons **C. Electrons**

7. Which of the following elements is the least electronegative?
   A. F B. O C. C D. B. **E. Li**

8. Which of the following statements (A-D) about water is FALSE? If statements A-D are true, then choose E.
   A. Water is a poor insulator because it resists changes in temperature
   B. Water has strong adhesive and cohesive properties
   C. Water has a very high boiling point and freezing point when compared to other similar sized molecules
   D. Water has high surface tention
   E. All of the above statements about water are TRUE

9. When ethane (C_2H_6) is burned (reacts with O_2) to form CO_2 and H_2O, what is the change in oxidation state of the carbon?
   A. Carbon becomes more oxidized B. Carbon becomes more reduced
   C. The oxidation state of carbon does not change

10. Which of the following statements is true about adding HCl to pure water?
   A. The pH will increase **B. The pH will decrease**
   C. The pH will remain the same

11. The formation of phosphodiester bonds in DNA is an example of what type of reaction?
   A. Condensation B. Hydrolysis C. Energy coupling
   D. Monomeric E. None of the above

12. 
   The diagram to the left is an example of what type of molecule?
   A. Amino acid
   B. Nucleotide
   C. Phospholipid
   D. Sugar
   E. ATP

13. Which of the molecules listed below is the least hydrophillic?
   A. A protein **B. A steroid** C. DNA
   D. A protein E. A phosopholipid

14. A protein shape is stabilized by a covalent bond joining two cysteines. This is an example of a protein _____ structure
   A. Primary B. Secondary **C. Tertiary** D. Quaternary

15. ATP is most similar to what type of molecule?
   A. Polysaccharide B. Glyceride C. Amino Acid **D. Nucleotide**

16. _____ nuleotides have an -OH group attached to the 2' carbon of the pentose sugar.
   A. RNA B. DNA

17. The manner in which the tubulin subunits are joined together to construct a microtubule is an example of protein _____ structure.
   A. Primary B. Secondary C. Tertiary **D. Quaternary**

18. Which of the pairs below are both purines
   A. A & G B. A & T C. C & T D. G & T E. C & A

19. All of the organisms below contain a version of the enzyme peroxidase. In which organism would you expect to find the enzyme with the greatest Topt?
   A. Hummingbird B. Gorilla C. Alligator **D. Grass**

20. Which graph below best represents enzyme activity as a function of pH?

A **B** C

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. Which of the following statements (A-D) about enzymes is FALSE. If statements A-D are true, then choose E.
    A. Enzymes function by lowering the activation energy of a reaction
    B. Enzymes catalyze the forward and reverse reactions
    C. Enzymes temporarily bind to the substrates, forming an enzyme-substrate complex
    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

23. The enzyme Rubisco takes CO_2 from the atmosphere and adds it to a five-carbon molecule, making two three-carbon molecules. However, O_2 will also fit into the active site of rubisco. O_2 is an example of a(n)
    A. Competitive inhibitor
    B. Non-competitive inhibitor
    C. Allosteric inhibitor
    D. Allosteric enhancer

24. What to 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

25. What is the function of an Nuclear Localization Signal (NLS)?
    A. It helps enzymes find the nucleus
    B. It marks proteins for import or export from the nucleus
    C. It marks proteins for destruction by the lysosome
    D. It aids nucleoli in ribsosome synthesis
    E. None of the above

26. All of the following cell structures are part of the endomembrane system except:
    A. Golgi apparatus
    B. Plant central vacuole
    C. Outer nuclear membrane
    D. Plasma membrane
    E. Nucleoli

27. What is the function of the Golgi Apparatus?
    A. Protein syntheis
    B. Ribosome synthesis
    C. Protein packaging and distribution
    D. Protein degradation
    E. Lipid synthesis

28. Which of the following statements (A-D) about the mitochondria is FALSE? If statements A-D are true, then choose E.
    A. The mitochondria has evolved from the endosybiosis of an aerobic prokaryote
    B. The inner membrane of a mitochondrion has a much greater surface area than the outer membrane
    C. Mitochondria contain chromosomes with associated proteins very similar to the nuclear chromosomes
    D. Mitochondria contain ribosomes and can synthesize proteins
    E. All of the above statements about proteins are TRUE

29. What is the function of the nucleolis?
    A. Regulation of cell division
    B. Protein synthesis
    C. Protection of the DNA
    D. Synthesis of ribosomes
    E. Synthesis of the nuclear envelope

Matching - use the key below for questions 29 to 32.
    A. Archaeans B. Prokaryotes C. Eukaryotes

30. An *E. coli* bacterium is this type of organism
    A. A only **B. B only** C. C only D. A & B E. B & C

31. These cells lack organelles
    A. A only B. B only C. C only **D. A & B** E. B & C

32. These cells typically live in extreme environments
    A. A only B. B only C. C only D. A & B E. B & C

33. These cells contain mitochondria
    A. A only B. B only **C. C only** D. A & B E. B & C

34. Which organelle is incorrectly matched with its function?
    A. Mitochondria - site of cellular respiration
    B. Rough ER - synthesis of ribosomes
    C. Central vacuole - storage and maintenance of turgor pressure
    D. Smooth ER - synthesis of lipids
    E. Gogli apparatus - packaging and distribution of proteins

35. Which is not a function of the cytoskeleton?
    A. Maintaining cell shape
    B. Providing a track for motor proteins
    C. Anchorage of enzymes and organelles
    D. Contractile movement
    E. All of the above are functions of the cytoskeleton

36. What is the major difference between the fluid mosaic model of biological membranes and the Davson-Danielli model (the sandwich model) - aside from the fact that the Davson-Danielli model is incorrect, that is :)
    A. The fluid mosaic model has membranes composed of phosopholipids while the sandwich model has membranes composed of caramides and sphingolipids
    B. There are no proteins associated with membranes in the Davson-Danielli model
    C. In the Davson-Danielli model, the proteins are uniformly distributed on the outer and inner surfaces of the membrane while in the fluid mosaic model, proteins are not uniform and may be peripheral or integral
    D. In the fluid mosaic model, phospholipids may flip-flop, but in the Davson-Danielli model, the phospholips are locked into place by the protiens
    E. The sandwich model is yummier than the fluid mosaic model

37. Which of the following statements (A-D) about phospholipids is FALSE? If statements A-D are true, then choose E.
    A. Phospholipids are amphipathic molecules
    B. Phospholipids are modified triglycerides
    C. Phospholipids will not spontaneously form micelles and lipid bilayers - these must be assembled with enzymes
    D. Phospholipid bilayers are self-healing if they are gently distupted
    E. All of the above statements about phospholipids are TRUE

38. Which of the following will increase 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

39. Mary is blood type A (geontype AO) and Juan is blood type B (genotype BO). If they were to have a baby, which blood type is impossible to see in the baby?
    A. Type A B. Type B C. Type AB
    D. Type O **E. All four blood types are possible**

40. The above blood antigens are examples of
    A. Glycolipids B. Proteins C. Steroids
    D. Peptidosteroids E. Enzymes

41. An integral protein will almost always have:
    A. almost all of its amino acids be hydrophobic
    B. almost all of its amino acids be hydrophillic
    C. alpha helices with the hydrophobic centers and hydrophilic ends
    D. beta pleated sheets which are largely hydrophobic
    E. None of the above

42. Which group of molecules can most easily diffuse across a biological membrane?
    A. O_2, N_2 B. H_2O, glycerol C. Glucose, sucrose
    D. Na^+, Cl^-

Use the key below to answer questions 43 - 45

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

43. Which of the above processes involve carrier proteins?
    A. I, II B. V only C. IV, V **D. III, IV, V** E. III, IV

44. Which of the above require energy?
    A. I, II **B. V only** C. IV, V D. III, IV, V E. III, IV

45. Which of the above processes can become saturated?
    A. I, II B. V only **C. IV, V** D. III, IV, V E. III, IV

46. A cell has an internal osmotically active solute concentration of 0.5 M. It is placed in a solution that is 0.9 M. Which of the following statements is true about this system?
    A. The outside solution is hypertonic and the cell will shrink
    B. The outside solution is hypertonic and the cell will expand
    C. The outside solution is hypotonic and the cell will shrink
    D. The outside solution is hypotonic and the cell will expand

47. How does a cell utilize GLUT-1 to maximize glucose import into the cell?
    A. GLUT-1 is an active transport carrier, so it can import large amounts of glucose when powered by ATP hydrolysis
    B. GLUT-1 is a facilitated diffusion symport that will bring in glucose and Na^+. The cell first actively transports lots of Na^+ out of the cell, and then allows the glucose and Na^+ to enter down the net concentration gradient
    C. GLUT-1 is a facilitated diffusion uniport. However, once the glucose enters the cell, it is immediately converted to glucose-6-P, so it cannot leave. This creates a glucose gradient, bringing more glucose into the cell.
    D. GLUT-1 is an active transport antiport that pumps out one Na^+ for every glucose it brings in
    E. None of the above

48. 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

49. 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
    B. It utilizes ATP energy
    C. It is a symport so 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

50. 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 is utilized in many nervous system and digestive system cells
    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

51. What is the function of ribosomes?
    A. Protein synthesis B. Nuclear replication C. Lipid synthesis
    D. Cellular movement E. None of the above

52. Which of the following statements (A-D) about the nuclear envelope is FALSE? If statements A-D are true, then choose E
    A. The nuclear envelope is a double membrane system
    B. Both membranes of the nuclear envelope are continuous with the endoplasmic reticulum
    C. The nuclear envelope contains pores which regulate molecule entry and exit from the nucleus
    D. The nuclear envelope surrounds and encloses the nucleoplasm
    E. All of the above statements about the nuclear envelope are TRUE

53. Which of the following questions about biological polymers is FALSE? If statements A-D are true, then choose E.
    A. Biological polymers are typically formed via condensation reactions and are broken apart via hydrolysis
    B. Most biological polymers have the monomers joined together by a common bond type, thus requiring few enzymes to create many different molecules
    C. The synthesis and break down of biological polymers are both exergonic
    D. Biological polymers include polysaccharides, proteins, and nucleic acids
    E. All of the above statements about biological polymers are TRUE.