

## MCDB/CHEM 103/203 Mid-Term Examination, February 10, 2012

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*(Exams Lacking Names or with Illegible and Incomplete Names will not be Graded)*

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*In answering the questions below: Absent, illegible or otherwise unclear responses will be considered wrong responses. Carefully circle answers to multiple choice questions and legibly write answers to questions requiring written responses. Return ALL 8 pages for credit.*

1) List the four types of macromolecular and structural components of cells and their basic units of composition  
(8 pts).

2) Which is **incorrect**? (4 pts)

- a) All cellular components arise from translation of the genetic code
- b) The first observation of cells was achieved by compound microscopes
- c) Proteins are produced from RNA by the process of transcription
- d) All of the above
- e) a and b

3) Which is **correct**? (4 pts)

- a) Stem cells can differentiate into other types of cells
- b) Clones are organisms sharing identical genes
- c) Monozygotic twins are always clones
- d) All of the above
- e) a and c

4) List the three tenets of Cell Theory (6 pts)

5) Which of the following is **incorrect**? (4 pts)

- a) All bacteria are prokaryotes
- b) All multicellular organisms are eukaryotes
- c) Prokaryotes lack a nucleus
- d) All of the above
- e) a and b

6) What are the three major divisions/classifications in the phylogeny of life? (3 pts)

- 7) Which of the following is **incorrect**? (4 pts)
- a) Increasing genome size is usually accompanied by increasing gene number
  - b) Gene paralogs and gene orthologs are always gene homologs
  - c) DNA segment shuffling contributes to genetic diversity
  - d) All of the above
  - e) None of the above
- 8) Which of the following is **correct**? (4 pts)
- a) A scientific hypothesis is more likely to be correct than a scientific theory
  - b) Empirical and measurable evidence is the basis of the scientific method
  - c) Scientific theories do not explain most successfully tested hypotheses
  - d) The scientific method begins with a scientific theory that consists of testable hypotheses
  - f) Scientific theories cannot be disproved by scientific hypotheses
- 9) Organism complexity is most directly related to: (4 pts)
- a) Larger genomes
  - b) Larger numbers of genes
  - c) Metabolic processes
  - d) All of the above
  - e) a and b
- 10) Which of the following is **incorrect**? (4 pts)
- a) Epigenetics is associated with a change in DNA sequence
  - b) Epigenetics uses proteins to control gene expression
  - c) Epigenetics can explain why clones are not alike in all ways
  - d) All of the above
  - e) a and b

11) List three of the four molecular bonds of life. (6 pts)

12) Genetic redundancy refers two related genes that are each functionally irrelevant alone but when expressed together they provide an essential function. (2 pts)

- a) True
- b) False

13) Which of the following are properties of covalent bonds? (3 pts)

- a) electron sharing between atoms
- b) hydrogen bonding between amino acid side chains
- c) ionic bonds between atoms
- d) All of the above
- e) a and b

14) Which is the correct order of bond strength, from strongest to weakest? (3 pts)

- a) Ionic, covalent, hydrogen, van der Waals
- b) Covalent, hydrogen, ionic, van der Waals
- c) Covalent, ionic, hydrogen, van der Waals
- d) Ionic, covalent, van der Waals, hydrogen
- e) None of the Above

15) Covalent bonds are always involved in the interactions of different macromolecules. (3 pts)

- a) True
- b) False

16) What did the results of Meselson-Stahl experiment reveal? (3 pts)

17) Why is a polar covalent bond especially important in biology? (4 pts)

18) Which of the following is **incorrect**? (4 pts)

- a) Eukaryotic mRNAs have a methylguanine “cap” at the 5’ end
- b) Gene introns are spliced out before an mRNA is used to make a protein
- c) Transcription termination leads to poly-adenylation of the mRNA 3’ end
- d) Translation uses tRNAs to generate proteins directly from a DNA transcript
- e) b and d

19) Which of the following is **correct**? (3 pts)

- a) Lipids are more likely to flip across leaflets than they are to diffuse laterally
- b) Lipids in biological membranes have two fatty acid tails
- c) Membranes typically have equal amounts of cis and trans fatty acids
- d) All of the above
- e) a and b

20. List the three major types of membrane-associated proteins and their mechanism of association with the membrane (6 pts)

21. Why is it that disulfide bonds do not form in the cytoplasm of cells? (3 pts)
- a) The cytoplasm is an oxidative environment
  - b) Extracellular / luminal compartments are a reductive environment
  - c) a and b are correct
  - d) Neither a nor b is correct
22. Which of the following is **correct**? (3 pts)
- a) Passive transport is always protein-mediated
  - b) Active transport may or may not require energy
  - c) Active co-transport is non-saturable when transport is in the direction of an electrochemical gradient
  - d) None of the above
  - e) b and c
23. What is the difference between a Symporter and an Antiporter? (4 pts)
24. Which of the following is **incorrect**? (4 pts)
- a) The formation of glycogen requires a protein called glycogenin
  - b) Sialic acids are usually found on the terminal (outermost) positions of glycan chains
  - c) Unlike glycosylation, glycation is an enzymatic process linking glucose to proteins
  - d) All of the above
  - e) b and c

25. List the three main structural features that differentiate glycans (3 pts)

26. List the different types/classes of glycans in mammals (7 pts)

27. Which of the following is **correct**? (4 pts)

- a) The nucleus contains all of the inherited genetic information in a cell
- b) The nuclear pore complex uses active and passive transport mechanisms that are determined primarily by the size of the cargo transported
- c) Like ion channels, the nuclear pore complex is selective for the transport of small molecules such as ions and proteins under 60 kilodaltons.
- d) All of the above
- e) a and b

28. Which of the following is **incorrect**? (4 pts)

- a) The electron transport chain is directly coupled to the ATP synthase complex
- b) Endoplasmic reticulum is the major reservoir of calcium ions in the cell
- c) The majority of mitochondrial proteins are synthesized in the mitochondria
- d) All of the above
- e) a and c

29. List two functions of peroxisomes (4 pts)

30. Which of the following is **incorrect**? (4 pts)

- a) Peroxisomes acquire their protein contents from both the endoplasmic reticulum and the nucleus
- b) Peroxisomes are always located close to the nucleus
- c) Although Golgi has only one membrane, this membrane is unusual because it is divided into 4 lipid leaflets.
- d) All of the above
- e) a and c

31. Which of the following is **incorrect**? (3 pts)

- a) Lysosomes have an acidic lumen
- b) The Golgi is the main site of lipid synthesis
- c) Endosomes are first formed from the plasma membrane
- d) All of the above
- e) b and c