

LIF101 Mid-semester examination

20-9-2013, 12:30 to 2:30 PM

Total Pages: 8

Please write your **name** and **Roll No.** and **sign** the Objective response sheet. All questions have only **ONE** correct choice. Please fill the bubble corresponding to your choice in the answer sheet with a **PEN**. Fill only one bubble per question – otherwise the answer will not be considered. For correct bubbles that you fill, you will be awarded **+1**. In case you have filled the wrong bubble or more than one bubble you will be awarded **minus 0.5**. You will be awarded **0** if you have not filled any bubble. Your paper will not be evaluated if you do not submit both the question and answer sheets.

- 1) Which molecule(s) is/are synthesized during light-dependent reactions of photosynthesis?

- A) Oxygen
B) ATP
 C) Both A) and B)
D) Glucose
E) A, B and D.
F) ATP, Glucose and CO₂

- 2) The simplest way to distinguish a prokaryote from eukaryote is?

- A) To see if the cell is an entire organism
 - B) See if the nucleus is present
 - C) Look for the plasma membrane
 - D) Check for the presence of DNA
 - E) Look if the cell is motile (i.e. moving).

- 3) Among the following substances, all of them are able to diffuse freely across the cell membrane except for:

1. Oxygen
 2. Water
 3. Carbon Dioxide
 4. Glucose
 5. H^+

- A) 1 and 2 B) 4 and 5 C) 2, 3 and 5 D) only 5 E) only 2 F) only 1.

- 4) During winter coconut oil solidifies. This is due to the following reason:

- A) Coconut oil is primarily composed of polyunsaturated fatty acids
 - B) Coconut oil is primarily composed of saturated fatty acids**
 - C) Coconut oil is primarily composed of steroids
 - D) Coconut oil is primarily composed of monounsaturated fatty acids in the trans configuration (i.e. trans fatty acids).

- 5) During photosynthesis, plants absorb light energy. What happens to the large proportion of this energy taken up by the plants cells?

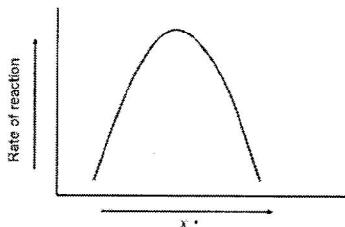
- A) Energy is lost by the plants in the form of heat energy.
 - B) Energy is taken up by water molecules to maintain the temperature in the plants to normal level.
 - C) Energy is stored by the plant cells in the form of chemical energy.

D) Energy is released back in the form of green colored light. That is the reason behind green color of the plants.

6) In the class the DNA that we discussed about, is called the 'B form of DNA'. Another form of DNA called the 'A form' differs from the 'B form' only in the geometrical aspects or helical parameters. DNA as you know is a double stranded helix - for simplification of calculation let us now consider only one strand. In this A form, a nucleic acid is encountered every 2.4 \AA in the z-direction (i.e. the helical axis) and the angle between two such adjacent nucleic acids is 32.7° . How many nucleic acids would constitute a repeating structural unit in the helix? In other words, after how many nucleic acids will the structure repeat in each chain of the helix (one periodic unit) and what will be the height of this periodic unit?

- A) 11 & 24.0 \AA
- B) 10 & 21.6 \AA
- C) 12 & 26.4 \AA
- D) None of the above

7) A plot for the rate of the reaction as a function of some variable X, for a typical enzyme catalyzed reaction is shown below.



What do you think X might be ?

- A) Substrate concentration or temperature
- B) Substrate concentration or enzyme concentration
- C) Substrate concentration or pH
- D) pH or temperature

8) Cells majorly contain three type of plastids that are involved in different functions. Chloroplast is responsible for photosynthesis, chromoplast for colour and leucoplast/amyloplast for storage of starch. Choose which one of these combinations is correct?

- A) Chloroplast- rose flower
- B) Chromoplast- banana leaf
- C) Amyloplast- potato tuber
- D) Leucoplast- stem bark

9) Muscle cells under excessive physical stress produce _____ metabolite at the end of anaerobic respiration, which is responsible for fatigue and pain.

- A) Acetone
- B) Lactic acid
- C) Glucose

Name

Roll Number

D) Acetyl-CoA

10) A microscopic unicellular organism is observed to have the following characteristics : a food gullet, a flagellum, chloroplast, mitochondria and a nucleus. This organism belongs to which kingdom of life?

- A) Protista
- B) Plantae
- C) Fungi
- D) Bacteria

11) Hemoglobin is a protein that transports O₂ inside the human body - it captures oxygen from the lungs (where CO₂ is less) and releases it at the distant tissues (where CO₂ is more). The O₂ carrying capacity of Hemoglobin depends on the pH of the surroundings. We know that the pH inside the human body is maintained by the bicarbonate buffer system. What do you expect would be the strength or affinity of hemoglobin for binding oxygen at low pH?

- A) It binds weakly to oxygen
- B) It binds tightly to oxygen
- C) Can not say
- D) Sometimes tightly and sometimes weakly.

12) Dynein is a protein which has two arms and is exclusively responsible for the bending movements of cilia and flagella. What will happen if dynein is absent from the cilia?

- A) Bending will occur properly
- B) No bending of cilia will occur
- C) Bending will occur but more ATP will be required
- D) Cilia will remain bent permanently

13) A polypeptide chain in alpha-helix conformation is composed of the following amino acid sequence from the amino terminus to the carboxyl terminus: **Tyrosine-Lysine-Glutamic acid-Phenylalanine-Cysteine-Valine-Glycine-Methionine**. The oxygen of the carbonyl group of Glutamic acid makes a hydrogen bond with the hydrogen of the amido group of _____ amino acid.

- A) Phenylalanine
- B) Cysteine
- C) Glycine
- D) Valine

14) In a lipid bilayer, _____ of all the lipid molecules are sandwiched between all the _____.

- A) hydrophilic tails; hydrophobic heads
- B) hydrophilic heads; hydrophilic tails
- C) hydrophobic tails; hydrophilic heads
- D) hydrophobic heads; hydrophilic tails

15) When a person takes normal diet and there is sufficient glucose available in the body cells, the process of glycolysis generates pyruvic acid which then enters into the Kreb's cycle for energy production. When a person does not take food for a few weeks, there is weakness in muscles and

Name

Roll Number

the person becomes very thin/lean. What should be the reason for this?

- A) Due to decrease in glucose level, there is less ATP production. This results in weakness.
- B) Lipid molecules present in the fat cells break down into fatty-acids and glycerol. Fatty acids and glycerol then generate metabolites that participate in energy production by entering into glycolysis and Kreb's cycle. This results in the loss of body fat.
- C) Decreased ATP production prevents active transport of nutrients from the intestine and therefore the person feels weak.
- D) Decrease in glucose level leads to alkaline condition in the cells which leads to protein degradation and hence weak muscles.

16) When a spherical cell grows in size by increasing its diameter by n-fold, it would have to make certain changes in order to sustain the increased volume of the cytoplasm. Which one of the following changes would be the most effective?

- A) Changing its shape to become a cube instead of a sphere
- B) Increasing the rate of breakdown of stored glycogen to produce more glucose
- C) Increasing its surface area by folding the membrane in many finger like projections.
- D) Decreasing the rate of generation of waste products inside the cell.

17) What is the difference between amylose and cellulose?

- A) The monomers forming the polysaccharides are different.
- B) The amylose is branched whereas the cellulose is unbranched.
- C) They are identical in all respects, except the chain length.
- D) The covalent linkage between the monomers is different.

18) Which of the following events is not common to both - photosynthesis and aerobic respiration?

- A) Participation of vitamin derived coenzymes.
- B) Buildup of H^+ gradient
- C) Redox reactions
- D) Reduction of oxygen molecule to water.

19) Read the following statements carefully:

- i) Eukaryotic cells contain mitochondria and chloroplast
- ii) Mitochondria and chloroplast are involved in production of energy
- iii) Mitochondria and chloroplast both convert solar energy to chemical energy

Which of the statement(s) is/are correct?

- A) i only
- B) ii only
- C) i and ii
- D) ii and iii

20) An organism being grown at $37^{\circ}C$ is suddenly shifted to $15^{\circ}C$. In order to survive, the organism has to make certain changes to its cell membrane, so that the membrane does not become stiff. The organism is likely to change the membrane composition by:

- A) increasing cholesterol and decreasing unsaturated fatty acids
- B) decreasing both cholesterol and unsaturated fatty acids

Name

Roll Number

- C) increasing both cholesterol and unsaturated fatty acids
 D) decreasing cholesterol and increasing unsaturated fatty acids

21) A researcher working with a penta-peptide has found out that it is composed of amino acids L, F, F, G and Y (single letter code is used). How many different peptides are possible with this set of amino acids?

- A) 120
B) 90
 C) 60
D) None of the above

22) Which of the following statements is false with respect to an enzyme's ability to catalyse a reaction?

- A) An enzyme provides a reaction surface and a suitable environment for the reaction to take place.
B) An enzyme binds reactants such that they are positioned correctly and can attain their transition-state configurations.
 C) An enzyme allows the reaction to go through a less stable transition state .
D) An enzyme can weaken bonds in reactants through the binding.

23) Metabolically active cells have more requirement of energy and thus contain large number of mitochondria for ATP production. Which of the following statements is wrong?

- A) ATP is the energy currency of the cell
B) Motile cells have large number of mitochondria
C) Plant cells have mitochondria
 D) None of the above

24) Turgidity is the condition in which the cell is fully expanded and the cell membrane is stretched due to excessive accumulation of water. The outward pressure exerted by the cell on the cell wall due to turgidity is called turgor pressure. Choose the correct statement from the following.

- A) If the plant cells are placed in distilled water, they will shrink.
 B) Eukaryotic cells do not exhibit turgidity because of the presence of active transporters in their plasma membrane.
C) Red blood cells are the only eukaryotic cells that show turgidity.
D) When the living cells are kept in highly concentrated KCl solution, ions will move into cells.

25) Certain proteins bind to a particular molecule, such as a hormone, outside the cell. Binding triggers a change in the cell's interior, while the molecule that binds outside does not get inside the cell. Based on this function, the protein can be called as:

- A) Receptor protein
B) Transport protein
C) Adhesion proteins
D) Enzyme

26) Photopigments of plants absorb light from visible range during photosynthesis to produce glucose. **Chlorophyll a** which is a green colored photopigment present in the chloroplast absorbs light and releases electrons. Consider a hypothetical situation where **chlorophyll a** is of yellow

Name

Roll Number

color. Which of the following would be the expected outcome?

- A) Plants will show minimum rate of photosynthesis in the presence of blue color light, which is complementary to yellow color of the pigments.
- B) Maximum glucose production by the plant would occur in the presence of yellow light.
- C) Least amount of oxygen will be generated, if only yellow color light is available to plants.
- D) None of the above.

27) Which of the following can be characterized as carbohydrate?

- A) C_2H_5O
- B) $C_3H_4O_2$
- C) $C_6H_{12}O_7$
- D) $C_4H_8O_4$

28) Which of the following factors determine whether or not a particular substance will be able to pass through a cell membrane?

- i) the presence of a carrier molecule for that substance
- ii) Size of the molecules
- iii) the use of ATP to transport a substance against a concentration gradient

- A) All of the above
- B) i and ii
- C) ii and iii
- D) None of the above

29) Consider the basic cell structure only and think what is common to both a rose plant and a cat?

- i) They both are eukaryotic cells
- ii) They both have nucleus
- iii) They both have mitochondria
- iv) They both have chloroplast

Select the correct combination of choices:

- A) All of the above
- B) i, ii & iii
- C) i & iii
- D) ii, iii & iv

30) If all the double bonds present in conjugated system present in **chlorophyll a** of chloroplasts are saturated by hydrogenation, which of the following would be expected? [Hint – more energy is required to excite electrons from single bonds ($\sigma-\sigma^*$ transition) in comparison to double bonds ($\pi-\pi^*$ transition)].

- A) Chlorophyll a will not function under any circumstance.
- B) Photosynthesis would not be evoked by any of the wavelengths in the visible range.
- C) Rate of photosynthesis will be tremendous in the presence of red-orange colored light.

Name

Roll Number

D) Chlorophyll a will get destroyed upon exposure to visible light.

31) Eukaryotic cells are more efficient than prokaryotic cells because of their internal compartmentalization. This feature is advantageous to eukaryotic cells because it _____.

- A) makes each compartment nutritionally independent of others
- ~~B) allows specialization by subdivision of tasks~~
- C) allows specialization through merging different tasks
- D) reduces overall cell size

32) To enter or leave a cell, substances must pass through

- A) Microtubule
- B) The golgi apparatus
- C) Nucleus.
- ~~D) Plasma Membrane~~

33) Sucrose (table sugar) is a disaccharide of Glucose and Fructose, all three are chiral molecules and have the ability to rotate plane polarized light differently. In an experiment, a researcher mixes the sucrose solution with a minute amount of a protein X; he measures the optical rotation at the start of experiment and after 30 minutes. He is surprised to see that optical rotation of light changes from 170° to 140° at the end of experiment. What could the protein have done to the sucrose molecule?

- ~~A) Broken down the sucrose into elemental components: $C_6H_{12}O_6$~~
- ~~B) Changed the chirality of sucrose molecule at one chiral center~~
- C) The protein has converted the sucrose into nucleic acids
- D) The phenomenon can not be performed by the protein, something else is involved.

34) Which among the following is not harmful to the growth of plants?

- A) Growing plants in soil with very high salinity and very low temperature.
- ~~B) Growing the plants in an area with an artificial source of red-orange light.~~
- C) Keeping the plants in the area with no access of light.
- D) Complete lack of micronutrients like manganese and copper in the soil.

35) We have a protein which is soluble in water; something happens to this protein and now it becomes insoluble and starts aggregating i.e. protein molecules make more favorable interactions between themselves than with water and thus become insoluble. Upon investigation, it is found that there is a change in an amino acid which lies on the surface of the protein. What could this change be that leads to this aggregation?

- A) Hydrophobic to hydrophilic
- ~~B) Acidic to hydrophobic~~
- C) Less hydrophilic to more hydrophilic
- D) Acidic to Basic

36) Which of the following cells would be least tolerant to a hypotonic (i.e. lower salt concentration outside the cell) condition in the extracellular environment?

- A) Epidermal cells from a flower

Name

Roll Number

- B) Red blood cells
C) Yeast cells that have a cell wall
D) bacteria that have a cell wall (they are called Gram positive bacteria).

37) In the human body lactose from milk is converted into glucose and galactose, with the simultaneous consumption of one water molecule. This reaction is carried by an enzyme called lactase. What kind of reaction is this?

- A) Condensation
 B) Hydrolysis
C) Rearrangement
D) Electron transfer

38) Which of the following structures may require more than one chain of protein?

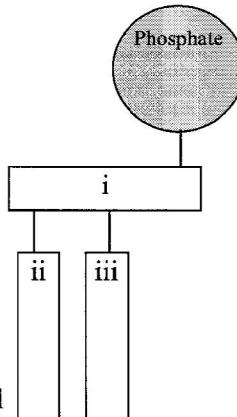
- A) Primary structure
B) Secondary structure
C) Tertiary structure
 D) Quaternary structure

39) A particular protein is known to interact only with the RNA and not with the DNA. Recall the differences between the DNA and RNA molecules and suggest possible reasons for this discrimination?

- i) The protein specifically recognizes the 2' OH groups
ii) The protein specifically recognizes the Thymidine groups
iii) The protein specifically recognizes the Uridine groups

- A) Both i and ii
B) Both ii and iii
 C) Both i and iii
D) None of the above

40) Given below is the schematic of a Phospholipid, fill up the appropriate biomolecule in the structure.



i, ii, iii are respectively:

- A) Glycine, Glycerol, Glycerol
B) Fatty Acid, Glycerol, Glycerol
C) Sterol, Fatty Acid, Fatty Acid
 D) Glycerol, Fatty Acid, Fatty Acid