

NAME \_\_\_\_\_ SECTION # \_\_\_\_\_ DISCUSSION GSI

1. Sit every other seat and sit by section number. Place all books and paper on the floor. **Turn off all phones, pagers, etc. and place them in your backpack. They cannot be visible. No calculator is permitted.**

**Scantron Instructions**

2. Use a #2 pencil. **ERASE ALL MISTAKES COMPLETELY AND CLEARLY.**
3. Write in & bubble in your name, SID, and section # (last 2 digits). The top 8 boxes of the ID field are for your SID, the bottom two are for the last 2 digits of your section #. Put your name on the scantron form. Under "test" write in your GSI's name. See below.

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**IMPORTANT**  
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Write I.D. Number Here: 130594806  
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NAME: Last ; First  
 TEST: GSI name  
 DATE: DATE  
 PERIOD: Disc. #

Bubble in: [Bubble in] [Bubble in] [Bubble in] [Bubble in] [Bubble in] [Bubble in] [Bubble in] [Bubble in] [Bubble in] [Bubble in]

Last 2 digits Disc. #: [Bubble in] [Bubble in]

**EXAM Instructions:**

4. Print your name on THIS COVER SHEET. (otherwise, you will get a ZERO).
5. Leave your exam **face up**. When told to begin, check your exam to see that there are 8 numbered pages, 53 multiple-choice questions. The exam is worth 100 pts. Each question is worth 2 points unless otherwise indicated. You are **NOT PENALIZED** for guessing!
6. Read all questions & choices carefully before bubbling in your response.
7. Do not talk during the exam. The exam is closed book. You cannot use a calculator. If you have a question, raise your hand; a GSI will help you. They will not give you the answer nor can they explain scientific terms (e.g. binding affinity, etc.).
8. LOCATE YOUR GSI. Turn in your SCANTRON and EXAM to your GSI. YOU MUST TURN IN **BOTH** or else you will get a ZERO.
9. WHEN TOLD TO STOP- YOU MUST REALLY **STOP, even if you are not finished!** Bubble in guesses **BEFORE** THIS TIME. If you continue to write after time has been called you will risk getting a 0.
10. There is always only one best answer.

1. **Mark A for question 1. You have version A. It is crucial to mark the correct version of the exam.**
2. **All proteins have**
- A. catalytic activity
  - B. disulfide bonds
  - C. prosthetic groups
  - D.  $\alpha$ -helices
  - E. None of the above is correct
3. **Which of the following statements, if any, is FALSE? If none of A-D are false select E.**
- A. Protein folding often occurs spontaneously
  - B. Chaperones are specific proteins involved in protein folding
  - C. The final tertiary structure of a protein is dictated by its amino acid sequence
  - D. Unfolding a protein, i.e. denaturation, is always irreversible
  - E. None of the above statements is false
4. **The strongest bond that specifically stabilizes tertiary structure is the**
- A. disulfide bond
  - B. hydrophobic bond
  - C. side-chain hydrogen bond
  - D. peptide-group hydrogen bond
  - E. Van der Waal's bond
5. **In order to determine the complete tertiary structure of a protein, you would need to**
- A. only determine its primary structure
  - B. only determine its secondary structure
  - C. identify prosthetic groups in the protein
  - D. identify S-S bonds in the protein
  - E. crystallize the protein and subject it to X-ray analysis
6. **Phospholipids are found**
- A. in all cell membranes
  - B. in the cytosol
  - C. in the matrix
  - D. only in eukaryotes
  - E. only in prokaryotes
7. **In a phospholipid, the three hydroxyl groups of glycerol are linked to**
- A. three fatty acids
  - B. two fatty acids and one phosphoric acid
  - C. one fatty acid and two low molecular weight organic alcohols
  - D. one amino acid, one saturated fatty acid and one unsaturated fatty acid
  - E. one organic alcohol and two fatty acids
8. **Amylose and amylopectin differ because**
- A. amylopectin is a branched polysaccharide
  - B. only amylose contains  $\beta$ -glucose
  - C. only amylopectin contains  $\alpha$ -glucose
  - D. amylose is found in animals and amylopectin in plants only
  - E. only amylose is a disaccharide
9. **(1 pt) Glucose and fructose**
- A. are stereoisomers
  - B. have the same structural formula
  - C. are both ketoses
  - D. are both aldoses
  - E. are both pentoses

## Did you correctly mark your answer for question 1?

### 10. During the formation of sucrose

- A. a pentose sugar and a hexose sugar are combined
- B. glucose is synthesized
- C. galactose is used
- D. two glycosidic bonds are formed
- E. None of the above is correct.

### 11. Which of the following statements is true?

- A. DNA is found only in the nucleus and RNA is found only in the cytosol
- B. DNA contains uracil while RNA contains thymine
- C. RNA is found in both free and bound ribosomes while DNA is absent from ribosomes
- D. DNA contains a pentose sugar and RNA contains a hexose sugar
- E. The bulk of the DNA in a prokaryotic cell is linear

### 12. Which of the following statements is true?

- A. Peroxisome proteins are glycosylated.
- B. Peroxisomes contain enzymes that catalyze oxidative reactions..
- C. Peroxisome proteins are synthesized by a co-translational pathway.
- D. Only B and C are correct
- E. A, B and C are all correct

### 13. Which of the following statements concerning ribosomes is true?

- A. Ribosomes are functional in the nucleus.
- B. Ribosomes are found in all cellular organelles.
- C. Ribosomal subunits are assembled in the nucleolus.
- D. Ribosomal subunits contain RNA, protein and phospholipids.
- E. None of the above statements are true.

### 14. Bound ribosomes

- A. are found in the cytosol
- B. are imported into mitochondria
- C. differ in chemical composition from free ribosomes
- D. are found in peroxisomes
- E. are involved in the synthesis of proteins that are secreted from a cell

### 15. Import of proteins into the nucleus is unusual because

- A. it is the only process that involves post-translational import.
- B. it requires a signal recognition particle.
- C. it is mediated by a cytosolic protein that forms a complex with the protein to be imported.
- D. the imported protein must be glycosylated.
- E. it requires the enzyme importase.

### 16. Protein glycosylation

- A. is involved in targeting proteins to their final destinations
- B. regulates the activity of enzymes
- C. occurs in the cytosol
- D. occurs during glycolysis
- E. regulates DNA transcription in mitochondria

### 17. The endomembrane system

- A. is required for protein targeting to peroxisomes
- B. involves transport of components using vesicles
- C. is the internal membrane system in the chloroplast
- D. is the internal membrane system in the mitochondrion
- E. is found only in prokaryotes

**18. The plasma membrane**

- A. is directly involved in oxidative phosphorylation in eukaryotic cells
- B. is present in both eukaryotic and prokaryotic cells
- C. contains only intrinsic proteins
- D. never contains transport proteins
- E. only contains antiports

**19. The endosymbiotic model**

- A. explains how cells make ATP
- B. explains the origins of mitochondria
- C. details how proteins fold
- D. describes how proteins are synthesized
- E. presents a model for biological membranes

**20. Which of the following is true?**

- A. The nuclear membrane is part of the endomembrane system
- B. Proteins are imported into the lysosome via the co-translational pathway
- C. Lysosomes degrade macromolecules in oxidative reactions
- D. Only A and B are correct
- E. A, B and C are all correct

**21. Chloroplasts and mitochondria are unusual organelles because**

- A. they are unable to import proteins
- B. they contain their own DNA
- C. RNA from these organelles is exported to the cytosol
- D. their proteins are imported by both co- and post-translational pathways
- E. their proteins are exported to the cytosol

**22. (1 pt) Peripheral proteins**

- A. are imbedded in the hydrophobic core of a membrane
- B. are covalently bound to the lipids of the membrane
- C. are anchored by disulfides to integral proteins
- D. require a detergent for removal from the membrane
- E. are weakly associated with the polar head groups of phospholipids

**23. The fluidity of a membrane is affected by**

- A. the degree of unsaturation in the fatty acid side chains
- B. the amount of protein in the membrane
- C. temperature
- D. Only A and B are correct
- E. A, B and C are all correct

**24. Glucose and H<sup>+</sup> are transported into cells together. This is an example of**

- A. a symport
- B. an antiport
- C. simple diffusion
- D. an activated channel
- E. a gated channel

**25. Endocytosis differs from transport via a channel in that only endocytosis**

- A. involves vesicle-mediated transport
- B. can transport molecules into the cell
- C. requires an energy source
- D. Only A and B are correct
- E. A, B and C are all correct

**26. All biological catalysts**

- A. are located in the cytosol
- B. contain a prosthetic group
- C. are regulated by covalent modification
- D. are proteins
- E. interact with a substrate

**27. Enzymes typically reduce the activation energy of a reaction by**

- A. bringing reacting molecules in close proximity
- B. inducing small changes in the structure of the substrate
- C. covalently binding the substrate
- D. Only A and B are correct
- E. A, B and C are all correct

**28. (1 pt)  $\Delta G^\circ$  for a chemical reaction**

- A. gives detailed information on the mechanism of the reaction
- B. can be used to predict if the reaction requires an enzyme
- C. can be used to predict if the reaction is exergonic
- D. demonstrates whether a prosthetic group is required for the reaction
- E. identifies if an allosteric effector is involved in the reaction

**29. Which of the following statements about an allosteric site is true?**

- A. An allosteric site often allows the product of a metabolic pathway to inhibit the enzyme and shut off the pathway
- B. An allosteric site is often found on a protein subunit that does not contain the active site
- C. An allosteric activator prevents the substrate from binding at the active site
- D. Only A and B are true
- E. A, B and C are all true

**30. Which of the following statements about enzyme inhibition is true?**

- A. If an inhibitor binds at the active site, it is a competitive inhibitor
- B. Competitive inhibition is never reversible
- C. A non-competitive inhibitor binds at the active site of an enzyme
- D. If an inhibitor binds at a site other than the active site, it is a competitive inhibitor
- E. Allosteric inhibition requires ATP

**31. When a prosthetic group is present in an enzyme, it usually**

- A. binds a non-competitive inhibitor
- B. undergoes reversible phosphorylation
- C. interacts with the substrate
- D. is removed from the enzyme after the product is formed
- E. reacts with  $O_2$

**32. Enzyme regulation by phosphorylation typically**

- A. is reversible
- B. involves a kinase
- C. requires a zymogen
- D. Only A and B are correct
- E. A, B and C are all correct

**33. Cooperativity is seen in enzymes that**

- A. undergo covalent modification
- B. are regulated by protein phosphorylation
- C. contain more than a single subunit
- D. have pH optima more basic than pH 8.0
- E. bind oxygen

**34. (1 pt) During glycolysis**

- A.  $O_2$  serves as the final electron acceptor
- B. ethanol is a final product
- C. NADH is formed
- D. ATP is synthesized via oxidative phosphorylation
- E. many of the required enzymes are membrane-bound

**35. The conversion of glyceraldehyde-3-phosphate to 1,3-diphosphoglyceric acid is an important step in glycolysis because**

- A. it requires oxygen
- B. it is the only step that requires NADH
- C. an inorganic phosphate is incorporated into an organic molecule
- D. it is the only energy-requiring reaction
- E. it is catalyzed by an enzyme that contains a heme prosthetic group

**36. Which of the following are characteristics of substrate-level phosphorylation?**

- A. It can occur in the cytosol of the cell
- B. It can occur in the absence of oxygen
- C. It requires at least 7.3 kcal of energy to make an ATP
- D. It does not require membrane-bound enzymes
- E. All of the above are correct

**37. During alcoholic fermentation,**

- A. pyruvate is converted to ethanol
- B. ATP is synthesized by oxidative phosphorylation
- C. the reactions occur in the mitochondrion
- D. acetaldehyde is converted to lactate by lactic dehydrogenase
- E.  $O_2$  is required

**38. The Krebs cycle**

- A. synthesizes ATP using substrate-level phosphorylation
- B. synthesizes intermediates that are used for biosynthetic reactions
- C. produces 4NADH and 1FADH<sub>2</sub> for one turn of the cycle
- D. Only A and B are correct
- E. A, B and C are all correct

**39. Which of the following statements concerning cytochromes is true?**

- A. Cytochromes contain heme groups that transfer electrons
- B. All cytochromes are integral proteins that are found only in mitochondria
- C. Cytochromes transfer protons across the mitochondrial membrane
- D. Cytochromes contain bound copper that reacts with oxygen
- E. Cytochromes are found in Complex I in mitochondria

**40. The oxidation of pyruvate by  $O_2$  in mitochondria has a  $\Delta G^\circ$  of -220 kcal. What is the efficiency of energy conversion for ATP formation for an organism that can grow directly on pyruvate with oxygen as the electron acceptor?**

- A. approx. 10%
- B. approx. 25%
- C. approx. 38%
- D. approx. 50%
- E. approx. 60%

**41. Which of the following statements concerning the chemiosmotic mechanism is true?**

- A. ATP synthesis involves a  $Na^+K^+$  ATPase
- B. A proton gradient is used to synthesize ATP
- C. All of the ATP synthesized in the mitochondrion involves a chemiosmotic mechanism
- D. The only organelle in which ATP synthesis occurs is the mitochondrion
- E. A soluble protein in the mitochondrial matrix catalyzes the synthesis of ATP

- 42. Which of the following most accurately describes the pathway for electrons in the mitochondrial electron transport chain? Not all components are necessarily listed.**
- $\text{NAD}^+ \rightarrow \text{Complex I} \rightarrow \text{Complex II} \rightarrow \text{Complex III} \rightarrow \text{Complex IV} \rightarrow \text{O}_2$
  - $\text{NADH} \rightarrow \text{Complex I} \rightarrow \text{Complex II} \rightarrow \text{O}_2$
  - $\text{NADH} \rightarrow \text{Complex I} \rightarrow \text{Complex III} \rightarrow \text{Complex IV} \rightarrow \text{O}_2$
  - $\text{NADH} \rightarrow \text{Complex III} \rightarrow \text{Cytochrome c} \rightarrow \text{Complex IV} \rightarrow \text{O}_2$
  - $\text{NADPH} \rightarrow \text{Complex II} \rightarrow \text{Complex III} \rightarrow \text{Complex IV} \rightarrow \text{O}_2$
- 43. Substrate-level phosphorylation and oxidative phosphorylation differ because**
- only substrate-level phosphorylation occurs in an organelle
  - only substrate-level phosphorylation requires cytochromes
  - only oxidative phosphorylation requires  $\text{O}_2$
  - only substrate-level phosphorylation utilizes a proton gradient to make ATP
  - only oxidative phosphorylation involves an oxidation-reduction reaction
- 44. Chlorophyll a is found in**
- PSI
  - PSII
  - Antenna complexes
  - Only A and B are correct
  - A, B and C are correct
- 45. All reaction center complexes**
- contain chlorophyll *b*
  - convert light energy into chemical products
  - are directly involved in proton translocation
  - contain at least one cytochrome
  - are localized in the plasma membrane
- 46. During non-cyclic electron transport**
- cytochromes are oxidized but not reduced
  - plastoquinone is oxidized with electrons from PSI
  - protons from the stroma are moved into the matrix
  - $\text{NADP}^+$  is oxidized
  - $\text{NADPH}$  is formed as a product
- 47. CCCP is an inhibitor that specifically reacts with the enzyme responsible for the oxidation of water in PSII. Which of the following reactions would occur continuously in the light in the presence of CCCP?**
- non-cyclic photophosphorylation
  - $\text{NADP}^+$  reduction
  - non-cyclic electron transport
  - the conversion of  $\text{CO}_2$  into carbohydrates by the Calvin cycle
  - cyclic photophosphorylation
- 48. Mitochondrial Complex III and the chloroplast cytochrome *b-f* complex are believed to be similar because**
- they both contain *b* type cytochromes
  - they both oxidize a quinol compound
  - they both reduce an extrinsic *c*-type cytochrome
  - Only A and B are correct
  - A, B and C are all correct

**EXAM CONTINUES ON THE NEXT PAGE**

**49. Cyclic photophosphorylation**

- A. involves PSI but not PSII
- B. is activated primarily by far-red light
- C. requires P680 as its reaction center chlorophyll
- D. Only A and B are correct
- E. A, B and C are all correct

**50. The chloroplast stroma is the region where**

- A. ATP is synthesized
- B. the enzymes of the Calvin cycle are located
- C. water oxidation occurs
- D. Only A and B are correct
- E. A, B and C are all correct

**51. The C-4 photosynthetic reactions are different from the C3 reactions because**

- A. they require more ATP than the C3 reactions
- B. they require oxygen
- C. they do not require Rubisco
- D. the C4 pathway requires only one type of cell while the C3 pathway requires two types of cells
- E. the C4 pathway results in a very high rate of photorespiration

**52. During the Calvin cycle**

- A. CO<sub>2</sub> is reduced by glyceraldehyde-3-phosphate dehydrogenase
- B. NADH is oxidized to NAD<sup>+</sup>
- C. Glyceraldehyde-3-phosphate is formed which can be used as a precursor for a hexose sugar
- D. ATP that is synthesized in the lumen is used
- E. light directly activates Rubisco to maintain a functional Calvin cycle during the day

**53. Photorespiration**

- A. is considered a valuable process in most plants
- B. occurs when oxygen concentrations are low
- C. requires Rubisco to function as a carboxylase
- D. occurs at a low rate in CAM plants
- E. occurs when PEP carboxylase is activated in the light

**END OF THE EXAM – re-check your answer to question #1.**