

BIOS 100 - Summer 2007
Exam II, 2 July, 2007
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Name:
TA:

This exam consists of 52 questions over 7 pages (the codon chart is on page 7). 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. No kidding. Good Luck!

Matching - Use the key below to select the **best answers** for questions 1 - 7. Here's a hint - most people get really thrown by this section, so take the rest of the exam and come back to it.

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| I. Glycolysis | V. Ethanol Fermentation |
| II. Oxidation of Pyruvate | VI. Lactic Acid Fermentation |
| III. Krebs Cycle | VII. Cyclic Photophosphorylation |
| IV. Oxidative Phosphorylation | VIII. Non-Cyclic Photophosphorylation |
| | IX. Calvin-Benson Cycle |

- Which of the above processes regenerates NAD⁺ from NADH?
A. III only B. IV only C. V, VI D. IV, V, VI E. III, IV, V, VI
- How many of the above processes produce ATP?
A. 4 B. 5 C. 6 D. 7 E. 8
- Which of the above processes can be performed by all organisms?
A. I only B. I, III C. I, II, III, IV D. V only E. IX only
- Which of the above processes produce CO₂ ?
A. V only B. V, VI C. II, III D. II, III, IV E. II, III, V
- How many of the above processes consume ATP?
A. 0 B. 1 C. 2 D. 3 E. 4
- Which of the above processes produce NADPH?
A. VII only B. VIII only C. IX only D. VII, VIII E. VII, VIII, IX
- Which of the above processes produce O₂?
A. VII only B. VIII only C. IX only D. VII, VIII E. VII, VIII, IX
- Which of the below statements (A-D) about Rubisco and photorespiration is FALSE? If statements A-D are true, then choose E.
A. Rubisco is a large and very slow enzyme with an active site that fits both CO₂ and O₂ (O₂ is a competitive inhibitor)
B. The products of photorespiration, glyceraldehyde and phosphoglycolate, are both useful in photosynthesis
C. Rubisco is concentrated in the bundle sheath cells of C₄ plants
D. C₃ plants experience much more photorespiration than do C₄ plants
E. All of the above statements about Rubisco and photorespiration are TRUE

9. A plant grown under equal intensities of what color light would show the least amount of growth?
 A. Yellow light B. Blue light C. Green light D. Red light
10. From where does PSII (p680) replenish its lost electron?
 A. H₂O B. O₂ C. CO₂ D. PSI (p680) E. NADPH
11. When the light-dependent reactions are most active, where would you expect the pH of the chloroplast to be the greatest?
 A. The thylakoid space B. The stroma C. Both are equal
12. Which state would you expect to have the greatest portion of the flora to be C₄ plants?
 A. Oregon B. Nebraska C. Illinois D. Maine E. Hawaii
13. Increased global warming will ultimately benefit our agricultural production
 A. True B. False
14. In a C₃ plant, what enzymes fix CO₂?
 A. Rubisco B. Phosphofructokinase C. PEP Carboxylase
 D. A & B C. A & C
15. Which of the below statements (A-D) about the various types of photosynthesis is FALSE?
 If statements A-D are true, then choose E.
 A. C₃ plants possess Rubisco
 B. C₄ plants typically possess Kranz anatomy
 C. CAM plants typically open their stomates at night
 D. CO₂ is fixed twice in both C₄ and CAM plants
 E. All of the above statements about photosynthesis are TRUE
16. What is the relationship between ATP and phosphofructokinase?
 A. ATP is a substrate of phosphofructokinase
 B. ATP is a competitive inhibitor of phosphofructokinase
 C. ATP is an allosteric regulator of phosphofructokinase
 D. A & B
 E. A & C
17. Which of the below processes produces the most ATP?
 A. Glycolysis B. Oxidation of pyruvate
 C. Krebs cycle D. Oxidative phosphorylation
18. During beta oxidation and the use of fatty acids for energy, the fatty acid chains are broken down into molecules with how many carbons?
 A. 1 carbon B. 2 carbons C. 3 carbons D. 4 carbons
19. During oxidative phosphorylation, what is the ultimate electron acceptor?
 A. NADH B. NAD⁺ C. H₂O D. CO₂ E. O₂

20. During oxidative phosphorylation, how does the H⁺ move from the intramembrane space to the matrix?
- A. via ATP synthase B. Through H⁺ pumps C. Through pores
 D. using phosphofructokinase E. via O₂
21. If DNA replication were conservative, which of the below results would you expect for the Meselson Stahl experiment?

A B C D E

22. All of the following statements about DNA are true EXCEPT:
- A. DNA is an anti-parallel double helix
 B. During typical nucleotide pairing, a pyrimidine pairs with a purine
 C. DNA can base pair with DNA and with RNA
 D. DNA is always synthesized in a 3' to 5' direction
 E. A typical nucleotide will have a phosphate group attached to the 5' carbon of the ribose sugar
23. Which of the following statements (A-D) about DNA replication is FALSE? If statements A-D are true, then choose E.
- A. DNA polymerase III requires a primer to initiate synthesis of DNA, but DNA polymerase I does not (it can start from scratch)
 B. The leading strand is the strand of the replication fork synthesizing DNA in the direction of helicase unwinding
 C. Ligase activity is greater in the lagging strand than the leading strand
 D. When replicating DNA of a linear chromosome, there will be one strand that is slightly shorter due to the lack of replacement of the RNA primer by DNA polymerase I
 E. All of the above statements about DNA replication are TRUE

Matching - use the key on the right to answer questions 24 - 26

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| 24. This enzyme removes supercoils from DNA | A. DNA polymerase I |
| 25. This enzyme is a form of RNA polymerase | B. DNA polymerase III |
| 26. This enzyme is most active in the synthesis of DNA during replication | C. Primase |
| | D. Helicase |
| | E. Topoisomerase |

27. Which of the following statements (A-D) about telomeres and telomerase is FALSE? If statements A-D are true, then choose E.
- A. Telomeres are regions located on the ends of eukaryotic chromosomes which contain repeating sequences of DNA
 - B. Telomerase is a type of DNA polymerase which can synthesize DNA 3' to 5'
 - C. Telomere regions of chromosomes contain no functional genes
 - D. Almost all human cells contain telomerase
 - E. All of the above statements are TRUE

Use the piece of DNA below to answer questions 28 - 30

Template strand: 3' C G T T A C C G G A A G G A C A C T C G C A A A 5'

28. What is the complement to this strand of DNA?
- A. 3' C G T T A C C G G A A G G A C A C T C G C A A A 5'
 - B. 5' C G T T A C C G G A A G G A C A C T C G C A A A 3'
 - C. 3' G C A A T G G C C T T C C T G T G A G C G T T T 5'
 - D. 5' G C A A T G G C C T T C C T G T G A G C G T T T 3'
29. What is the second protein to be synthesized from the mRNA created from this template?
- A. Methionine B. Argenine C. Alanine D. Proline
30. What type of mutation would occur if the base labeled C were changed to a G?
- A. Silent (neutral) B. Missense C. Nonsense D. Frame shift
31. What amino acid is attached to the tRNA with the following anticodon: 3' ACG 5'
- A. Threonine B. Alanine C. Cysteine D. Arginine
32. What is the wobble model of tRNA base pairing?
- A. The tRNA doesn't perfectly fit into the ribosome, it must "wobble" a bit to wedge itself into the A site
 - B. The tRNA must "wobble" back and forth in the ribosome to form the peptide bond
 - C. There are other nucleotides, such as inosine, which can pair up with more than one nucleotide
 - D. Matches of the first codon position are variable when evaluating base pairing success
 - E. None of the above
33. Which site of a ribosome do charged tRNA's enter?
- A. The A site B. The P site C. The E site
34. Plant cells contain functional mitochondria
- A. True B. False
35. Which of the above is not necessary for initiation of protein synthesis?
- A. A charged tRNA in the P site B. A charged tRNA in the A site
 - C. A large ribosomal subunit D. A small ribosomal subunit
 - E. A mRNA

36. What happens when a stop codon is in the A site?
- A stop tRNA enters and binds to the mRNA
 - The ribosome reads the stop codon and disassociates from the mRNA
 - A release factor enters and binds to the mRNA
 - A protein hairpin forms and breaks apart the ribosome
 - None of the above
37. Which one of these would not permanently turn off the *lac* operon?
- The promoter becomes damaged so that RNA polymerase cannot bind
 - The operator becomes mutated and permanently binds the repressor protein
 - The gene that makes the repressor protein becomes mutated and the repressor protein cannot bind lactose
 - The gene that makes the repressor protein becomes mutated and the repressor protein cannot bind to the operator
 - All of the above would
38. What conditions must be met in order to completely turn on the *lac* operon?
- High concentration of glucose, high concentration of lactose
 - High concentration of glucose, low concentration of lactose
 - Low concentration of glucose, high concentration of lactose
 - Low concentration of glucose, low concentration of lactose
39. What is the allosteric regulator of the repressor protein in the *lac* operon (i.e. what binds to the allosteric site of the repressor protein?)
- Lactose
 - ATP
 - The Promoter
 - The Operator
 - Glucose
40. What must be present in high concentrations to form a complex with CRP to aid RNA polymerase binding to the promoter?
- Lactose
 - Glucose
 - ATP
 - cAMP
 - Lactose and glucose
41. What could you first assume about a molecule with a helix-turn-helix?
- It is an enzyme
 - It is an integral protein
 - It is a DNA binding protein
 - It is a promoter
 - Nothing
42. Most eukaryotic genes are regulated at what level of control?
- Transcription
 - Post transcription
 - Translation
 - Post translation
43. Which of the following must be bound to the DNA in order to initiate transcription in almost all eukaryotic genes?
- TATA box
 - TFIID
 - Sigma protein
 - Primase
 - None of the above

44. Which of the following is not an example of post-transcription control?
 A. Removal of the insulin C chain B. Removal of introns
 C. Addition of a 5' guanine cap D. Addition of a 3' poly A tail
45. Of the four levels of genetic regulation discussed in lecture, how many take place in the nucleus?
 A. One B. Two C. Three D. Four E. Five
46. When does crossing over occur?
 A. During prophase of mitosis B. During prophase I of meiosis
 C. During prophase II of meiosis D. A & B
 E. B & C
47. After mitosis, what types of cells will you have?
 A. Two genetically identical daughter cells B. Two genetically unique daughter cells
 C. Four genetically identical daughter cells D. Four genetically unique daughter cells
 E. None of the above
48. During what stage of the cell cycle would you expect topoisomerase activity to be the greatest?
 A. G0 B. G1 C. G2 D. S E. M
49. What is a non-disjunction?
 A. When chromosomes fail to properly fuse during fertilization
 B. When chromosomes fail to properly line up during metaphase of mitosis
 C. When chromosomes fail to properly line up during metaphase I of meiosis
 D. When chromosomes fail to properly separate during anaphase I or II of meiosis
 E. None of the above

Use the diagrams below to answer the following questions about a $3n=6$ cell.

A B C D E

50. Which of the above cells is an example of a $3n=6$ cell in metaphase II of meiosis?
51. Which of the above cells is an example of a $3n=6$ cell in metaphase of mitosis?

52. Which of the following statements (A-D) about cyclins and associated molecules is FALSE?
If statements A-D are true, then choose E.
- A. Cyclin levels are constant throughout the cell cycle
 - B. Cyclin levels are highest at the end of G2 and beginning of the M stages of the cell cycle
 - C. Cyclins and cyclin-dependent kinases (CDK's) combine to form maturation MPF complexes
 - D. MPF promotes mitosis and initiates processes to destroy cyclins
 - E. All of the above statements are TRUE.

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