

This exam consists of 52 questions over 6 pages. 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. The answer to question 24 is A. No kidding. Good Luck!

Matching - Use the key below to select the best answers for questions 1 - 10. 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 | VI. Alcohol Fermentation |
| II. Oxidation of Pyruvate | VII. Cyclic Photophosphorylation |
| III. Krebs Cycle | VIII. Non-cyclic Photophosphorylation |
| IV. Oxidative Phosphorylation | IX. Calvin Cycle |
| V. Lactic Acid Fermentation | |

- This/These produce NADH
A. I, III B. I, II, III C. I, II, III, IV D. I, III, IV E. None of the above
- Oxygen is the final electron acceptor in this/these:
A. I only B. III only C. IV only D. VIII only E. IV, VIII
- Light is directly used as an energy source in this/these:
A. VII only B. VIII only C. IX only D. VII, VIII E. VII, VIII, IX
- CO₂ is produced in this/these:
A. I only B. I, II C. III only D. II, III E. II, III, VI
- This/these have a net energy consumption
A. I only B. V, VI C. III only D. IX only E. III, IX
- NADH is oxidized to NAD⁺ in this/these:
A. IV only B. V, VI C. IX only D. IV, V, VI E. IV, V, VI, IX
- Oxygen gas is produced in this/these:
A. IV only B. VII only C. VIII only D. VII, VIII E. IX only
- ATP and NADPH are produced in this/these:
A. IV only B. VII only C. VIII only D. VII, VIII E. IX only
- There is a net consumption of CO₂ in this/these:
A. IV only B. VII only C. VIII only D. VII, VIII E. IX only
- ATP is produced in how many of the above stages?
A. 3 B. 4 C. 5 D. 6 E. 7

11. Which color of light is LEAST likely to be absorbed by pigments in plant leaves?
 A. Red B. Blue C. Green D. A & B
12. During photorespiration, what is being added to RuBP by Rubisco?
 A. CO₂ B. NH₃ C. O₂ D. H₂O E. None of the above
13. Which of the following statements (A-D) about the light-dependent reactions of photosynthesis is FALSE. If statements A-D are true, then choose E.
 A. Non-cyclic photophosphorylation utilizes two photosystems and forms NADPH
 B. Cyclic photophosphorylation uses light energy to pump H⁺ into the thylakoid space
 C. During non-cyclic photophosphorylation, plastoquinone (PQ) is mobile and carries H⁺ across the thylakoid membrane
 D. The electron used to reduce NADP to NADPH is regenerated through splitting a water molecule
 E. All of the above are TRUE
14. Which part of the leaf of a C₃ plant does the majority of gas exchange take place?
 A. Epidermis B. Spongy Mesophyll C. Palisade Mesophyll
 D. Xylem E. Phloem
15. In a C₄ plant, where is most of the Rubisco located?
 A. Epidermis B. Mesophyll C. Bundle Sheath
 D. A & B E. B & C
16. In which part of the United States would you expect to find the greatest abundance of C₄ plants?
 A. Coastal California B. Kansas C. Illinois
 D. New York E. Hawaii
17. What enzymes fix CO₂ in a C₄ plant?
 A. PEP Carboxylase B. Rubisco C. Pyruvate Dehydrogenase
 D. A & B E. A, B, & C
18. Which of the plants below would you expect to have the greatest amount of photorespiration?
 A. C₃ B. C₄ C. CAM D. B & C E. A & C
19. Which of the molecules below will act as an allosteric inhibitor to phosphofructokinase?
 A. Oxygen B. ATP C. cAMP D. Fructose 6-Phosphate E. Pi
20. When digesting fats for energy, the fatty acid chains are initially converted to:
 A. Acetyl CoA B. Glucose C. Glycerol D. Ethanol

21. Which of the following processes can occur in muscle cells?
 A. Oxidative Phosphorylation B. Ethanol Fermentation
 C. Lactic Acid Fermentation D. A & B
 E. A & C
22. Approximately what percentage of the CO₂ you exhale is produced in the Krebs Cycle?
 A. 33% B. 50% C. 66% D. 80% E. 100%
23. Which step produces the most ATP?
 A. Glycolysis B. Oxidation of Pyruvate C. Krebs Cycle
 D. Oxidative Phosphorylation E. Ethanol Fermentation
24. All life on earth can perform the following:
 A. Glycolysis B. Oxidation of Pyruvate C. Krebs Cycle
 D. Oxidative Phosphorylation E. Ethanol Fermentation
25. Every NADH oxidized to NAD⁺ during oxidative phosphorylation will pump how many H⁺ into the intermembrane space?
 A. B. 2 C. 3 D. 4 E. 5

Matching - use the key to answer questions 26-28.

- A. The R strain bacteria was transformed into the virulent S-strained bacteria
- B. Radiolabeled nucleic acids were found in the bacteria after infection with bacteriophages, but no radiolabeled proteins after infection
- C. The first replicant showed a band at 15/14. Subsequent generations show two bands, one at 15/14 and one at 14/14
- D. There are always equal numbers of A and T as well as C and G in all prokaryotic genomes
- E. Proteases did not inhibit transformation, but DNAses did

26. What were the results of the Hershey Chase experiments?
 27. What were the results of the Frederick Griffith's experiments?
 28. What were the results of Avery, McCarty, and MacLeod's experiments?
29. How many of the nucleotides listed below are pyrimidines?

Adenine (A) Thymine (T) Cytosine (C) Guanine (G) Uracil (U)

- A. 0 B. 1 C. 2 D. 3 E. 4
30. Which of the following enzymes prevents supercoiling in DNA?
 A. Topoisomerase B. Ligase C. Helicase
 D. Primase E. DNA Supercoil reductase

31. Which of the following statements (A-D) about DNA synthesis is FALSE? If statements A-D are true, then choose E.
- A. DNA pol III requires a primer or some form of double stranded DNA present before it can begin DNA replication
 - B. DNA poly III and primase both create nucleotide polymers in a 5' to 3' direction
 - C. There are several replication origins in a eukaryotic chromosome
 - D. Ligase is more active in the lagging strand than in the leading strand
 - E. All of the above statements about DNA synthesis are TRUE.
32. Which of the enzymes listed below has a proofreading function?
- A. DNA polymerase
 - B. Primase
 - C. Topoisomerase
 - D. Ligase
 - E. Telomerase
33. Which of the enzymes listed below as a built-in RNA template?
- A. DNA polymerase
 - B. Primase
 - C. Topoisomerase
 - D. Ligase
 - E. Telomerase
34. If DNA replication was dispersive, which of the following results would you expect after the first replication using N¹⁴?
- A. One band at 15/15
 - B. One band at 15/14
 - C. One band at 14/14
 - D. Two bands, one at 15/14 and one at 14/14
 - E. Two bands, one at 15/15 and one at 14/14
35. Who was the X-ray Crystallographer whose data was stolen and used to determine the 3D structure of DNA?
- A. James Watson
 - B. Francis Crick
 - C. Rosalind Franklin
 - D. Maurice Wilkins
 - E. A & B
36. Which of the following is not necessary for initiation of translation?
- A. mRNA
 - B. tRNA in the P site
 - C. tRNA in the E site
 - D. Small ribosomal subunit
 - E. Large ribosomal subunit
37. A change in which position of the codon is least likely to cause a change in the amino acid?
- A. The first position
 - B. The second position
 - C. The third position
38. Which of the following statements (A-D) about protein synthesis is FALSE? If statements A-D are true, then choose E.
- A. Uncharged tRNA's are destroyed as they no longer have amino acids attached
 - B. The anti-codon of a tRNA is complementary to a codon of the mRNA
 - C. There are three stop codons
 - D. Translation will occur until a stop codon is reached
 - E. All of the above statements about protein synthesis are TRUE
39. Which of the following mutations causes a change in the reading frame of the codons?
- A. Missense
 - B. Nonsense
 - C. Frame shift
 - D. Neutral

Use the piece of DNA below to answer questions 40 - 43. The DNA below is the coding strand.

5' C G A T G C C G G G T C A A G T T T G G T A A A T G C C A A 3'

40. How many amino acids are coded for in the above piece of DNA?
- A. 4 B. 5 C. 6 D. 8 E. 10
41. What is the second amino acid in the protein coded for in the above piece of DNA?
- A. Methionine B. Proline C. Cystein D.
42. If the DNA base marked C is changed to an A, what will be the change in the protein?
- A. Glutamine to stop B. Glutamine to lysine
C. Leucine to methionine D. Proline to threonine
E. No change in the amino acid
43. The above mutation is known as a _____ mutation.
- A. Missense B. Nonsense C. Frame shift D. Neutral
44. In the *lac* operon, to where on the DNA does the repressor protein bind?
- A. The Promoter B. The Operator C. The *lac Z* gene D. Lactose
45. The *lac* operon is an example of a _____ operon
- A. Repressible B. Inducible C. Interstitial D. Regulatory
46. If lactose and glucose are present, what will happen:
- A. The repressor protein will bind to the operator
B. Lactose will bind to the repressor protein and the *lac* operon will be turned off
C. The *lac* operon will be on, but not at full ability because RNA polymerase will bind poorly to the promoter
D. The concentration of CRP will be high
E. None of the above

Use the key below to answer questions 47 - 49

- A. Transcription control B. Post transcription control
C. Translation control D. Post translation control
47. Which level of control is most commonly found in eukaryotic genes?
48. The removal of introns is an example of which level of control?
49. The removal of the C-chain in the manufacture of insulin is an example of which level of control

50. What would you assume about a protein with five zinc fingers?
- A. It binds to DNA
 - B. It is imbedded in a plasma membrane
 - C. It is a repressor protein
 - D. It is an enhancer
 - E. It has opposable thumbs
51. Which of the following statements (A-D) about transcription enhancers is FALSE? If statements A-D are TRUE, then choose E.
- A. Enhancers help stabilize transcription factors binding to DNA
 - B. The location of an enhancer is not crucial to its function - they can work even if moved to a new location
 - C. The activity of an enhancer is not affected by its 5' to 3' polarity
 - D. Enhancers may be located upstream, downstream, or even within the gene they regulate
 - E. All of the above statements about enhancers are TRUE
52. What would happen if the gene which produces TATA binding proteins (TBP) became mutated and produced TBP's that could no longer bind to the TATA box?
- A. Transcription of a few genes would be affected, but it would not significantly affect the organism
 - B. Transcription of many genes would be affected, but the organism could still survive
 - C. Transcription of almost all genes would be affected, and the organism would die
 - D. Not enough information to make a prediction