

ACADEMIC CHALLENGE FOR
ACES
ENGINEERING AND SCIENCE



EASTERN ILLINOIS UNIVERSITY

2023 Academic Challenge

STATE BIOLOGY EXAM

Biology Test Production Team

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GENERAL DIRECTIONS

Please read the following instructions carefully. This is a timed test; any instructions from the test supervisor should be followed promptly.

The test supervisor will give instructions for filling in any necessary information on the answer sheet. Most Academic Challenge sites will ask you to indicate your answer to each question by marking an oval that corresponds to the correct answer for that question. One oval should be marked to answer each question. Multiple ovals will automatically be graded as an incorrect answer.

Be sure ovals are marked as  , not  ,  ,  , etc.

If you wish to change an answer, erase your first mark completely before marking your new choice.

You are advised to use your time effectively and to work as rapidly as you can without losing accuracy. Do not waste your time on questions that seem too difficult for you. Go on to the other questions, and then come back to the difficult ones later if time remains.

Time: 40 Minutes

Number of Questions: 50

DO NOT OPEN TEST BOOKLET UNTIL YOU ARE TOLD TO DO SO!

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1. The pancreas does **not** produce _____.
a. insulin b. glucagon c. amylase d. pepsin e. lipase
2. Which is **not** a common shape of bacteria?
a. star b. cocci c. bacilli d. spirochete e. spirillum
3. An antigen is a molecule that is usually a _____.
a. carbohydrate b. protein c. lipid d. nucleic acid e. both a and b
4. The enzyme used by C₄ plants to fix carbon dioxide is _____.
a. PEP carboxylase
b. ATP synthase
c. DNA polymerase
d. amylase
e. dehydrogenase
5. The _____ cycle requires many soil bacteria such as *Rhizobium*.
a. carbon b. phosphorous c. nitrogen d. sulfur e. hydrologic
6. Which structure is **not** associated with the correct animal?
a. collar cells – sponge
b. tube feet – planarian
c. green glands – crayfish
d. notochord – lancelet
e. nematocyst – jelly fish
7. Which is the correct order starting with simplest to most complex plants?
a. bryophyte → horsetail → monocot → ginkgo
b. horsetail → bryophyte → ginkgo → monocot
c. bryophyte → horsetail → ginkgo → monocot
d. monocot → ginkgo → horsetail → bryophyte
e. horsetail → monocot → ginkgo → bryophyte
8. Barr bodies inactivate the _____ chromosome.
a. X b. Y c. autosomal d. first e. twenty-first

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9. All viruses are composed of ____.
- a. RNA
 - b. nucleic acids
 - c. protein
 - d. a and c
 - e. b and c
10. Western Blot is used to transfer ____.
- a. DNA
 - b. RNA
 - c. protein
 - d. carbohydrate
 - e. all of these
11. There are many molecules used and responsible for controlling eukaryotic transcription. Which is **not** one of the regulatory elements?
- a. enhancers
 - b. upstream promoter elements
 - c. TATA box
 - d. DNA methylation
 - e. operon
12. Francis Collins is to ____, as Ian Wilmut is to ____.
- a. DNA; sheep
 - b. sheep; monkeys
 - c. monkeys; sheep
 - d. mice; sheep
 - e. none of the above
13. Which of the following statements is **not** true?
- a. When molecules heat up they spread apart.
 - b. When molecules cool they shrink.
 - c. When water freezes it crystallizes and becomes less dense.
 - d. Liquid nitrogen is used for flash freezing.
 - e. Dry ice releases CO as it thaws.
14. Calvin-Benson is to ____, as Krebs is to ____.
- a. light dependent reactions; light independent reactions
 - b. light independent reactions; light dependent reactions
 - c. light independent reactions; aerobic respiration
 - d. aerobic respiration; light independent reactions
 - e. none of the above
15. DNA replication is semiconservative in nature because it has ____ percent of the genetic information from its parent strand.
- a. 10%
 - b. 15%
 - c. 25%
 - d. 50%
 - e. 75%

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16. The epidermis, primary xylem, primary phloem, pith, and cortex are produced by the ____.
- lateral meristem
 - apical meristem
 - intercalary meristem
 - both a and c
 - none of the above

17. Match the scientists in **Column A** with the scientists from **Column B** whose research was similar in nature.

| Column A | Column B |
|---------------------|------------------------|
| 1. Maurice Wilkins | i. Thomas Morgan |
| 2. Gregor Mendel | ii. Oswald Avery |
| 3. James Watson | iii. Rosalind Franklin |
| 4. Carolus Linnaeus | iv. Robert Whittaker |
| 5. Alfred Wallace | v. Francis Crick |
| 6. Fred Griffith | vi. Charles Darwin |

Select the most appropriate matching sequence.

- 1 – iii; 2 – v; 3 – i; 4 – iv; 5 – ii; 6 – vi
- 1 – iii; 2 – i; 3 – v; 4 – iv; 5 – vi; 6 – ii
- 1 – vi; 2 – v; 3 – iv; 4 – iii; 5 – ii; 6 – i
- 1 – ii; 2 – i; 3 – v; 4 – iv; 5 – iii; 6 – vi
- 1 – iii; 2 – i; 3 – v; 4 – iv; 5 – ii; 6 – vi

18. Match the process in **Column A** with its location from **Column B**.

| Column A | Column B |
|------------------------------|-----------------|
| 1. Calvin cycle | i. cytosol |
| 2. Photolysis | ii. granum |
| 3. Glycolysis | iii. cristae |
| 4. Electron transport system | iv. stroma |
| 5. Citric acid cycle | v. matrix |

Select the most appropriate matching sequence.

- 1 – iv; 2 – i; 3 – ii; 4 – iii; 5 – v
- 1 – ii; 2 – iii; 3 – i; 4 – v; 5 – iv
- 1 – ii; 2 – iv; 3 – v; 4 – i; 5 – iii
- 1 – iv; 2 – ii; 3 – i; 4 – iii; 5 – v
- 1 – iii; 2 – iv; 3 – v; 4 – ii; 5 – i

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19. If the anticodon sequence is **UACUGACCG** the original DNA template strand would be _____.

- a. TACTCTGGC
- b. AUGACUGGC
- c. ATGACACCG
- d. TACTGACCG
- e. none of the above

20. Match the mammal type in **Column A** with the example in **Column B**.

Column A

- 1. Egg laying
- 2. Marsupials
- 3. Eutherians

Column B

- i. giraffes
- ii. platypus
- iii. opossum

Select the most appropriate matching sequence.

- a. 1 – i; 2 – ii; 3 – iii
- b. 1 – iii; 2 – ii; 3 – i
- c. 1 – ii; 2 – iii; 3 – i
- d. 1 – ii; 2 – i; 3 – iii
- e. 1 – iii; 2 – i; 3 – ii

21. Which is the correct order for the stages of aerobic cellular respiration?

- a. Glycolysis → citric acid cycle → fermentation
- b. fermentation → glycolysis → electron transport system
- c. citric acid cycle → fermentation → chemiosmosis
- d. fermentation → citric acid cycle → chemiosmosis
- e. glycolysis → citric acid cycle → chemiosmosis

22. A chemical that has shown a strong effect in blocking the replication of Hepatitis C virus was discovered in _____ leaves.

- a. raspberry
- b. blueberry
- c. strawberry
- d. tomato
- e. none of the above

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23. Match the plant types in **Column A** with the plant examples in **Column B**.

Column A

1. vascular plants
2. gymnosperms
3. bryophytes
4. angiosperms

Column B

- i. orchids
- ii. ferns
- iii. pine trees and evergreens
- iv. liverworts and mosses

Select the most appropriate matching sequence.

- a. 1 – ii; 2 – iii; 3 – iv; 4 – i
- b. 1 – iv; 2 – iii; 3 – i; 4 – ii
- c. 1 – ii; 2 – iv; 3 – i; 4 – iii
- d. 1 – iii; 2 – ii; 3 – iv; 4 – i
- e. 1 – i; 2 – iii; 3 – iv; 4 – ii

24. Which of the following functional groups is in every amino acid?

- a. CH₃ b. NH₃ c. SH d. PO₄ e. OH

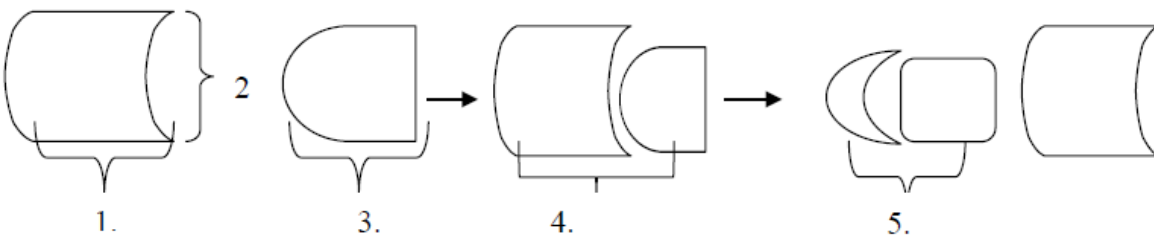
25. The fundamental niche is ____ than the ecological niche.

- a. larger b. more diverse c. broader d. smaller e. more inclusive

26. NADPH is produced during ____.

- a. Calvin-Benson cycle
- b. light independent reactions of photosynthesis
- c. light dependent reactions of photosynthesis
- d. citric acid cycle
- e. none of the above

27. The figure below represents an enzyme's activity. Select the correct labels.



- a. 1 – active site; 2 – enzyme; 3 – substrate; 4 – end products; 5 – enzyme-substrate
- b. 1 – enzyme; 2 – active site; 3 – substrate; 4 – enzyme-substrate; 5 – end products
- c. 1 – substrate; 2 – active site; 3 – enzyme; 4 – enzyme-substrate; 5 – end products
- d. 1 – end products; 2 – enzyme-substrate; 3 – substrate; 4 – active site; 5 – enzyme
- e. 1 – enzyme; 2 – end products; 3 – enzyme-substrate; 4 – active site; 5 – substrate

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28. Organisms that maintain their own body temperatures are ____.
- a. ectotherms
 - b. poikilotherms
 - c. cold blooded
 - d. homeotherms
 - e. none of the above
29. If a neutral atom had an atomic number of 15, then it would have ____ electrons in the second shell.
- a. 2 b. 5 c. 8 d. 10 e. 15
30. Halophiles ____.
- a. are in Domain Archae
 - b. are found in salty conditions
 - c. are prokaryotes
 - d. have ribosomes
 - e. all the above
31. The expected phenotype ratio for a dihybrid test cross is ____.
- a. 1 : 1 : 1 : 1 b. 9 : 3 : 3 : 1 c. 1 : 2 : 1 d. 3 : 1 e. 1 : 1
32. Apoptosis normally occurs ____.
- a. when a tadpole's tail is reabsorbed
 - b. when a human fetus loses the webbing between his/her fingers
 - c. in an adult human's intestines
 - d. in an adult human's skin
 - e. all the above
33. ____ are the forces that cause saturated fatty acids to be solid at room temperature.
- a. Hydrogen bonds
 - b. Van der Waals interactions
 - c. Ionic bonds
 - d. Covalent bonds
 - e. none of the above

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34. MicroRNA ____.
- a. produces ribozymes
 - b. is important for transcription
 - c. controls expression of genes in growth and development
 - d. is important in the formation of ribosomal subunits
 - e. processes pre-rRNA
35. There are three possible arrangements of leaves on a stem. Which of the following is correct?
- a. whorled arrangement – one leaf per node
 - b. whorled arrangement – two leaves per node
 - c. opposite arrangement – one leaf per node
 - d. alternate arrangement – one leaf per node
 - e. alternate arrangement – two leaves per node
36. What method do insects use for communication?
- a. vision
 - b. chemicals
 - c. tactile
 - d. auditory
 - e. All the above are ways insects to communicate.
37. In constructing cladograms, scientists are looking for ____.
- a. outgroups
 - b. convergence
 - c. paraphyletic groups
 - d. vestigial structures
 - e. homoplastic structures
38. If an individual was heterozygous for four traits, what would be the probability of producing a gamete with all recessive traits?
- a. 1/32 b. 1/16 c. 1/8 d. 1/4 e. 1/2
39. The quaternary structure of a protein ____.
- a. can be described as the amino acid sequence
 - b. is held together by peptide bonds
 - c. is a three dimensional shape caused by the folding of more than one peptide chain
 - d. is described as beads on a string
 - e. is an alpha helix or beta pleated structure

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40. Which is **not** true pertaining to Sue, the T-Rex?

- a. A flat tire on Sue Hendrickson's vehicle led to the accidental discovery of Sue.
- b. Sue is the most complete T-Rex skeleton at this time.
- c. Sue's skull is not mounted because it is very heavy.
- d. Sue can be viewed at the Field Museum in Chicago.
- e. Sue was found in South Carolina.

41. Which of the following statements is **not** true?

- a. In oxidation reactions electrons are given off.
- b. Buffer solutions may contain a weak acid.
- c. If a solution has a hydrogen ion concentration of 10^{-12} , then its pH is 12.
- d. Hydrogen bonds usually form between hydrogen and carbon.
- e. Ionic bonds form between a cation and an anion.

42. Match the following terms in **Column A** with their descriptions in **Column B**.

Column A

- 1. chiasmata
- 2. kinetochore fibers
- 3. centromere
- 4. chromatid

Column B

- i. constricted region of a doubled chromosome
- ii. half of a doubled chromosome
- iii. an X-shaped configuration at the crossing-over site
- iv. a multiprotein complex which microtubules bind

Select the proper matching sequence.

- a. 1 – ii; 2 – i; 3 – iv; 4 – iii
- b. 1 – iii; 2 – iv; 3 – ii; 4 – i
- c. 1 – iii; 2 – iv; 3 – i; 4 – ii
- d. 1 – iv; 2 – iii; 3 – ii; 4 – i
- e. 1 – iv; 2 – i; 3 – ii; 4 – iii

43. The synthetic theory of evolution incorporates _____.

- a. the endosymbiosis theory and Darwin's theory of evolution
- b. the cell theory and the endosymbiosis theory
- c. Darwin's theory of evolution and Mendelian inheritance
- d. Mendelian inheritance and the cell theory
- e. Mendelian inheritance and the endosymbiosis theory

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44. Which of the following is **not** a form of horizontal gene transfer?
- a. transformation
 - b. conjugation
 - c. transduction
 - d. parent to offspring
 - e. none the above
45. In the life cycle of a moss, the _____ forms when the spore is germinated.
- a. protonema
 - b. archegonium
 - c. antheridia
 - d. sporophyte
 - e. zygote
46. Which of the following is **not** a characteristic of the Order Primate?
- a. flexible hands
 - b. five digits
 - c. herbivores
 - d. front facing eyes
 - e. opposable thumbs
47. _____ is the study of chromosomes and their role in inheritance.
- a. Cytology
 - b. Cytogenetics
 - c. Histology
 - d. Immunology
 - e. Proteomics
48. In the lactose operon, the inducer is _____.
- a. lactose permease
 - b. RNA polymerase
 - c. the repressor protein
 - d. the operator
 - e. allolactose

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49. Which of the following does **not** take place during meiosis?

- a. crossing-over of homologous chromosomes
- b. homologous chromosomes line up on the same spindle
- c. 4 haploid cells are produced
- d. DNA duplicates twice
- e. a reduction division

50. Gram positive bacteria stain _____ because it has a _____ peptidoglycan cell wall.

- a. purple; thick
- b. pink; thick
- c. purple; thin
- d. pink; thin
- e. green; waxy

