



**ENGINEERING
AT ILLINOIS**

2018 Academic Challenge

BIOLOGY TEST – STATE

– This Test Consists of 50 Questions –

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 *****

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

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WYSE – Academic Challenge
Biology Test (State) – 2018

1. Which is a **not** a correct association?
 - a. lichen – algae and fungi
 - b. mycorrhizae – fungi and plant roots
 - c. mycelium – a group of root hairs
 - d. epiphyte – plants that grows on other plants
 - e. phytoplankton – photosynthetic algae
2. The highest concentration of circulating antibodies in the human body is _____.
 - a. IgG
 - b. IgM
 - c. IgA
 - d. IgD
 - e. IgE
3. Another name for root hairs is _____.
 - a. parenchymas
 - b. sclereids
 - c. collenchymas
 - d. tracheids
 - e. trichomes
4. Which of the following is associated with Lyme disease?
 - a. *E. coli*
 - b. *H. pylori*
 - c. *Borrelia burgdorferi*
 - d. *Vibrio cholerae*
 - e. *Yersinia pestis*
5. Which of the following statements is correct?
 - a. Sodium gives up an electron to form a cation.
 - b. An atom can have more than one isotope.
 - c. Chlorine has seven valence electrons.
 - d. NH_2 is an amino group.
 - e. All of the above are correct.
6. Which of the following is correct?
 - a. The inner membrane of the chloroplast produces folds called the cristae.
 - b. NAD is a coenzyme necessary for photosynthesis.
 - c. A noncompetitive inhibitor may bond to the allosteric site of an enzyme.
 - d. FAD is the only coenzyme necessary for cellular respiration activities.
 - e. Both a and b are correct.

7. Which does **not** apply to the lactose operon?
- Allolactose is the inducer for the lactose operon.
 - RNA polymerase binds to the operator.
 - A repressor protein attaches to the operator when there is no lactose.
 - Three enzymes are produced.
 - The promoter region is upstream from the operator.
8. Sex chromosomes in human's females are XX and males are XY. Which are the sex chromosomes for chickens?
- XX – females and XY – males
 - XO – females and XY – males
 - XX – females and XO – males
 - ZW – females and ZZ – males
 - ZZ – females and ZW – males

9. Match the prezygotic barriers in **Column A** with their examples in **Column B**.

Column A

- Temporal isolation
- Behavioral isolation
- Gametic isolation
- Habitat isolation
- Mechanical isolation

Column B

- breed in different parts of an area
- structural differences
- different mating rituals
- reproduce at different times of day or seasons
- chemical difference between sex cells

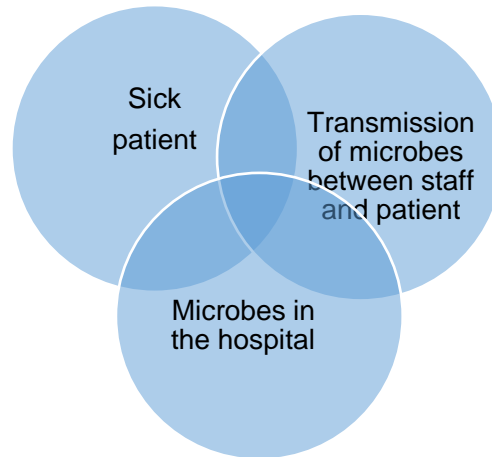
Select the correct matching sequence:

- | | | | | |
|----------|-------|-------|-------|-------|
| a. 1 – b | 2 – a | 3 – e | 4 – d | 5 – c |
| b. 1 – d | 2 – c | 3 – e | 4 – a | 5 – b |
| c. 1 – d | 2 – c | 3 – b | 4 – a | 5 – e |
| d. 1 – c | 2 – d | 3 – e | 4 – b | 5 – a |
| e. 1 – b | 2 – c | 3 – e | 4 – a | 5 – d |

10. Which of the following is correct?
- Fred Griffith performed mouse experiments using two strains of pneumonia causing bacteria and discovered that transformation can occur.
 - Avery, MacLeod, and McCarthy identified the transformation material as DNA.
 - Thomas Morgan 1st discovered sex linked traits in mice.
 - Both a and b are correct.
 - All of the above are correct.
11. Which is **not** correctly matched?
- Apicomplexan – *Plasmodium*
 - Archaeplastids – *Laminaria*
 - Parabasilids – *Trichonymphs*
 - Unikonts – *Entamoeba histolytica*
 - Diplomonads – *Giardia*

12. Which of the following is true?
- During catabolic reactions, larger molecules are broken down into smaller ones.
 - During oxidation reactions, electrons are given up.
 - Hydrolysis reactions involve the enzymatic addition of H₂O to break down larger molecules into smaller ones.
 - During photolysis, water is split and oxygen is given off.
 - All of the above are correct.
13. Which of the following statements is correct?
- NO and NO₂ from vehicle emissions are linked to acid rain.
 - SO₂ emissions from electrical utilities are linked to increasing the acidity of lakes and streams.
 - Acid rain can harm aquatic life, trees, statues, bridges and buildings.
 - Both a and c are correct.
 - All of the above are correct.
14. Which of the following are true?
- Lactase is a disaccharide composed of glucose and fructose.
 - Maltose is a sugar found in seeds.
 - Glucose is the most abundant monosaccharide found in humans.
 - Both b and c are correct.
 - All of the above are correct.
15. Which of the following is **not** a mechanism of microevolution?
- random mating
 - mutation
 - gene flow
 - natural selection
 - genetic drift
16. Cyclin-dependent kinase is ____.
- involved in controlling the cell cycle
 - active when it binds to cycline
 - involved in cytokinesis
 - Both a and b are correct.
 - Both b and c are correct.
17. N-acetyl glucosamine (NAG) is found in ____.
- chitin
 - the exoskeleton of crayfish
 - the cell walls of fungi
 - All of the above are correct.
 - None of the above are correct

18. The area where the circles overlap, can best be described as _____.



- a. nosocomial infection
- b. endemic infection
- c. droplet infection
- d. pandemic infection
- e. fomite infection

19. Many animals pollinate flowers. Which of the following is **not** the time of day when the animals pollinate the flowers?

- a. bat – night
- b. bee – day
- c. moth – night
- d. butterfly – day
- e. All of the above are true.

20. Match the animal in **Column A** with their Class in **Column B**.

Column A

- 1. *Taenia saignata*
- 2. *Schistosoma mansoni*
- 3. Squid
- 4. Chitons

Column B

- a. Cephalopoda
- b. Polyplacophora
- c. Cestoda
- d. Trematoda

Select the correct matching sequence:

- | | | | |
|----------|-------|-------|-------|
| a. 1 – c | 2 – d | 3 – b | 4 – a |
| b. 1 – c | 2 – d | 3 – a | 4 – b |
| c. 1 – d | 2 – c | 3 – b | 4 – a |
| d. 1 – d | 2 – b | 3 – a | 4 – c |
| e. 1 – b | 2 – a | 3 – d | 4 – c |

21. Which of the following is **not** produced during a stage of cellular respiration?

- oxygen
- carbon dioxide
- ATP
- H₂O
- FADH₂

22. Which of the following statements is **not** correct?

- Crossing over takes place between non-sister chromatids.
- Kinetochores form during prometaphase.
- The Golgi apparatus receives transport vesicles on the cis face.
- Plant cells produce cell walls after telophase I and telophase II.
- The tonoplast is the membrane of the plant vacuole.

23. Match the organic molecule in **Column A** with their components in **Column B**.

Column A

- phospholipid
- triglyceride
- adenosine triphosphate
- steroid
- amino acids

Column B

- ribose and adenine
- amino group and carboxyl group
- glycerol and fatty acid
- phosphate and two fatty acids
- four carbon rings

Select the correct matching sequence:

- | | | | | |
|----------|-------|-------|-------|-------|
| a. 1 – c | 2 – d | 3 – b | 4 – e | 5 – a |
| b. 1 – d | 2 – e | 3 – a | 4 – c | 5 – b |
| c. 1 – d | 2 – c | 3 – a | 4 – e | 5 – b |
| d. 1 – e | 2 – d | 3 – b | 4 – a | 5 – c |
| e. 1 – c | 2 – e | 3 – a | 4 – b | 5 – d |

24. Which brain part and its function are **incorrect**?

- frontal lobe – concentration
- parietal lobe – breathing
- occipital lobe – visual
- temporal lobe – auditory
- cerebellum – coordination

25. Which is the correct order followed by the scientific method?

- observation – question – hypothesis – experiment – conclusion
- research – observation – hypothesis – experiment – discussion
- hypothesis – research – question – experiment – conclusion
- observation – research – experiment – hypothesis – discussion
- hypothesis – question – research – discussion – experiment

26. Which color of the light spectrum has the greatest influence on the opening of the stomata?
- green light
 - blue light
 - yellow light
 - violet light
 - All of the above are correct.
27. Which best explains the wobble hypothesis?
- The third nucleotide of DNA can code for more than one mRNA base.
 - The third nucleotide of mRNA can pair with multiple tRNA anticodons.
 - Some tRNA anticodons may pair with different mRNA codons, if the codon codes for the same amino acid, and only the third nucleotide differs.
 - Some tRNA anticodons may pair with more than one mRNA codon, if only the first nucleotide differs.
 - Some tRNA anticodons can carry more than one kind of amino acid, if the codon that codes for the amino acid has one base that differs.
28. Some genes are influenced by their environment. Which is **not** an example of the environment effecting the genes?
- pH in the soil and the color of hydrangeas flowers
 - fur color of Himalayan rabbits
 - diet influencing height in humans
 - Mirabilis jalapa* – four o'clock flowers can be red, white, or pink
 - All of the above, are genes influenced by their environment.
29. Prions ____.
- are PrP proteins that are misfolded
 - are infectious RNA agents
 - are affected by radiation
 - have a short latency period
 - have not been transmitted via organ transplants
30. The ____ is the part of the wood that conducts water and dissolved minerals, and the ____ is the in the center of the tree.
- heartwood; sapwood
 - summerwood; springwood
 - springwood; heartwood
 - sapwood; heartwood
 - springwood; sapwood
31. Which statement is **not** true?
- Ribozymes are involved with protein synthesis.
 - The pentose phosphate pathway can produce NADPH.
 - Cytochromes are proteins with a heme group.
 - The Entner-Doudoroff Pathway produces that same amount of ATP as glycolysis.
 - Coenzyme Q is found in the electron transport chain.

32. Match the muscle in **Column A** with the correct group in **Column B**.

Column A

1. rectus femoris
2. semitendinosus
3. external oblique
4. teres minor

Column B

- a. rotator cuff
- b. hamstring
- c. quadriceps
- d. abdominal

Select the correct matching sequence:

- | | | | |
|----------|-------|-------|-------|
| a. 1 – d | 2 – b | 3 – c | 4 – a |
| b. 1 – c | 2 – d | 3 – a | 4 – b |
| c. 1 – b | 2 – d | 3 – a | 4 – c |
| d. 1 – d | 2 – a | 3 – b | 4 – c |
| e. 1 – c | 2 – b | 3 – d | 4 – a |

33. During mitosis in plant cells, representative cells of each stage are best viewed in the _____ region.

- a. meristematic
- b. maturation
- c. elongation
- d. root cap
- e. None of the above are correct.

34. Which is **not** the correct association?

- a. apoptosis – caspases
- b. BRCA1 – breast cancer
- c. P53 – prostate cancer
- d. prokaryotes – binary fission
- e. G1 & G2 – interphase

35. Which of the following is **not** correct?

- a. Pseudomurein is a phospholipid found in shellfish.
- b. Albumin is a protein found in humans.
- c. Cellulose can be found as a component of algae cell walls, and peptidoglycan can be found in bacterial cell walls.
- d. Both a and b are not correct.
- e. Both b and c are not correct.

36. NAD and FAD are coenzymes for _____.

- a. photosynthesis
- b. chemiosmosis
- c. cellular respiration
- d. Both b and c are correct.
- e. All the above are correct

37. Match the terms in **Column A** with their definitions in **Column B**.

Column A	Column B
1. proteomics	a. DNA fragments separated by size and charge
2. bioinformatics	b. determine the function of gene from the gene sequence
3. gel electrophoresis	c. all of the proteins expressed in cells
4. reverse genetics	d. understanding the function of genes through computer-assisted analysis

Select the correct matching sequence:

a. 1 – d	2 – a	3 – c	4 – b
b. 1 – c	2 – d	3 – a	4 – b
c. 1 – b	2 – d	3 – a	4 – c
d. 1 – a	2 – c	3 – d	4 – b
e. 1 – c	2 – b	3 – a	4 – d

38. Which is **not** a correct association?

- a. transmission electron microscope – electrons pass through the specimen
- b. scanning electron microscope – secondary electrons give a 3 – D picture
- c. differential centrifugation – separation via a series of centrifugation stages
- d. confocal microscopes – use lasers to excite fluorophores
- e. All of these are correct.

39. In corn, purple kernels (P) are dominant to yellow (p) and starchy (S) is dominant to sweet (s). In a cross between, corn heterozygous for both traits, how many yellow, sweet kernels are expected from 800 total kernels counted.

- a. 450
- b. 150
- c. 50
- d. 16
- e. None of the above are correct.

40. Which is **not** a correct association?

- a. chemoheterotroph – chemical energy source and organic carbon source
- b. chemoautotroph – light source and inorganic carbon source
- c. photoheterotroph – light source and organic carbon source
- d. photoautotroph – light source and inorganic carbon source
- e. All of the above are correct.

41. Which statement is **not** true?

- a. Proteins contain the L-isomer of the amino acid.
- b. Complex lipids can contain carbon, hydrogen, oxygen, phosphorus, and nitrogen.
- c. Dextran is a polysaccharide produced by some bacteria.
- d. A nucleoside contains a base and a pentose sugar.
- e. Adenosine diphosphate is produced from ATP during a phosphorylation reaction.

42. The _____ is the protective sheath that encircles the grass tip.

- xylem
- coleoptile
- abscisic acid
- endosperm
- None of the above are correct.

43. Homologous chromosomes synapse during _____.

- Anaphase I
- Prophase I
- Telophase II
- Anaphase II
- None of the above are correct.

44. Using the DNA sequence, determine the type of mutation and the new amino acid sequence, if the 8th nucleotide is changed to an adenine.

TAC TTT AGA CCA CGC CAT

AUG – Met	UCU – Ser	GGU – Gly	GCG – Ala	AAA – Lys	UUU - Phe
GUA - Val	UCC - Ser	GCA – Ala	GGC – Gly	GUG – Val	AGA – Arg

Select the correct matching sequence:

- Met – Lys – Ser – Gly – Ala – Val – silent mutation
- Met – Phe – Arg – Gly – Ala – Val – frameshift mutation
- Met – Lys – Phe – Gly – Ala – Val – missense mutation
- Met – Phe – Arg – Ala – Val – Gly – silent mutation
- Met – Lys – Gly – Ala – Phe – Ser – missense mutation

45. Determine the mass of 6.02×10^{23} molecules of sucrose ($C_{12}H_{22}O_{11}$).

Element	Atomic number	Atomic mass
H – Hydrogen	1	1
C – Carbon	6	12
O – Oxygen	8	16

- 45 g
- 182 g
- 342 g
- 6.02×10^{23} g
- None of the above are correct.

46. The process of cytoplasm combining from two different mating types of fungi is called _____.

- a. karyogamy
- b. plasmogamy
- c. monkaryotic
- d. sporangium
- e. coenocytes

47. In humans, red – green colorblindness is an X-linked trait. Normal color vision is dominant (X^N) to colorblindness (X^n). Normal skin pigmentation (A) is dominant to albinism (a). Determine the genotype of a colorblind, normal skin pigmentation man and the genotype of a normal vision and normal skin pigmentation woman. The couple have three children. One of their sons has normal skin and normal color vision. Their other son has normal skin pigmentation and is colorblind. Their daughter is albino and has normal color vision.

- | | |
|--------------------|---------------------|
| a. Male $X^N Y AA$ | Female $X^n X^n Aa$ |
| b. Male $X^N Y Aa$ | Female $X^N X^N aa$ |
| c. Male $X^N Y aa$ | Female $X^n X^n Aa$ |
| d. Male $X^n Y Aa$ | Female $X^N X^n Aa$ |
| e. Male $X^n Y AA$ | Female $X^N X^N AA$ |

48. Which of the following is correct?

- a. Saturated fats are not liquids because of van der Waal interactions.
- b. Salts are electrolytes and inorganic.
- c. A solution with a pH of 3 is 100 times more acidic than a solution with a pH of 5.
- d. Both a and c are correct.
- e. All of the above are correct.

49. Match the animals in **Column A** with their classes in **Column B**.

Column A

- 1. tuna
- 2. coelacanth
- 3. ray
- 4. lamprey
- 5. lungfish

Column B

- a. Dipnoi
- b. Actinopterygii
- c. Petromyzontida
- d. Actinistia
- e. Chondrichthyes

Select the correct matching sequence:

- | | | | | |
|----------|-------|-------|-------|-------|
| a. 1 – b | 2 – e | 3 – a | 4 – c | 5 – d |
| b. 1 – d | 2 – b | 3 – e | 4 – a | 5 – c |
| c. 1 – b | 2 – d | 3 – e | 4 – c | 5 – a |
| d. 1 – a | 2 – d | 3 – e | 4 – c | 5 – b |
| e. 1 – b | 2 – d | 3 – a | 4 – e | 5 – c |

50. Which of the following is **not** true?
- a. Gnetophytes are angiosperms.
 - b. A perfect flower contains both stamens and carpals.
 - c. Phylum Ginkgophyta has only one extant species.
 - d. Cycads are dioecious.
 - e. Magnolia and black pepper are Magnoliids.