

Advanced Life Science Concepts

Life Science · Answer Key · 18 Questions

1. Which of the following cellular organelles is primarily responsible for the synthesis of phospholipids and steroid hormones?

- A) Golgi apparatus
- B) Lysosome
- C) Smooth endoplasmic reticulum**
- D) Mitochondrion

2. The concept of endosymbiosis, a key hypothesis in explaining the origin of eukaryotic organelles, is most directly supported by the presence of what in mitochondria and chloroplasts?

- A) Ribosomes and a double membrane
- B) Linear DNA and histones
- C) Circular DNA and their own protein-synthesizing machinery**
- D) A single membrane and a peptidoglycan cell wall

3. In the process of DNA replication, which enzyme is primarily responsible for unwinding the DNA double helix by breaking hydrogen bonds between base pairs?

- A) DNA polymerase
- B) RNA primase
- C) Helicase**
- D) DNA ligase

4. The Calvin cycle, a crucial part of photosynthesis, occurs in which part of the chloroplast?

- A) Thylakoid membrane
- B) Stroma**
- C) Outer membrane
- D) Intermembrane space

5. Which mechanism is primarily responsible for the movement of water molecules across a semipermeable membrane from an area of high water concentration to an area of low water concentration?

- A) Active transport
- B) Facilitated diffusion
- C) Osmosis**
- D) Pinocytosis

6. The development of antibiotic resistance in bacterial populations is a classic example of which evolutionary principle?

- A) Genetic drift
- B) Gene flow
- C) Natural selection**
- D) Artificial selection

7. Which phase of meiosis is characterized by the synapsis of homologous chromosomes and the formation of chiasmata, where genetic recombination occurs?

- A) Prophase I**
- B) Metaphase II
- C) Anaphase I
- D) Telophase II

8. The genetic code is often described as degenerate. What does this degeneracy specifically refer to?

- A) Each codon codes for more than one amino acid.
- B) Multiple codons can code for the same amino acid.**
- C) The code is identical in all known organisms.
- D) The genetic code changes over time.

9. Which of the following biomolecules is primarily responsible for catalyzing biochemical reactions within living organisms?

- A) Nucleic acids
- B) Lipids
- C) Carbohydrates
- D) Proteins (enzymes)**

10. The Hardy-Weinberg principle describes a theoretical population that is not evolving. Which of the following conditions must be met for a population to be in Hardy-Weinberg equilibrium?

- A) Random mating only
- B) No mutation, gene flow, genetic drift, or natural selection**
- C) High rates of mutation
- D) Constant gene flow

11. Which of the following neurotransmitters is primarily associated with muscle contraction and learning in the peripheral nervous system?

- A) Serotonin
- B) Dopamine
- C) Acetylcholine**
- D) GABA

12. The process by which a single cell differentiates into a specialized cell type is known as:

- A) Fertilization
- B) Mitosis
- C) Cellular differentiation**
- D) Apoptosis

13. Which layer of the skin is avascular and primarily composed of keratinized stratified squamous epithelium?

- A) Dermis
- B) Hypodermis
- C) Epidermis**
- D) Stratum corneum

14. The absorption of light energy by pigments such as chlorophyll is the initial step in which biological process?

- A) Cellular respiration
- B) Fermentation
- C) Photosynthesis**
- D) Glycolysis

15. What is the primary function of the myelin sheath surrounding axons in the nervous system?

- A) To transmit signals between neurons
- B) To protect the axon from damage
- C) To increase the speed of nerve impulse transmission**
- D) To provide nutrients to the neuron

16. In ecological terms, a population's carrying capacity refers to:

- A) The number of individuals that can migrate into an area.
- B) The maximum population size that a given environment can sustain indefinitely.**
- C) The rate at which individuals are born.
- D) The total number of species in an ecosystem.

17. Which of the following is a key characteristic of a prokaryotic cell that distinguishes it from a eukaryotic cell?

- A) Presence of a nucleus
- B) Presence of membrane-bound organelles
- C) Absence of a cell wall
- D) Circular DNA in the cytoplasm**

18. The central dogma of molecular biology describes the flow of genetic information. Which process involves the synthesis of RNA from a DNA template?

- A) Translation
- B) Replication
- C) Transcription**
- D) Reverse transcription