1. In the 1966 tuberculosis case study, what caused the bacteria to become resistant to antibiotics?

a) Overuse of antibiotics by the patient
b) A mutation in a specific gene
c) Incomplete initial treatment
d) Transmission from another patient
Answer: b) A mutation in a specific gene
Explanation: A mutation in a specific gene allowed the bacteria to survive antibiotics, leading to resistance, as confirmed by DNA analysis.

2. What was the initial treatment duration for tuberculosis in the case study?

a) 6 weeks of one antibiotic
b) 33 weeks of multiple antibiotics
c) 6 weeks of multiple antibiotics plus 33 weeks of a specific antibiotic
d) 10 months of one antibiotic
Answer: c) 6 weeks of multiple antibiotics plus 33 weeks of a specific antibiotic
Explanation: The patient received multiple antibiotics for 6 weeks, followed by a specific antibiotic for 33 weeks.

3. What term describes bacteria resistant to multiple antibiotics?

a) Pathogens
b) Superbugs
c) Mutants
d) Variants
Answer: b) Superbugs
Explanation: Superbugs are bacteria that resist multiple antibiotics due to mutations, posing a healthcare challenge.

4. According to Lamarckism, how did giraffes develop longer necks?

a) Natural selection of longer-necked giraffes
b) Stretching necks to reach leaves, inherited by offspring
c) Genetic mutations over generations
d) Competition with other species
Answer: b) Stretching necks to reach leaves, inherited by offspring
Explanation: Lamarckism suggests acquired traits, like stretched necks, are inherited, though this is disproved.

5. Why was Lamarckism disproved?

a) It lacked examples like giraffes
b) Acquired traits do not alter genetic structure
c) It contradicted fossil evidence
d) It ignored environmental changes
Answer: b) Acquired traits do not alter genetic structure
Explanation: Genetic studies showed acquired traits (e.g., stretched necks) are not inherited, disproving Lamarckism.

6. Which principle of Darwin's theory explains why finches produce more offspring than can survive?

a) Survival of the fittest
b) Overproduction
c) Struggle for existence
d) Natural selection
Answer: b) Overproduction
Explanation: Overproduction means organisms produce excess offspring, leading to competition for resources.

7. What caused the diversity in beak shapes among Galapagos finches?

a) Acquired traits inherited over time
b) Variations selected by food availability
c) Direct environmental changes to beaks
d) Migration to new islands
Answer: b) Variations selected by food availability
Explanation: Natural selection favored beak variations suited to different food sources, leading to diversity.

8. What does "survival of the fittest" mean in Darwin's theory?

a) Only the strongest organisms survive
b) Organisms with favorable variations reproduce more
c) All offspring survive in a population
d) Organisms adapt during their lifetime
Answer: b) Organisms with favorable variations reproduce more
Explanation: Favorable variations enable better survival and reproduction, passing traits to offspring.

9. How does Neo-Darwinism improve upon Darwin's original theory?

a) It includes acquired traits
b) It explains variations through genetics
c) It rejects natural selection
d) It ignores fossil evidence
Answer: b) It explains variations through genetics
Explanation: Neo-Darwinism integrates Mendel's genetics, explaining variations via mutations and recombination.

10. What is the Last Universal Common Ancestor (LUCA)?

a) The ancestor of humans and chimpanzees
b) The ancestor of all life forms
c) The most recent ancestor of finches
d) The ancestor of superbugs
Answer: b) The ancestor of all life forms
Explanation: LUCA is the hypothetical single-celled ancestor of all life, existing billions of years ago.

11. Which organism is most closely related to humans based on hemoglobin beta chain differences?

a) Gorilla (1 difference)
b) Rat (31 differences)
c) Chimpanzee (0 differences)
d) Monkey (unknown differences)
Answer: c) Chimpanzee (0 differences)
Explanation: Zero differences indicate chimpanzees share a recent common ancestor with humans.

12. What type of fossil provides evidence of a transitional form between reptiles and birds?

a) Dinosaur fossils
b) Archaeopteryx fossils
c) Mammoth fossils
d) Horse fossils
Answer: b) Archaeopteryx fossils
Explanation: Archaeopteryx, with reptilian and avian features, is a connecting link.

13. Which human ancestor had the largest cranial capacity?

a) Homo sapiens (1350 cm^3)
b) Homo neanderthalensis (1450 cm^3)
c) Homo erectus (900 cm^3)
d) Australopithecus (450 cm^3)
Answer: b) Homo neanderthalensis (1450 cm^3)
Explanation: Neanderthals had the largest cranial capacity among listed ancestors.

14. What evolutionary advantage did increased cranial capacity provide humans?

a) Faster running speed
b) Enhanced cognitive and social skills
c) Improved digestion
d) Stronger immune system
Answer: b) Enhanced cognitive and social skills
Explanation: Larger brains enabled tool-making, language, and complex social interactions.

15. What is the function of the myelin sheath in neurons?

a) Receive impulses
b) Release neurotransmitters
c) Insulate axons and speed impulse transmission
d) Protect the cell body
Answer: c) Insulate axons and speed impulse transmission
Explanation: The myelin sheath insulates axons, enhancing impulse speed and protection.

16. Which brain part regulates involuntary actions like heartbeat?

a) Cerebrum
b) Cerebellum
c) Medulla oblongata

d) Thalamus
Answer: c) Medulla oblongata
Explanation: The medulla oblongata controls involuntary functions like heartbeat and breathing.

17. What is the role of the synaptic knob in a synapse?

a) Receive neurotransmitters
b) Release neurotransmitters
c) Insulate the axon
d) Connect dendrites
Answer: b) Release neurotransmitters
Explanation: The synaptic knob releases neurotransmitters into the synaptic cleft to stimulate the next neuron.

18. Which nervous system component prepares the body for emergencies?

a) Parasympathetic system
b) Sympathetic system
c) Central nervous system
d) Somatic nervous system
Answer: b) Sympathetic system
Explanation: The sympathetic system increases heartbeat and dilates pupils during emergencies.

19. What is the significance of a reflex arc?

a) Controls voluntary movements
b) Enables rapid involuntary responses
c) Regulates digestion
d) Processes complex thoughts
Answer: b) Enables rapid involuntary responses
Explanation: Reflex arcs allow quick responses (e.g., withdrawing hand from heat) to protect the body.

20. Which organism has the simplest nervous system?

a) Hydra
b) Planaria
c) Insects
d) Humans
Answer: a) Hydra
Explanation: Hydra has a neural network without a control center, the simplest among listed organisms.

21. What protects the brain and spinal cord from external injuries?

a) Myelin sheath
b) Neuroglial cells
c) Cerebrospinal fluid and meninges
d) Synaptic knobs
Answer: c) Cerebrospinal fluid and meninges
Explanation: Meninges and cerebrospinal fluid cushion and protect the CNS.

22. Which neuroglial cell function supports neurons?

a) Transmitting impulses
b) Providing nutrition
c) Releasing neurotransmitters
d) Controlling heart rate
Answer: b) Providing nutrition
Explanation: Neuroglial cells supply nutrients, remove wastes, and support neurons.

23. What is the primary source of variations in organisms according to Neo-Darwinism?

a) Environmental changes
b) Acquired traits
c) Genetic mutations and recombination
d) Use and disuse
Answer: c) Genetic mutations and recombination
Explanation: Neo-Darwinism attributes variations to genetic changes, unlike Lamarckism.

24. Which evidence supports the evolutionary relationship between humans and chimpanzees?

a) Fossil records
b) Molecular biology (DNA similarity)
c) Comparative anatomy of limbs
d) Extinct species fossils
Answer: b) Molecular biology (DNA similarity)
Explanation: High DNA sequence similarity and zero hemoglobin differences confirm close ties.

25. Which human ancestor was the first to show bipedalism?

a) Sahelanthropus tchadensis
b) Australopithecus
c) Homo habilis
d) Homo erectus
Answer: b) Australopithecus
Explanation: Australopithecus fossils confirm bipedalism through skeletal structure.

Application-Level Questions

26. If a new antibiotic kills 99% of a bacterial population, what is likely to happen to the survivors?

a) They will become weaker
b) They will develop resistance through use
c) They may carry resistant mutations and multiply
d) They will stop reproducing
Answer: c) They may carry resistant mutations and multiply
Explanation: Survivors with resistant mutations (like in the TB case) will reproduce, increasing resistant strains.

27. If a drought reduces seed size in an island, which finch is most likely to survive?

a) Large-beaked seed-eater
b) Small-beaked seed-eater

c) Insect-eater with sharp beak
d) Cactus-eater with pointed beak
Answer: b) Small-beaked seed-eater
Explanation: Small-beaked finches are better suited to smaller seeds, surviving and reproducing per natural selection.

28. Why might a virus like COVID-19 evolve to resist vaccines, based on the chapter?

a) Vaccines weaken the virus
b) Mutations in RNA allow immune evasion
c) Viruses acquire resistance during infection
d) Vaccines stop viral reproduction
Answer: b) Mutations in RNA allow immune evasion
Explanation: RNA viruses mutate rapidly, enabling variants (e.g., Omicron) to evade immunity, as described.

29. If a predator targets slow-moving fish, which fish trait would natural selection favor?

a) Larger fins for slower movement
b) Smaller body for hiding
c) Faster swimming speed
d) Brighter colors for attraction
Answer: c) Faster swimming speed
Explanation: Fish with faster swimming variations escape predators, surviving to reproduce, per natural selection.

30. How might a damaged myelin sheath affect an organism's survival in a forest?

a) Improved impulse transmission
b) Slower responses to danger
c) Enhanced cognitive abilities
d) Increased neurotransmitter release
Answer: b) Slower responses to danger
Explanation: A damaged myelin sheath slows impulse transmission, delaying reactions to predators, reducing survival chances.