

單選題，每題2分。

1. Which of the following is not an observation or inference on which natural selection is based?
 - (A) There is heritable variation among individuals
 - (B) Poorly adapted individuals never produce offspring
 - (C) Species produce more offspring than the environment can support
 - (D) Individuals whose characteristics are best suited to the environment generally leave more offspring than those whose characteristics are less suited
 - (E) Only a fraction of the offspring produced by an individual may survive
2. DNA sequences in many human genes are very similar to the sequences of corresponding genes in chimpanzees. The most likely explanation for this result is that
 - (A) Human and chimpanzees share a relatively recent common ancestor
 - (B) Humans evolved from chimpanzees
 - (C) Chimpanzees evolved from humans
 - (D) Convergent evolution led to the DNA similarities
 - (E) Humans and chimpanzees are not closely related
3. A fruit fly population has a gene with two alleles, A1 and A2. Tests show that 70% of the gametes produced in the population contain the A1 allele. If the population is in Hardy-Weinberg equilibrium, what proportion of the flies carry both A1 and A2?
 - (A) 0.7
 - (B) 0.49
 - (C) 0.21
 - (D) 0.42
 - (E) 0.09
4. Natural selection changes allele frequencies because some _____ survive and reproduce more successfully than others
 - (A) alleles
 - (B) gene pools
 - (C) species
 - (D) loci
 - (E) individuals
5. The largest unit within which gene flow can readily occur is a
 - (A) population
 - (B) species
 - (C) genus
 - (D) hybrid
 - (E) phylum
6. According to the punctuated equilibria model
 - (A) natural selection is unimportant as a mechanism of evolution
 - (B) given enough time, most existing species will branch gradually into new species
 - (C) most new species accumulate their unique features relatively rapidly as they come into existence, then change little for the rest of their duration as a species
 - (D) most evolution occurs in sympatric populations
 - (E) speciation is usually due to a single mutation
7. If you were using cladistics to build a phylogenetic tree of cats, which of the following would be the best outgroup?
 - (A) lion

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- (B) domestic cat
 - (C) wolf
 - (D) leopard
 - (E) tiger
8. To apply parsimony to constructing a phylogenetic tree,
- (A) choose the tree that assumes all evolutionary changes are equally probable
 - (B) choose the tree in which the branch points are based on as many shared derived characters as possible
 - (C) base phylogenetic trees only on the fossil records, as this provides the simplest explanation for evolution
 - (D) choose the tree that represents the fewest evolutionary changes, either in DNA sequences or morphology
 - (E) choose the tree with the fewest branch points.
9. Suppose that the number of bird species is determined mainly by the number of vertical strata found in the environment. If so, in which of the following biomes would you find the greatest number of bird species?
- (A) Tropical rain forest
 - (B) Savanna
 - (C) Desert
 - (D) Temperate broadleaf forest
 - (E) Temperate grassland
10. Which of the following is not evidence that charophytes are the closest algal relatives of plants?
- (A) similar sperm structure
 - (B) similarities in chloroplast shape
 - (C) similarities in cell wall formation during cell division
 - (D) genetic similarities in chloroplasts
 - (E) similarities in proteins that synthesize cellulose
11. In plants, which of the following are produced by meiosis? haploid sporophytes
- (A) haploid gametes
 - (B) diploid gametes
 - (C) haploid spores
 - (D) diploid spores
12. Gymnosperms and angiosperms have the following in common except
- (A) seed
 - (B) pollen
 - (C) vascular tissue
 - (D) ovaries
 - (E) ovules
13. With respect to angiosperms, which of the following is incorrectly paired with its chromosome count?
- (A) egg - n
 - (B) megaspore - $2n$
 - (C) microspore - n
 - (D) zygote $2n$
 - (E) sperm - n

14. Which of the following cells or structures are associated with asexual reproduction in fungi?
- (A) ascospores
 - (B) basidiospores
 - (C) zygosporangia
 - (D) conidiophores
 - (E) ascocarps
15. The adaptive advantage associated with the filamentous nature of fungal mycelia is primarily related to
- (A) the ability to form haustoria and parasitize other organisms
 - (B) avoiding sexual reproduction until the environment changes
 - (C) the potential to inhabit almost all terrestrial habitats
 - (D) the increased probability of contact between different mating types
 - (E) an extensive surface area well suited for invasive growth and absorptive nutrition
16. High-energy electrons from molecules of NADH and FADH₂ are transferred to a chain of proteins within the electron transport chain. What is the final electron acceptor of the electron transport chain?
- (A) carbon dioxide
 - (B) oxygen
 - (C) cytochrome c
 - (D) ubiquinone
 - (E) NAD⁺
17. Which of the following is mismatched with its location?
- (A) light reaction; grana
 - (B) electron transport; thylakoid membrane
 - (C) Calvin cycle; stroma
 - (D) ATP synthase; intermembrane space
 - (E) splitting of water; thylakoid space
18. What are the primary functions of photosystems I and II?
- (A) produce ATP and NADP⁺
 - (B) produce CO₂ and ATP
 - (C) produce ATP and NADPH
 - (D) produce O₂, ATP, and NADP⁺
 - (E) produce O₂, ATP, and NADPH
19. Plant embryos grow into seedlings by adding new cells at only two growth points which are called:
- (A) parenchyma cell points
 - (B) collenchyma cell points
 - (C) sclerenchyma cell points

- (D) vascular cell points
- (E) shoot and root apical meristems

20. The production of root hairs is mostly dependent on which of the following influences?
- (A) auxin production
 - (B) position of an epidermal cell
 - (C) width of the root
 - (D) length of the root
 - (E) position of the root in the soil
21. Plant roots that are in a horizontal position grow down because:
- (A) Cells on the upper side elongate more than those on the lower side
 - (B) Auxins are stimulating cells on the lower side to elongate more
 - (C) Auxins are being pulled to the upper side
 - (D) Auxins are having no influence on this process
 - (E) Statoliths are pushing auxins to the upper side
22. Cytokinins are plant hormones that usually affect cell:
- (A) elongation
 - (B) growth
 - (C) division
 - (D) wall expansion
 - (E) turgor pressure
23. Gibberellins were discovered as a result of:
- (A) extractions of this hormone from plants
 - (B) a fungal disease on rice
 - (C) an application of the hormone accidentally
 - (D) many years of experiments to isolate it from plants
 - (E) discovery of its relationship to auxins
24. Ethylene has the effect of causing fruits to:
- (A) enlarge
 - (B) ripen
 - (C) shrink
 - (D) elongate
 - (E) increase in juice content
25. Abscisic acid is an important signal, transported from roots to the stem and leaves during times of water stress that prevents:

- (A) additional auxin production
 - (B) ethylene buildup in the stems
 - (C) leaf drop
 - (D) phototropism
 - (E) stomatal opening
26. Phototropism is a plant response controlled largely by which color of light?
- (A) red
 - (B) blue
 - (C) violet
 - (D) green
 - (E) None of the choices is correct
27. What is the mutualistic association between roots and fungi called?
- (A) nitrogen fixation
 - (B) *Rhizobium* infection
 - (C) mycorrhizae
 - (D) parasitism
 - (E) root hair enhancement
28. Which of the following is the *correct* order of floral organs from the outside to the inside of a complete flower?
- (A) petals-sepals-stamens-carpels
 - (B) sepals-stamens-petals-carpels
 - (C) spores-gametes-zygote-embryo
 - (D) sepals-petals-stamens-carpels
 - (E) male gametophyte-female gametophyte-sepals-petals
29. Recent research has shown that pollination requires that carpels recognize pollen grains as "self or nonself." For self-incompatibility, the system requires:
- (A) rejection of nonself cells
 - (B) the rejection of self cells
 - (C) carpel incompatibility with the egg cells
 - (D) that the flowers be incomplete
 - (E) the union of genetically identical sperm and egg cells
30. Biofuels are mainly produced by:
- (A) the breakdown of cell wall biopolymers into sugars that can be fermented
 - (B) plants that convert hemicellulose into gasoline
 - (C) the genetic engineering of ethanol generating genes into plants
 - (D) transgenic crops that have cell walls containing ethylene
 - (E) plants that are easy to grow in arid environments.

31. Which structure is *not* part of the endomembrane system?
A) chloroplast
B) ER
C) Golgi apparatus
D) nuclear envelope
E) plasma membrane
32. Which structure-function pair is *mismatched*?
A) Golgi; protein trafficking
B) nucleolus; production of ribosomal subunits
C) lysosome; intracellular digestion
D) ribosome; protein synthesis
E) microtubule; muscle contraction
33. Which of the following is most similar in structure to ATP?
A) an amino acid with three phosphate groups attached
B) a DNA helix
C) an anabolic steroid
D) an RNA nucleotide
E) a phospholipid
34. How would one explain a testcross involving F₁ dihybrid flies in which more parental-type offspring than recombinant-type offspring are produced?
A) Both of the characters are controlled by more than one gene.
B) The two genes are linked.
C) Recombination did not occur in the cell during meiosis.
D) The two genes are linked but on different chromosomes.
E) The testcross was improperly performed.
35. What is the mechanism for the production of genetic recombinants?
A) Crossing over and independent assortment
B) X inactivation
C) Nondisjunction
D) Deletions and duplications during meiosis
E) Methylation of cytosine
36. The tryptophan operon is a repressible operon that is
A) turned off whenever tryptophan is added to the growth medium.
B) turned on only when glucose is present in the growth medium.
C) turned on only when tryptophan is present in the growth medium.
D) turned off only when glucose is present in the growth medium.
E) permanently turned on.

37. In eukaryotes, general transcription factors
- A) usually lead to a high level of transcription even without additional *specific* transcription factors.
 - B) are required for the expression of specific protein-encoding genes.
 - C) bind to other proteins or to a sequence element within the promoter called the TATA box.
 - D) inhibit RNA polymerase binding to the promoter and begin transcribing.
 - E) bind to sequences just after the start site of transcription.
38. What is considered to be the first evidence of differentiation in the cells of an embryo?
- A) changes resulting from induction
 - B) the occurrence of mRNAs for the production of tissue-specific proteins
 - C) cell division
 - D) changes in the size and shape of the cell
 - E) determination
39. Without functioning parietal cells, which of the following would you expect for an individual?
- A) not to be able to initiate mechanical digestion in the stomach
 - B) not to be able to initiate digestion in the small intestine.
 - C) only to be able to digest fat in the stomach
 - D) not to be able to produce pepsinogen
 - E) not to be able to initiate protein digestion in the stomach
40. Which of the following is an example of countercurrent exchange?
- A) the flow of water across the gills of a fish and that of blood within those gills
 - B) the flow of blood in the dorsal vessel of an insect and that of air within its tracheae
 - C) the flow of fluid out of the arterial end of a capillary and that of fluid back into the venous end of the same capillary
 - D) the flow of air within the primary bronchi of a human and that of blood within the pulmonary veins
 - E) the flow of water across the skin of a frog and that of blood within the ventricle of its heart
41. A bone marrow transplant may not be appropriate from a given donor (Jane) to a given recipient (Jane's cousin Bob), even though Jane has previously given blood for one of Bob's needed transfusions. Which of the following might account for this?
- A) For each gene, there is only one blood allele but many tissue alleles.

- B) Jane's blood type is a match to Bob's but her MHC proteins are not.
 - C) Bob's immune response has been made inadequate before he receives the transplant.
 - D) Jane's class II genes are not expressed in bone marrow.
 - E) A blood type match is less stringent than a match required for transplant because blood is more tolerant of change.
42. Jenner successfully used cowpox virus as a vaccine against the virus that causes smallpox. Why was he successful even though he used viruses of different kinds?
- A) The immune system responds nonspecifically to antigens.
 - B) There are some antigenic determinants common to both pox viruses.
 - C) Cowpox and smallpox are antibodies with similar immunizing properties.
 - D) The cowpox virus made antibodies in response to the presence of smallpox.
 - E) Both viruses have same DNA sequence
43. Which of the following nitrogenous wastes requires hardly any water for its excretion?
- A) amino acid
 - B) uric acid
 - C) ammonia
 - D) nitrogen gas
 - E) urea
44. The transfer of fluid from the glomerulus to Bowman's capsule
- A) is very selective as to which subprotein sized molecules are transferred.
 - B) transfers large molecules as easily as small ones.
 - C) is mainly a consequence of blood pressure in the capillaries of the glomerulus
 - D) results from active transport.
 - E) usually includes the transfer of red blood cells to the Bowman's capsule.
45. What do nitric oxide and epinephrine have in common?
- A) They both function as hormones.
 - B) They both function as neurotransmitters.
 - C) They are both involved in the "fight-or-flight" response.
 - D) They bind the same receptors.
 - E) Only A and B are correct.

46. When an individual is subject to short-term starvation, most available food is used to provide energy (metabolism) rather than building blocks (growth and repair). Which hormone would be particularly active in times of food shortage?
- (A) epinephrine
 - (B) oxytocin
 - (C) glucagon
 - (D) insulin
 - (E) antidiuretic hormone
47. Which hormone exerts antagonistic action to PTH (parathyroid hormone)?
- (A) growth hormone
 - (B) epinephrine
 - (C) glucagon
 - (D) calcitonin
 - (E) thyroxine
48. Which of the following statements about the adrenal gland is *correct*?
- (A) At all times, the anterior portion secretes ACTH, while the posterior portion secretes oxytocin.
 - (B) During stress, TSH stimulates the adrenal cortex and medulla to secrete acetylcholine.
 - (C) During stress, ACTH stimulates the adrenal cortex, and neurons of the sympathetic nervous system stimulate the adrenal medulla.
 - (D) At all times, the adrenal gland monitors calcium levels in the blood and regulates calcium by secreting the two antagonistic hormones, epinephrine and norepinephrine.
 - (E) During stress, the alpha cells of islets secrete insulin and simultaneously the beta cells of the islets secrete glucagon.
49. Which part of the vertebrate nervous system is most involved in preparation for the fight-or-flight response?
- (A) visceral
 - (B) central
 - (C) somatic
 - (D) sympathetic
 - (E) parasympathetic
50. Which of the following coordinates muscle actions?
- (A) cerebellum
 - (B) medulla oblongata
 - (C) hypothalamus
 - (D) cerebrum
 - (E) thalamus