

※ 注意：請於試卷上「選擇題作答區」依序作答。

Multiple Choice (Select only ONE answer; 2.5 points each)

1. The development of heart disease can result from a diet high in
 - A) protein.
 - B) unsaturated fats.
 - C) saturated fats.
 - D) sugars.

2. What is the main adaptive advantage of the C₄ and CAM photosynthesis strategies over the C₃ strategy?
 - A) They help the plant synthesize glucose efficiently under dry conditions.
 - B) They allow the plant to fix carbon under conditions of low CO₂.
 - C) They allow the plant to fix carbon in cool conditions.
 - D) They make it possible for the plant to use the Calvin cycle at night.

3. RNA interference (RNAi) can be used by
 - A) researchers to induce the production of more mRNA.
 - B) researchers to artificially turn on gene expression.
 - C) viruses to stop the production of new proteins.
 - D) cells to prevent infections from double-stranded RNA viruses.

4. Sympatric speciation commonly occurs through _____ in plants but is more likely to occur through _____ in animals.
 - A) polyploidy; habitat differentiation and sexual selection
 - B) habitat differentiation and sexual selection; polyploidy
 - C) asexual reproduction; chromosome duplications
 - D) self-pollination; polyploidy and other genetic mechanisms

5. Mycorrhizal fungi are sometimes purposely introduced to new areas of land that are used for growing plants for commercial uses (e.g., landscaping, crop production, timber production). What would be the benefit of doing this?
 - A) The fungi absorb toxic pesticides from the ground.
 - B) The fungi help facilitate horticulture, agriculture, and forestry.
 - C) The fungi promote the evolution of new fungus species.
 - D) The fungi prevent competitive plant species from growing.

6. Homeostasis
 - A) is the maintenance of a relatively constant internal state.
 - B) results from hormone imbalance.
 - C) occurs when the external environment changes to match the internal environment.
 - D) is the way the internal environment influences the external environment.

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7. The second vaccination is beneficial because it
- A) contains mast cells that survive longer than 4-5 days.
 - B) stimulates production of a higher concentration of antibodies in the bloodstream.
 - C) requires two injections to stimulate antibody formation.
 - D) keeps previously produced cytotoxic T cells circulating in the bloodstream.
8. Our biological clock, which regulates the sleep-wake cycle, is housed within the
- A) cerebrum.
 - B) hypothalamus.
 - C) cerebellum.
 - D) brainstem.
9. Which statement regarding compound eyes is TRUE?
- A) They have one light-focusing lens.
 - B) They are poor motion detectors.
 - C) They can provide excellent color vision.
 - D) They can perceive only visible light.
10. Which of the following biomes is characterized by mild, rainy winters and hot, dry summers?
- A) Tropical forest
 - B) Temperate grassland
 - C) Savanna
 - D) Temperate seasonal forest
 - E) Mediterranean woodland and shrubland
11. A child dies following a series of chronic bacterial infections. At the autopsy, the physicians are startled to see that the child's white blood cells are loaded with vacuoles containing intact bacteria. Which explanation could account for this finding?
- A) A defect in the Golgi apparatus prevented the cells from processing and excreting the bacteria.
 - B) A defect in the rough endoplasmic reticulum prevented the synthesis of the antibodies (defensive proteins) that would have inactivated the bacteria.
 - C) A defect in the cell walls of the white blood cells permitted bacteria to enter the cells.
 - D) A defect in the lysosomes of the white blood cells prevented the cells from destroying engulfed bacteria.
12. Two chromosomes in a nucleus that carry genes controlling the same inherited characteristics are
- A) homologous chromosomes.
 - B) sister chromatids.
 - C) complementary chromosomes.

13. Why is a guide RNA needed when using CRISPR-Cas9 for gene editing?
- A) to help Cas9 be transported into the nucleus
 - B) to help Cas9 find the target DNA to cut
 - C) to help repair the target DNA after it is cut
 - D) to help make copies of the target DNA
14. In mammals, the presence of four limbs is _____, and hair is _____.
- A) a shared derived character; a shared ancestral character that places mammals in the tetrapod clade
 - B) a shared ancestral character; a shared derived character unique to mammals
 - C) a homologous feature; an analogous feature
 - D) monophyletic; parsimonious
15. Which plant has a dominant sporophyte generation and a seed, but no fruit?
- A) fern
 - B) pine tree
 - C) tulip
 - D) moss
16. Which statement about metabolism is FALSE?
- A) The basal metabolic rate is the amount of energy an animal needs just to stay alive; it does not include the energy needed for activities.
 - B) Cells usually use carbohydrates and fats as fuel sources.
 - C) Humans store some extra energy in the form of glycogen reserves in the pancreas and spleen.
 - D) The average basal metabolic rate is 1,300-1,500 kcal per day for females and 1,600-1,800 kcal per day for males.
17. In saltwater fish
- A) the concentration of solutes in the internal fluids of saltwater fish is lower than that in the surrounding water.
 - B) the concentration of solutes in the internal fluids of saltwater fish is higher than that in the surrounding environment.
 - C) large amounts of diluted urine are produced.
 - D) body fluids have a solute concentration equal to their surroundings.
18. Suppose that the circular muscles in an earthworm have become selectively paralyzed such that they are not able to contract. How will this affect the earthworm's locomotion?
- A) The earthworm will be able to elongate, but not get thicker.
 - B) The earthworm will be able to get thicker, but not elongate.
 - C) The earthworm will not be able to elongate or get thicker.
 - D) The earthworm will be able to crawl as normal.

19. In Utah of the USA, there is a clone of aspen trees that covers over 100 acres. Such clones can be considered as a single plant with many stems. It appears that the first stem of this clone originated over 80,000 years ago, even before there were humans in North America. What likely contributes most to the long-term survival (long life span) of aspens?

- A) If parts of the organism (clone) are damaged, there are still other parts that can continue growing.
- B) All parts of the clone carry the same genes.
- C) A shared root system means that all stems receive the same nourishment.
- D) Sexual reproduction can occur more frequently in clones.

20. A beetle that feeds exclusively on dead wood is an example of a(n) _____ and is part of the _____ trophic level.

- A) herbivore; first
- B) herbivore; second
- C) omnivore; second
- D) detritivore; first
- E) detritivore; second

21. Which feature is typical of an ATP-driven active transport mechanism?

- A) The transport protein must cross to the correct side of the membrane before the solute can bind to it.
- B) The transport protein is irreversibly phosphorylated as transport takes place.
- C) The transport protein catalyzes the conversion of ADP to ATP.
- D) The solute moves against the concentration gradient.

22. The alleles of a gene are found at _____ chromosomes.

- A) the same locus on nonhomologous
- B) different loci on homologous
- C) different loci on nonhomologous
- D) the same locus on homologous

23. Which statement about evolutionary adaptation is TRUE?

- A) An individual who has learned how to survive cold winters has become adapted to the cold.
- B) A population that has an increase in frequency of alleles for thicker fur has become adapted to the cold.
- C) Adaptation results when cold temperatures cause mutations for longer fur.
- D) Adaptation is possible when all the alleles in a gene pool are the same.

24. How do scientists calibrate a molecular clock for a group of organisms with known nucleotide sequences?

- A) They use radioactive isotopes to measure the age of DNA material directly.
- B) They graph the number of nucleotide differences against the dates of evolutionary branch points known from the fossil record.
- C) They analyze fossilized DNA of known age and compare its nucleotide sequences to modern DNA sequences.

25. Which phylum is most closely related to echinoderms?
- A) Annelida
 - B) Mollusca
 - C) Arthropoda
 - D) Chordata
26. Some crocodiles and turtles have an exceptional ability to divert blood flow through the heart when they are diving and no longer breathing and exchanging gases. What most likely occurs when these animals dive?
- A) Instead of flowing to the lungs, blood travels to the rest of the body to support bodily functions.
 - B) Instead of flowing to the body, blood travels to the lungs to exchange gases.
 - C) Instead of flowing to the capillaries, blood travels to alveoli to exchange gases.
 - D) Blood flow ceases altogether since gases cannot be exchanged while diving.
27. The hormone prolactin, found in distantly related vertebrates, exerts different effects in different species. From an evolutionary standpoint, this is an indication that prolactin
- A) can only have functions related to childbirth.
 - B) is an ancient hormone whose function diversified through evolution.
 - C) was a recent evolutionary adaptation.
 - D) was not required in fish and amphibians.
28. What form of nitrogen can most plants absorb and use directly?
- A) nitrite and nitrate
 - B) nitrate only
 - C) ammonium and nitrogen gas
 - D) nitrate and ammonium
29. Where does the majority of the net primary production go?
- A) Being stored in plants after being photosynthesized
 - B) Being grazed by herbivores
 - C) Being processed by decomposers and detritivores
 - D) Being stored in the soil
30. If a turtle and a night heron both eat the same species of fish, what is the relationship between a turtle and a night heron?
- A) predation
 - B) mutualism
 - C) parasitism
 - D) competition

31. Wood frogs freeze solid during the winter and then thaw in the spring. As the freezing progresses, blood circulation stops, which means that cells are not being served by the circulatory system. How would you expect these cells to produce ATP during this time, and what by-product would you expect to build up in these cells?

- A) aerobic respiration and CO₂
- B) fermentation and lactate
- C) fermentation and alcohol
- D) photosynthesis and O₂

32. Which statement regarding the flow of genetic information is FALSE?

- A) Polypeptides form proteins that determine the appearance and function of the cell and organism.
- B) Eukaryotic mRNA is processed in several ways before export out of the nucleus.
- C) Transcription occurs in the cytoplasm of eukaryotic cells.
- D) Ribosomes function as factories that coordinate the functioning of mRNA and tRNA.

33. Uplift and formation of a mountain range divide a freshwater snail species into two isolated populations. Erosion eventually lowers the mountain range and brings the two populations together again, but when they mate, the resulting hybrids all produce sterile young. This scenario is an example of

- A) sympatric speciation.
- B) allopatric speciation.
- C) incomplete speciation.
- D) diversifying speciation.

34. Cyanobacteria

- A) are photosynthetic archaea.
- B) are eukaryotes and the earliest type of algae.
- C) are chemoautotrophs.
- D) are the only prokaryotes with plantlike, oxygen-generating photosynthesis.

35. Which statement best describes the current scientific view of birds?

- A) a group of feathered, endothermic dinosaurs
- B) a group of feathered, ectothermic lizards that lack teeth
- C) a group of flying, endothermic reptiles that have lost teeth, the amniotic egg, and other heavy body features as an adaptation for flight
- D) a group of flying mammals that are derived from monotremes, which also lay amniotic eggs

36. Which statement about blood pressure is FALSE?

- A) Normal blood pressure for adult humans is usually at or below 120/80.
- B) Hypertension is defined as persistent systolic pressure above 120 and/or diastolic above 80.
- C) High blood pressure can lead to an enlarged and weakened heart, increased risk of heart attack, stroke, and kidney failure.
- D) The higher number in a blood pressure reading measures the force of a heart contraction.

37. What occurs during gastrulation?
- A) A solid embryo is changed into a hollow morula.
 - B) A solid blastula is changed into a hollow embryo with a dorsal nerve cord.
 - C) A hollow blastula is changed into a hollow embryo that has three tissue layers.
 - D) A neural tube is created by invagination of the ectoderm.
38. When a nursery worker pinches off the terminal buds on a young plant to make it grow bushy, which plant hormone, when produced, is mainly responsible for growth of side branches?
- A) an auxin
 - B) a gibberellin
 - C) a cytokinin
 - D) abscisic acid (ABA)
39. Non-native species, such as cats and dogs in Taiwan, that are introduced to new environments, spread far beyond the original point of introduction, and cause damage are called
- A) predators.
 - B) pets.
 - C) invasive species.
 - D) pathogens.
40. Global warming is a phenomenon in which global temperature is increasing as a result of increasing greenhouse gas concentrations in the atmosphere. Scientists believe that the Earth can tolerate X-Y degree Celsius temperature increase before it passes the point of no return and moves into a positive feedback loop. "X-Y" should be
- A) 1-2
 - B) 3-4
 - C) 5-6
 - D) 7-8

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