

※請將選擇題作答於試卷內之「選擇題作答區」。

選擇題 (共 40 題,每題 2.5 分,單選)

1. Which of the following natural phenomena are not a direct result of the properties of water?
  - A. insects that walk on water
  - B. sugar dissolving in water
  - C. floating icebergs
  - D. the thermometer
2. Macromolecules that are used by organisms to store hereditary information are called
  - A. transfer RNA molecules
  - B. messenger RNA molecules
  - C. DNA molecules
  - D. amino acids molecules
3. In cells, which of the following molecules is not usually associated with providing energy?
  - A. DNA
  - B. neutral fat
  - C. starch
  - D. egg albumin
4. Humans are unable to get metabolic energy from cellulose because
  - A. cellulose contains very little chemical energy
  - B. cellulose is not part of a normal diet
  - C. cellulose digesting enzymes are absent
  - D. cellulose is present in large quantities in the gut
5. Early cyanobacteria evolved a form of photosynthesis that permanently changed the Earth's atmosphere by releasing which of the following gases?
  - A. carbon dioxide
  - B. oxygen
  - C. nitrogen
  - D. methane

Use the following scenario to answer Questions 6-8

After a coastal storm 3 deer mice (*Peromyscus*), huddled on a tree trunk, are carried several miles out to sea and wash ashore on a small island (500 acres) that has no mice, but can

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certainly support them. Deermice eat seeds, primarily. The entire island has lots of plants and places for mice to live. There are small groundnesting, seedeating birds, hawks, and a variety of lizards living on the island. Two of the mice are female, and already pregnant when they arrive, and later they both mate with the male. Over time a population of deermice is established on the island. Deermice can reproduce two to three times a year, with 3-6 offspring per litter.

6. The first year on the island the population of deermice
- A. increases in a sigmoidal fashion
  - B. is K-selected
  - C. quickly reaches its biotic potential
  - D. is limited only by its carrying capacity
7. Within 2 years on the island the population of deermice
- A. is r-selected
  - B. is K-selected
  - C. has reached its biotic potential
  - D. may be competing with the birds for resources
8. After 100 years on the island, the population of deermice is most likely to
- A. be still growing rapidly
  - B. has reached its biotic potential
  - C. evolve into a new species
  - D. is r-selected
9. A restriction in genetic variability caused by a drastic reduction in population size is called
- A. founder effect
  - B. Hardy-Weinberg effect
  - C. bottleneck effect
  - D. polymorphic effect
10. One of the reasons why the model systems of Arabidopsis, elegans, fruit flies and mice are so often used for study is because
- A. they all have only a few chromosomes
  - B. they are easy to cross with each other and observe polyploidy effects
  - C. they are easy to culture and have short life cycles
  - D. they mutate easily leading to new genomic variations

11. Rumen of the first stomach of ruminants serves as a fermentation chamber in which bacteria and protozoa degrade
- A. protein
  - B. fats
  - C. cellulose
  - D. glucose
12. All of the following are functions of the circulatory system except
- A. oxygen, nutrient, and waste transport
  - B. synthesis of red and white blood cells
  - C. blood clotting and immune defense
  - D. temperature regulation
13. The most efficient lungs are found in which of the terrestrial vertebrates listed below?
- A. birds
  - B. reptiles
  - C. mammals
  - D. amphibians
14. Juvenile insects are capable of shedding their exoskeletons in a process called molting. Select the best choice that presents a diagrammed sequence of events during the molting process.
- A. prior to molting—brain surface cells secrete brain hormone → which stimulates the prothoracic gland to produce ecdysone → which causes molting
  - B. prior to molting—brain surface cells secrete juvenile hormone → which stimulates the prothoracic gland to produce ecdysone → which causes molting
  - C. prior to molting—brain surface cells secrete ecdysone → which stimulates the prothoracic gland to produce juvenile hormone → which causes molting
  - D. prior to molting—the corpora allata near the brain secretes brain hormone → which stimulates the prothoracic gland to produce ecdysone → which causes molting
15. The most efficient lungs are found in which of the terrestrial vertebrates listed below?
- A. amphibians
  - B. reptiles
  - C. mammals
  - D. birds

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16. Sea otters have been used as an example of the “Keystone Species” concept. This means that sea otters
- A. provide the carnivorous component of the food chain in which they live
  - B. promote the edge effect in the kelp forests off the northern coastline of California
  - C. exert a particular strong influence on the structure and functioning of an ecosystem
  - D. offer an opportunity for scientists to study their long-term effects as they harvest the sea otter populations
17. An animal learns to associate its behavioral response with a reward or punishment in
- A. imprinting
  - B. classical conditioning
  - C. deviant behavior
  - D. operant conditioning
18. Lakes become eutrophic by
- A. accumulation of organic matter
  - B. loss of organic matter
  - C. circulation of water in the lake
  - D. free exchange of water with outside sources
19. In global terms, the production of  $\text{CO}_2$  by respiration and its fixation by photosynthesis are balanced, but the balance has been shifted towards accumulation of  $\text{CO}_2$  by the increase in consumption of
- A. meat products
  - B. vegetable products
  - C. fossil fuels
  - D. ozone
20. An insect feeds on a leaf. If a day's feeding activities gains a total of 1000 calories and 50% is lost in its feces and 33% of the energy is used to provide energy through cellular respiration, how many calories of the original intake are available for its biomass?
- A. 1000 calories
  - B. 500 calories
  - C. 330 calories
  - D. 170 calories

21. Which of the following structures is most directly associated with the secretion of compounds that will become part of the plant cell wall?
- A) smooth ER
  - B) rough ER
  - C) plasmodesmata
  - D) Golgi-derived vesicles
  - E) Golgi apparatus
22. Which of the following cell components is *not directly involved in synthesis or secretion*?
- A) ribosome
  - B) rough endoplasmic reticulum
  - C) Golgi body
  - D) smooth endoplasmic reticulum
  - E) lysosome
23. Which of the following is not considered part of the endomembrane system?
- A) nuclear envelope
  - B) chloroplast
  - C) Golgi apparatus
  - D) plasma membrane
  - E) ER
24. Which of the following structure-function pairs is *mismatched*?
- A) nucleolus-ribosome production
  - B) lysosome-intracellular digestion
  - C) ribosome-protein synthesis
  - D) Golgi-protein trafficking
  - E) microtubule-muscle contraction
25. C<sub>4</sub> plants differ from C<sub>3</sub> and CAM plants in that C<sub>4</sub> plants
- A) open their stomata only at night
  - B) are better adapted to wet conditions
  - C) transfer fixed carbon dioxide to cells in which the Calvin cycle occurs
  - D) use malic acid to transfer carbon dioxide to the Calvin cycle
  - E) use PEP carboxylase to fix carbon dioxide

26. Synthesis of a new DNA strand usually begins with
- A) an RNA primer
  - B) a DNA primer
  - C) an Okazaki fragment
  - D) DNA ligase
  - E) a thymine dimer
27. In a nucleosome, the DNA is wrapped around
- A) polymerase molecules
  - B) ribosomes
  - C) histones
  - D) the nucleolus
  - E) satellite DNA
28. Which of the following terms belongs with the words synapsis, tetrads, and chiasmata?
- A) haploid
  - B) crossing over
  - C) autosomes
  - D) prophase II
  - E) fertilization
29. What do fungi and arthropods have in common?
- A) Both groups are commonly coenocytic
  - B) The haploid state is dominant in both groups
  - C) Both groups are predominantly saprobic in nutrition
  - D) The protective coats of both groups are made of chitin
  - E) Both groups have cell walls
30. The formation of a cell plate is beginning across the middle of a cell and nuclei are re-forming at opposite ends of the cell. What kind of cell is this?
- A) an animal cell in metaphase
  - B) an animal cell in telophase
  - C) an animal cell undergoing cytokinesis
  - D) a plant cell in metaphase
  - E) a plant cell undergoing cytokinesis

31. Which of the following statements about xylem is *incorrect*?
- A) It conducts material upward
  - B) It conducts materials within dead cells
  - C) It transports mainly sugars and amino acids
  - D) It has a lower water potential than soil does
  - E) No energy input from the plant is required for xylem transport
32. Which of the following would likely *not* contribute to the surface area available for water absorption from the soil by a plant root system?
- A) root hairs
  - B) endodermis
  - C) mycorrhizae
  - D) fungi associated with the roots
  - E) fibrous arrangement of the roots
33. Stomata open when guard cells
- A) sense an increase in  $\text{CO}_2$  in the air spaces of the leaf
  - B) flop open because of a decrease in turgor pressure
  - C) become more turgid because of an influx of  $\text{K}^+$  followed by the osmotic entry of water
  - D) close aquaporins, preventing uptake of water
  - E) accumulate water by active transport
34. \_\_\_\_\_ is to xylem as \_\_\_\_\_ is to phloem.
- A) Sclerenchyma cell; parenchyma cell
  - B) Apical meristem; vascular cambium
  - C) Vessel element; sieve-tube member
  - D) Cortex; pith
  - E) Vascular cambium; cork cambium
35. All of the following cell types are correctly matched with their functions *except*
- A) mesophyll-photosynthesis
  - B) guard cell-regulation of transpiration
  - C) sieve-tube member-translocation
  - D) vessel element-water transport
  - E) companion cell-formation of secondary xylem and phloem

36. Gymnosperms and angiosperms have the following in common *except*
- A) seeds
  - B) pollen
  - C) vascular tissue
  - D) ovaries
  - E) ovules
37. All of the following are characteristic of angiosperms *except*
- A) coevolution with animal pollinators
  - B) double internal fertilization
  - C) free-living gametophytes
  - D) styles and stigmas
  - E) fruit
38. Which of the following is a land plant that produces flagellated sperm and has a sporophyte-dominant life cycle?
- A) fern
  - B) moss
  - C) liverwort
  - D) charophycean
  - E) hornwort
39. In which of the following does the sporophyte depend on the gametophyte for nutrition?
- A) fern
  - B) moss
  - C) horsetail (*Equisetum*)
  - D) both A and C
  - E) A, B, and C
40. Plant spores give rise directly to
- A) sporophytes
  - B) gametes
  - C) gametophytes
  - D) sporophylls
  - E) seeds