

請清楚標示題號並依序作答於試卷上

I. 單選題: (每題 1.5 分, 48%) ※請作答於試卷內之「選擇題作答區」

1. A plant will begin flowering in response to changes in length of daylight, temperature, and light quality. This is an example of which unifying principle of life?
(A) Plants conduct photosynthesis. (B) Living organisms maintain homeostasis.
(C) Living organisms interact with their environment. (D) Living organisms grow and develop.
(E) Populations of organisms evolve from one generation to the next.
2. In the process of biological evolution, new species may evolve through exchange of genes from one species to another. This process is called _____.
(A) genomic sciences (B) horizontal gene transfer (C) vertical evolution
(D) vertical descent with mutation (E) proteome transfer
3. When considering nomenclature for scientific names, what is the difference between the two primates, *Homo sapiens* and *Homo erectus*?
(A) One is a primate but the other is not. (B) They are animals of a different kingdom.
(C) They are animals of a different order. (D) They are animals of a different species.
(E) They are animals of a different genus.
4. If a specimen contains 30% adenine in its DNA, how much cytosine will it contain?
(A) 40% (B) 35% (C) 30% (D) 20% (E) 15%
5. Some regions of the plasma membrane, called lipid rafts, have a higher concentration of cholesterol molecules. At higher temperatures, these regions _____.
(A) are more fluid than the surrounding membrane
(B) detach from the plasma membrane and clog arteries
(C) are less fluid than the surrounding membrane
(D) have higher rates of lateral diffusion of lipids and proteins into and out of these regions
(E) dissolve into the whole plasma membrane
6. To observe the three-dimensional structure of a cell the best type of microscopy would be
(A) standard light microscopy. (B) fluorescence microscopy.
(C) scanning electron microscopy. (D) differential-interference light microscopy.
(E) transmission electron microscopy.
7. The general structural and functional differences between a nerve and smooth muscle cell within an individual are a result of
(A) the genome (DNA in a cell) being different between muscle and nerve cells.
(B) the proteome (proteins in a cell) that differ between muscle and nerve cells.
(C) the relative amounts of certain proteins between muscle and nerve cells.
(D) the genome and the relative amounts of certain proteins that differ between muscle and nerve cells.
(E) the proteome and the relative amounts of certain proteins that differ between muscle and nerve cells
8. A fabric company wants to create a new material based on cell research for the army that is able to bear high levels of tension efficiently. What cellular structure should be the target?
(A) Microtubules (B) Microfilaments (C) Centrioles (D) Intermediate filaments (E) Pili
9. An animal cell is permeable to water and urea but not to sucrose. The inside of the cell contains 0.5 M sucrose and 0.3 M urea and the outside 0.5 M sucrose and 0.6 M urea. The volume of the cell will
(A) increase. (B) decrease. (C) be no change.

見背面

10. The route that most accurately describes secretory protein movement through the endomembrane system would be
- (A) Golgi apparatus→smooth endoplasmic reticulum →lysosome→vesicles→plasma membrane.
(B) plasmid→plasma membrane→nuclear envelope→smooth endoplasmic reticulum→vesicles.
(C) nuclear envelope→vesicles→Golgi apparatus→rough endoplasmic reticulum→plasma membrane.
(D) lysosomes→rough endoplasmic reticulum→smooth endoplasmic reticulum→vesicles →plasma membrane.
(E) rough endoplasmic reticulum→vesicles→Golgi apparatus→vesicles→plasma membrane.
11. Lysosomes digest unneeded intracellular debris through the process of _____.
- (A) endocytosis (B) phagocytosis (C) autophagy (D) pinocytosis (E) exocytosis
12. What would be an expected feature of a plasma membrane that had no integral membrane proteins? The membrane would _____.
- (A) be unable to transport sodium ions (B) collapse (C) have no fluidity
(D) have no cholesterol (E) not associate with peripheral membrane proteins
13. Which of the following statements concerning carbohydrates associated with the plasma membrane is correct?
- (A) Membrane carbohydrates function primarily in cell-cell recognition.
(B) Carbohydrates on the plasma membrane are typically short chains of between two and five monosaccharides.
(C) Carbohydrates are only found associated with the membranes of prokaryotic cells.
(D) Carbohydrates associated with the plasma membrane are located on both surfaces of the membrane.
14. Although each of the following has a better chance of influencing gene frequencies in small populations than in large populations, which one most consistently requires a small population as a precondition for its occurrence?
- (A) Mutation (B) Nonrandom mating (C) Genetic drift (D) Natural selection (E) Gene flow
15. Estrogen is a steroid hormone. What can be concluded about estrogen receptors?
- (A) The receptors would be coupled to a G-protein.
(B) The receptors would be linked to enzymes that triggered a kinase cascade.
(C) The receptors would be found inside the cell.
(D) The receptors would be on the plasma membrane.
(E) The receptors would also be lipid soluble and able to cross membranes.
16. Which of the following statements about cellular respiration is correct?
- (A) If oxygen is present, pyruvate will be converted to acetyl CoA in the mitochondrial matrix.
(B) Substrate phosphorylation occurs when protons pass through ATP synthase and combine with oxygen to make water.
(C) An H^+ electrochemical gradient is formed so that the H^+ concentration is lower in the intermembrane space than inside the matrix.
(D) Oxygen is an excellent final electron acceptor because of its low electronegativity.
(E) In prokaryotic cells, the electron transport system occurs in the mitochondria.
17. Which of the following triggers the cell's passage past the G2 checkpoint into mitosis?
- (A) PDGF (B) MPF (C) Cyclin (D) Protein kinase (E) Cdk
18. Diffusion of ions across membranes through specific ion channels is driven by _____.
- (A) active transport pumps (B) ion concentration gradients only
(C) electrical gradients only (D) ion electrochemical gradients

19. Mutations that inhibit the function of photosystem I but not photosystem II would result in a plant cell that could still generate _____.
- (A) produce O₂, ATP, and NADP⁺ (B) produce ATP and NADP⁺ (C) produce CO₂ and ATP
(D) produce O₂, ATP, and NADPH (E) produce ATP and NADPH
20. Using ¹⁴CO₂ as a radioactive tracer, which molecule would be the last to incorporate ¹⁴C within the Calvin cycle?
- (A) 3-phosphoglycerate (3PG) (B) rubisco (C) ribulose biphosphate (RuBP)
(D) 1,3-biphosphoglycerate (1,3-BPG) (E) glyceraldehyde-3-phosphate (G3P)
21. The primary advantage C₄ plants have over C₃ plants is that
- (A) C₄ plants can produce CO₂ needed for sugar production in the Calvin cycle more efficiently than C₃ plants.
(B) C₄ plants minimize photorespiration compared with C₃ plants.
(C) C₄ plants can produce sugars more efficiently than C₃ plants under cool, wet conditions.
(D) relative to C₃ plants, C₄ plants can keep their stomata open more frequently to limit water evaporation.
22. A rod exposed to light will
- (A) fire action potentials that increase its release of glutamate.
(B) depolarize due to the opening of sodium channels.
(C) hyperpolarize due to the opening of potassium channels.
(D) undergo a graded depolarization that increase its release of glutamate.
(E) undergo a graded hyperpolarization that decrease its release of glutamate.
23. If you add the plant hormone auxin to one side of a plant, the cells exposed to the auxin elongate. If you measured auxin levels in plant cells exposed to light, what you would you expect to find?
- (A) They would be lower, causing the plant to bend away from the light.
(B) They would be higher, causing the plant to bend away from the light.
(C) They would be higher, causing the plant to bend towards the light.
(D) They would be lower, causing the plant to bend towards the light.
24. A summer occupation in the Corn Belt states is de-tasseling the corn: removing unwanted male flowers so that female flowers on the same plant are pollinated by the desired pollen for the hybrid corn. What does this tell you about corn? The flowers are _____.
- (A) perfect and the plant is dioecious (B) perfect and the plant is monoecious
(C) imperfect and the plant is dioecious (D) imperfect and the plant is monoecious
25. Plant phytochromes
- (A) control vernalization. (B) change their conformation after absorbing specific lights.
(C) are involved in root elongation. (D) All of the choices are true.
26. Which of the following pairs is false?
- (A) Compatible solutes – salt stress (B) Reactive oxygen species – second messenger
(C) Thigmotropism – response to touch (D) Abscisic acid – leaf abscission in autumn
27. When plants under drought,
- (A) leaf growth is increased. (B) growth of deeper roots is increased.
(C) transpiration is increased. (D) None of the choices is true.
28. Based on ABC model, which of the following is missing when C gene is mutated?
- (A) Sepal and petal (B) Petal and carpel (C) Petal and stamen (D) Stamen and carpel
29. Which of the following is not part of the bark?
- (A) Cork (B) Cork cambium (C) Secondary xylem (D) Secondary phloem

30. Arrange the following five events in an order that explains the mass flow of materials in the phloem.

1. Water diffuses into the sieve tubes.
2. Leaf cells produce sugar by photosynthesis.
3. Solutes are actively transported into sieve tubes.
4. Sugar is transported from cell to cell in the leaf.
5. Sugar moves down the stem.

(A) 4, 2, 1, 3, 5 (B) 1, 2, 3, 4, 5 (C) 2, 4, 3, 1, 5 (D) 2, 4, 1, 3, 5

31. Water flows into the source end of a sieve tube because

- (A) sucrose has been actively transported into the sieve tube, making it hypertonic.
- (B) the companion cell of a sieve tube actively pumps in water.
- (C) sucrose has been transported out of the sieve tube by active transport.
- (D) sucrose has diffused into the sieve tube, making it hypertonic.
- (E) water pressure outside the sieve tube forces in water.

32. The specific relationship between a legume and its mutualistic *Rhizobium* strain probably depends on

- _____.
- (A) each legume having a chemical dialogue with a fungus
 - (B) each *Rhizobium* strain having a form of nitrogenase that works only in the appropriate legume host
 - (C) each legume being found where the soil has only the *Rhizobium* specific to that legume
 - (D) specific recognition between the chemical signals and signal receptors of the *Rhizobium* strain and legume species

※ 注意：請於試卷上「非選擇題作答區」內依序作答，並應註明作答之部份及其題號。

II. 解釋名詞：(每題 3 分，24%)

- | | |
|-----------------------------|---|
| 1. sinoatrial node | 5. epigenetic inheritance |
| 2. ligand-gated ion channel | 6. endomycorrhizae |
| 3. character displacement | 7. clonal selection |
| 4. monophyletic group | 8. cortical reaction (in fertilization) |

III. 簡答題 (28%)

1. Describe three common ways that tumor-suppressor genes are silenced. (6%)
2. How do birds obtain sufficient oxygen when they fly over Mount Everest where the air is thin?
(List some adaptations about their lungs and blood.) (8%)
3. Many marine birds and reptiles ingest seawater when they spend prolonged periods at sea and have no fresh water for drinking. Why can't humans survive by drinking seawater? (8%)
4. What effects can introduced species have on biological communities? (6%)

試題隨卷繳回