第一大題：選擇題 (每題 2 分，共 70 分) ※ **注意：請於試卷上「選擇題作答區」依序作答。**

1. Which organelle plays an important role in photorespiration?
   A) Etioplast
   B) Peroxisome
   C) Chromoplast
   D) Vacuole
   E) Oil body

2. Cellulose synthase is an enzyme situated in the:
   A) vacuole.
   B) chloroplasts.
   C) cell wall.
   D) mitochondria.
   E) plasma membrane.

3. Chlorophylls and carotenoid pigments are embedded in the:
   A) stroma.
   B) outer chloroplast membrane.
   C) nucleoids.
   D) thylakoid membranes.
   E) plasmalemma.

4. Proteins and polysaccharides are most likely to enter a cell by:
   A) active transport
   B) osmosis.
   C) facilitated diffusion.
   D) vesicle-mediated transport.
   E) simple diffusion.

5. Most enzymes that catalyze phosphorylation reactions require _____ as a cofactor.
   A) NAD^+
   B) Mg^{2+}
   C) Ca^{2+}
   D) AMP
   E) an iron-sulfur cluster

6. In peas, green pod color is dominant over yellow pod color. If a plant heterozygous for pod color is crossed with a plant homozygous recessive for pod color, what phenotypes would you expect in the offspring?

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A) All with green pods
B) All with yellow pods
C) Half with green pods and half with yellow pods
D) Three-quarters with green pods and 1/4 with yellow pods
E) One-quarter with green pods and 3/4 with yellow pods

7. Cytoplasmic inheritance in plants involves genes present in the:
A) cytosol only.
B) plastids only.
C) mitochondria only.
D) cytosol and plastids.
E) mitochondria and plastids.

8. In _____, a single gene has many different effects on the phenotype.
A) pleiotropy
B) continuous variation
C) epistasis
D) polygenic inheritance
E) incomplete dominance

9. Mutant forms of the ethylene receptor gene from *Arabidopsis* are inserted into plants for the purpose of:
A) increasing starch content.
B) increasing levels of β-carotene.
C) stimulating fruit ripening.
D) conferring resistance to pesticides.
E) delaying flower wilting.

10. Which of the following would be linked to a promoter to determine if a particular gene introduced into a host cell is directing the synthesis of protein?
A) *GUS*
B) *lacZ*
C) X-gal
D) *Eco*RI
E) amp^R

11. By definition, an endosymbiont is an organism that:
A) is a parasite.
B) is a phagocyte.
C) lives within another, dissimilar organism.

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D) lives within a nonliving substance.
E) forms an organelle within the cells of another organism.

12. Bryophytes are a group of organisms at the transition between:
A) brown algae and green algae.
B) fungi and plants.
C) green algae and vascular plants.
D) nonvascular and vascular plants.
E) aquatic and terrestrial plants.

13. The main tissue systems of the vascular plant are the _____ systems.
A) root and shoot
B) root, shoot, and reproductive
C) root, stem, and leaf
D) dermal, vascular, and ground
E) xylem, phloem, and ground

14. Which of the following is NOT an evolutionary trend in the vascular plants?
A) Nutritional dependency of the gametophyte on the sporophyte
B) Reduction in size of the gametophyte
C) Reduction in complexity of the gametophyte
D) Increased prominence of antheridia and archegonia
E) Decreased reliance on water for transferring sperm to egg

15. In gymnosperms, pollination occurs usually by:
A) insects.
B) water.
C) wind.
D) birds.
E) mammals.

16. Which of the following was NOT a step in the evolution of the ovule?
A) Retention of the megaspores in the megasporangium
B) Production of only four megaspore mother cells per megasporangium
C) Formation of a highly reduced endosporic megagametophyte
D) Production of only one functional megaspore per megasporangium
E) Development of the embryo within the megagametophyte

17. Microsporangia are located in the:
A) ovary.

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B) corolla.
C) locule.
D) anther.
E) filament.

18. A dioecious species has:
A) flowers with all floral whorls.
B) floral parts united with other members of the same whorl.
C) floral parts united with members of other whorls.
D) staminate and carpellate flowers on the same plant.
E) staminate and carpellate flowers on different plants.

19. In angiosperms, the ovary develops into a(n):
A) ovule.
B) seed.
C) fruit.
D) carpel.
E) perianth.

20. Which of the following is NOT an evolutionary trend among flowers?
A) From radial symmetry to bilateral symmetry
B) From four floral whorls to fewer whorls
C) From an inferior ovary to a superior ovary
D) From an indefinite number of parts to a definite number of parts
E) From an undifferentiated perianth to one differentiated into a distinct calyx and corolla

21. If you were able to walk into an opening cut into the center of a large redwood tree, when you exited from the middle of the trunk (stem) outward, you would cross, in order, _____.
A) the annual rings, new xylem, vascular cambium, phloem, and bark
B) the secondary xylem, cork cambium, phloem, and periderm
C) the vascular cambium, oldest xylem, and newest xylem
D) the secondary xylem, secondary phloem, and vascular cambium

22. The water lost during transpiration is a side effect of the plant's exchange of gases. However, the plant derives some benefit from this water loss in the form of _____.
A) increased turgor and increased growth
B) sucrose transport and increased growth
C) evaporative cooling and increased turgor
D) evaporative cooling and mineral transport

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23. Active transport involves _____.
A) diffusion of solute through the lipid bilayer of a membrane
B) pumping of solutes across the membrane
C) production of adenosine triphosphate (ATP)
D) transport of solute down a concentration gradient

24. Which of the following elements is required for the stability of cell walls?
A) zinc
B) chlorine
C) calcium
D) manganese

25. Why do plants use cotransporters instead of ion channels to transfer anions into cells?
A) Cotransporters are able to transfer anions against the membrane potential gradient, but ion channels cannot.
B) Cotransporters can transfer ions across cell membranes, but ion channels cannot transport ions across cell membranes.
C) Cotransporters are able to transfer anions against the proton gradient, but ion channels cannot.
D) Anions are too bulky to be transported by ion channels.

26. Which of the following can be sensed by plants?
I. gravity
II. pathogens
III. wind
IV. light
A) only I and III
B) only III and IV
C) only I, II, and IV
D) I, II, III, and IV

27. Plant hormones can have different effects at different concentrations. This explains how _____.
A) some plants are long-day plants, while others are short-day plants
B) signal transduction pathways in plants differ from those in animals
C) plant genes recognize pathogen genes, although plants lack an immune system
D) auxin can stimulate cell elongation in apical meristems yet inhibit the growth of axillary buds

28. In flowering plants, a mature male gametophyte contains _____.
A) two haploid gametes and a diploid pollen grain
B) a generative cell and a tube cell
C) two sperm cells and one tube cell
D) a haploid nucleus and a diploid pollen wall

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29. Based on the *ABC* model, what would be the structure of a flower from the outermost whorl that had normal expression of genes *A* and *C* and expression of gene *B* in all four whorls?
A) carpel–petal–petal–carpel
B) petal–petal–stamen–stamen
C) sepal–carpel–carpel–sepal
D) sepal–sepal–carpel–carpel

30. Substrate-level phosphorylation occurs _____.
A) in glycolysis
B) in the citric acid cycle
C) in both glycolysis and the citric acid cycle
D) during oxidative phosphorylation

31. The chemiosmotic hypothesis is an important concept in our understanding of cellular metabolism in general because it explains _____.
A) how ATP is synthesized by a proton motive force
B) how electron transport can fuel substrate-level phosphorylation
C) the sequence of the electron transport chain molecules
D) the reduction of oxygen to water in the final steps of oxidative metabolism

32. Even though plants cells photosynthesize, they still use their mitochondria for oxidation of pyruvate. This will occur in _____.
A) photosynthetic cells in the light, while photosynthesis occurs concurrently
B) cells that are storing glucose only
C) all cells all the time
D) photosynthesizing cells in the light and in other tissues in the dark

33. When oxygen is released as a result of photosynthesis, it is a direct by-product of _____.
A) splitting water molecules
B) chemiosmosis
C) the electron transfer system of photosystem I
D) the electron transfer system of photosystem II

34. Some botanists argue that the entire plant should be considered as a single unit rather than a composite of many individual cells. Which of the following cellular structures best supports this view?
A) cell wall
B) cell membrane
C) vacuole
D) plasmodesmata

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35. Which process is most directly driven by light energy?
A) creation of a pH gradient by pumping protons across the thylakoid membrane
B) carbon fixation in the stroma
C) reduction of $NADP^+$ molecules
D) removal of electrons from chlorophyll molecules

第二大題：問答題 (共 30 分)

※ 注意：請於試卷上「非選擇題作答區」標明大題及小題題號，並依序作答。

1. 被子植物果實在演化適應上具有多樣性，請描述果實與種子依靠動物傳播所特化出的形式及方法，並舉例說明之。(10 分)

2. 水 (H_2O) 是地球上所有生物不可或缺的物質，更是植物生長所必需的三要素之一，因此水資源一直是每種生物自古以來爭相取得的。請回答以下與"水"有關的問題。
2-1 (1) 請寫出兩項水分子對於生物很重要的物理或化學特性。(2) 根據前一小題的答案，說明這樣的特性對於植物生長與發育有何重要性? (10 分)
2-2 甚麼因子決定水在生物體內流動的方向? (2 分)
2-3 如果將一棵原本長在正常土壤的植物，移到海邊的沙地上，植物根細胞內的水分，會往哪裡移動? 為什麼? (4 分)
2-4 既然水那麼重要，為何有時會看到淹水的時候，植物反而枯萎? 請說明你的理由。(4 分)

試題隨卷繳回