

※ 本大題請於試卷內之「選擇題作答區」依序作答。

第 1~30 題：每題 2 分

1. Which of the following is NOT an attribute of living things?
 - a. Populations of living things evolve.
 - b. All livings require oxygen.
 - c. All living things use DNA as their genetic material.
 - d. They convert energy from one form to another.
 - e. All living things maintain complexity of order.
2. Compared with ^{31}P , the radioactive isotope ^{32}P has
 - a. one more electron.
 - b. one more proton.
 - c. a different atomic number.
 - d. a different charge
 - e. one more neutron.
3. The absorption of human-generated CO_2 by the oceans _____.
 - a. increases the hydrogen ion concentration in the oceans but decreases the carbonate ion concentration and threatens the livability of the oceans for calcifying organisms.
 - b. reduces the carbonate ion concentration in the oceans and threatens calcifying organisms in marine ecosystems.
 - c. increases the oceanic concentration of carbonic acid.
 - d. increases the oceans' acidity and pH.
 - e. All of the listed responses are correct.
4. System biology is mainly an attempt to
 - a. understand the behavior of entire biological systems.
 - b. build high-throughput machines for the rapid acquisition of biological data.
 - c. simplify complex problems by reducing the system into smaller, less complex units.
 - d. analyze genomes from different species.
 - e. speed up the technological application of scientific knowledge.
5. The enzyme amylase can break glycosidic linkages between glucose monomers. Which of the following could amylase break down?
 - a. cellulose and chitin.

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- b. glycogen and cellulose.
 - c. starch, amylopectin, and cellulose.
 - d. starch and chitin.
 - e. glycogen, starch, and amylopectin.
6. Which structure is not part of the endomembrane system?
- a. nuclear envelope
 - b. chloroplast
 - c. plasma membrane
 - d. Golgi apparatus
 - e. ER
7. According to the fluid mosaic model of membrane structure, proteins of the membrane are mostly
- a. randomly oriented in the membrane, with no fixed inside-outside polarity.
 - b. embedded in a lipid bilayer.
 - c. free to depart from the fluid membrane and dissolve in the surrounding solution.
 - d. confined to the hydrophobic interior of the membrane.
 - e. spread in a continuous layer over the inner and outer surfaces of the membrane.
8. If an enzyme is added to a solution where its substrate and product are in equilibrium, what will occur?
- a. The reaction will change from endergonic to exergonic.
 - b. Additional substrate will be formed.
 - c. Nothing; the reaction will stay at equilibrium.
 - d. Additional product will be formed.
 - e. The free energy of the system will change.
9. Which metabolic pathway is common to both fermentation and cellular respiration of a glucose molecule?
- a. glycolysis
 - b. synthesis of acetyl CoA from pyruvate
 - c. the electron transport chain
 - d. the citric acid cycle
 - e. reduction of pyruvate to lactate
10. How is photosynthesis similar in C_4 plants and CAM plants?
- a. In both cases, only photosystem I is used.

- b. In both cases, thylakoids are not involved in photosynthesis.
 - c. In both cases, rubisco is not used to fixed carbon initially.
 - d. Both types of plants make sugar without the Calvin cycle.
 - e. Both types of plants make most of their sugar in the dark.
11. Which of the following sequences correctly represents the flow of electrons during photosynthesis?
- a. $H_2O \rightarrow NADPH \rightarrow$ Calvin cycle
 - b. $H_2O \rightarrow$ photosystem I \rightarrow photosystem II
 - c. $NADPH \rightarrow$ chlorophyll \rightarrow Calvin cycle
 - d. $NADPH \rightarrow$ electron transport chain $\rightarrow O_2$
 - e. $NADPH \rightarrow O_2 \rightarrow CO_2$
12. Apoptosis involves all but which of the following?
- a. lysis of the cell
 - b. cell-signaling pathways
 - c. activation of cellular enzymes
 - d. fragmentation of the DNA
 - e. digestion of cellular contents by scavenger cells
13. Protein phosphorylation is commonly involved with all of the following except
- a. activation of G protein-coupled receptors.
 - b. enzyme activation.
 - c. activation of receptor tyrosine kinases.
 - d. activation of protein kinase molecules.
 - e. regulation of transcription by extracellular signaling molecules.
14. Through a microscope, you can see a cell plate beginning to develop across the middle of a cell and nuclei forming on either side of the cell plate. This cell is most likely
- a. an animal cell in the S phase of the cell cycle.
 - b. a plant cell in the process of cytokinesis.
 - c. a bacterial cell dividing.
 - d. an animal cell in the process of cytokinesis.
 - e. a plant cell in metaphase.
15. Vinblastine is a standard chemotherapeutic drug used to treat cancer. Because it interferes with the assembly of micro-tubules, its effectiveness must be related to
- a. inhibition of regulatory protein phosphorylation.

- b. inhibition of DNA synthesis.
 - c. myosin denaturation and inhibition of cleavage furrow formation.
 - d. suppression of cyclin production.
 - e. disruption of mitotic spindle formation.
16. One difference between cancer cells and normal cells is that cancer cells
- a. are arrested at the S phase of the cell cycle.
 - b. are always in the M phase of the cell cycle.
 - c. are unable to synthesize DNA.
 - d. continue to divide even when they are tightly packed together.
 - e. cannot function properly because they are affected by density-dependent inhibition.
17. Which life cycle stage is found in plants but not animals?
- a. unicellular diploid
 - b. multicellular haploid
 - c. multicellular diploid
 - d. gamete
 - e. zygote
18. If the DNA content of a diploid cell in the G1 phase of the cell cycle is x, then the DNA content of the same cell at the metaphase of meiosis I would be
- a. 2x.
 - b. x.
 - c. 4x.
 - d. 0.5x.
 - e. 0.25x.
19. In analyzing the number of different bases in a DNA sample, which result would be consistent with the base-pairing rules?
- a. $A = G$
 - b. $A + G = C + T$
 - c. $A + T = G + T$
 - d. $A = C$
 - e. $G = T$
20. *E. coli* cells grown on ^{15}N medium are transferred to ^{14}N medium and allowed to grow for two more generations (two rounds of DNA replication). DNA extracted from these cells is centrifuged. What density distribution of DNA would you expect in this experiment?

- a. one intermediate-density band
 - b. one low-density band
 - c. one low-density and one intermediate-density band
 - d. one high-density and one intermediate-density band
 - e. one high-density and one low-density band
21. Which of the following is *not* true of a codon?
- a. It may code for the same amino acid as another codon.
 - b. It consists of three nucleotides.
 - c. It extends from one end of a tRNA molecule.
 - d. It never codes for more than one amino acid.
 - e. It is the basic unit of the genetic code.
22. Most of the growth of a plant body is the result of
- a. morphogenesis.
 - b. cell differentiation.
 - c. reproduction.
 - d. cell division.
 - e. cell elongation.
23. Heartwood and sapwood consist of
- a. secondary phloem.
 - b. periderm.
 - c. bark.
 - d. secondary xylem.
 - e. cork.
24. The phase change of an apical meristem from the juvenile to the mature vegetative phase is often revealed by
- a. the activation of floral meristem identity genes.
 - b. a change in the morphology of the leaves produced.
 - c. the formation of lateral roots.
 - d. a change in the orientation of preprophase bands and cytoplasmic microtubules in lateral meristems.
 - e. the initiation of secondary growth.
25. "Golden Rice"
- a. is resistant to various herbicides, making it practical to weed rice fields with those herbicides.
 - b. contains daffodil genes that increase vitamin A content.

- c. produces larger, golden grains that increase crop yields.
 - d. includes bacterial genes that produce a toxin that reduces damage from insect pests.
 - e. is resistant to a virus that commonly attacks rice fields.
26. Which statement concerning grafting is correct?
- a. Stocks come from vines, but scions come from trees.
 - b. Stocks and scions refer to twigs of different species.
 - c. Stocks provide root systems for grafting.
 - d. Grafting creates new species.
 - e. Stocks and scions must come from unrelated species.
27. The hormone that helps plants respond to drought is
- a. auxin.
 - b. ethylene.
 - c. cytokinin.
 - d. gibberellin.
 - e. abscisic acid.
28. The signaling molecule for flowering might be released earlier than usual in a long-day plant exposed to flashes of
- a. red light during the night.
 - b. far-red light during the night.
 - c. red light followed by far-red light during the night.
 - d. red light during the day.
 - e. far-red light during the day.
29. Which of the following is common to the development of both birds and mammals?
- a. trophoblast
 - b. epiblast and hypoblast
 - c. holoblastic cleavage
 - d. gray crescent
 - e. yolk plug
30. Patients with damage to Wernicke's area have difficulty
- a. coordinating limb movement.
 - b. recognizing faces.
 - c. generating speech
 - d. experiencing emotion.

e. understanding language.

簡答題：每題 10 分

1. Using barley aleurone tissues as an example, explain how hormones are able to switch genes on and off.
2. Describe the photoconversion reactions of phytochrome. Use these reactions to explain why a lettuce seed exposed first to red light and then to far-red light will not germinate.
3. What is a reporter gene? Use an example to demonstrate why reporter genes are useful in genetic engineering.
4. Suppose that genes X , Y , and Z are linked and that crossing-over occurs between X and Y 20 percent of the time, between Y and Z 30 percent of the time, and between X and Z 10 percent of the time. Which genes are farthest apart on the chromosome? Explain it.

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