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科目： 普通生物學(A)
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國立臺灣大學 114 學年度碩士班招生考試試題

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一、 選擇題（四選一，每題 2 分，共 40 題 80 分）請回答問題或填空
※ 注意：請於試卷內之「選擇題作答區」依序作答。

1. The expression and transformation of genetic information is through the Central Dogma. Which of the following is the correct flow?
 - A. Protein-RNA-DNA
 - B. DNA-Protein-RNA
 - C. RNA-DNA-Protein
 - D. DNA-RNA-Protein
2. Controlled experiments are required for performing experiments. To test the toxicity of a chemical on cell viability, which of the following treatments is the most proper control treatment? The chemical is dissolved in 0.1% DMSO and added 1 μL into 3 mL of cells.
 - A. Add nothing to the cells.
 - B. Add 1 μL water to the cells.
 - C. Add 1 μL of 0.1% DMSO to the cells.
 - D. Add 1 μL of 1% DMSO to the cells.
3. Which of the following is not a nucleic acid component?
 - A. Nitrogenous base
 - B. Sugar
 - C. Phosphate group
 - D. None of the above
4. ATP has three phosphate groups which can be hydrolyzed to provide free energy. Which of the following phosphates is first hydrolyzed to make ADP?
 - A. α
 - B. β
 - C. γ
 - D. None of the above
5. Which of the following organelles is critical to the production of ATP?
 - A. Ribosome
 - B. Golgi apparatus
 - C. Lysosome
 - D. Mitochondrion
6. Which of the following is not a component or attached to the cell plasma membrane?
 - A. Phospholipid
 - B. Glycoprotein
 - C. Cholesterol
 - D. Nucleic acid
7. Mating yeast cells communicate with each other by which of the following.
 - A. Secreted factors
 - B. Cell-cell contact
 - C. Electric signal
 - D. None of the above
8. Cyclic AMP is one of the well-known second messengers. How does it transmit the signals?
 - A. Degrading into AMP
 - B. Binding to molecules containing cAMP-binding sites.
 - C. Translocating to the nucleus

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- D. All of the above
9. Which of the following reactions produces more ATP per cycle?
- A. Fermentation
 - B. The Citric Acid Cycle
 - C. Glycolysis
 - D. Oxidative phosphorylation
10. Which of the following is the key component of a mitotic spindle
- A. Actin
 - B. Tubulin
 - C. Lipid
 - D. carbohydrate
11. Which of the following enzymes is used to synthesize an RNA primer at the 5' end of the leading strand?
- A. Helicase
 - B. Topoisomerase
 - C. Primase
 - D. DNA ligase
12. The 5' cap and poly-A tail share which of the following functions.
- A. Facilitating the export of the mature mRNA from the nucleus
 - B. Triggering mRNA degradation
 - C. Assisting RNA splicing
 - D. None of the above
13. Which of the following cell types provides the most effective nuclei for a nuclear transplantation experiment to produce a cloned lamb?
- A. Blastomeres of a 4-cell stage embryo
 - B. 256-cell stage embryos
 - C. Skin fibroblast cells
 - D. None of the above
14. Which of the following moves DNA within a genome through an RNA intermediate?
- A. Transposon
 - B. Retrotransposon
 - C. Spliceosome
 - D. All of the above
15. Which of the following is usually with a large size or high abundance?
- A. Foundation species
 - B. Keystone species
 - C. Ecosystem engineers
 - D. None of the above
16. Which of the following is false about the virus?
- A. Viruses can replicate by themselves.
 - B. Viruses can insert their genes into the host genome.
 - C. Viruses can infect other cells by budding from the host cell.
 - D. None of the above
17. Monoclonal antibodies differ from polyclonal antibodies because (Which of the following is false?)
- A. monoclonal antibodies can only recognize a specific antigenic determinant on a given antigen.
 - B. they can both be collected from serum.
 - C. monoclonal antibodies need to generate and select hybridoma.

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D. monoclonal antibodies have an unlimited supply.

18. Sperm-containing enzymes are required to digest the egg's jelly coat during fertilization. Where are those enzymes stored in a sperm?
- A. Plasma membrane
 - B. acrosome
 - C. middle piece
 - D. head cytosol
19. What gene is most critical to drive segmentation patterning in fruitflies?
- A. calmodulin
 - B. Wnt
 - C. homeotic genes
 - D. Toll-like receptors
20. What ion causes the contraction of a skeletal muscle?
- A. Calcium
 - B. Chloride
 - C. Magnesium
 - D. Sodium
21. A plant that grows one year, without flowering, and then grows again the following year and produces flowers before it dies is described as which of the following?
- A. a biennial
 - B. not very fit
 - C. a perennial
 - D. an annual
22. In which of the following structures of a plant are apical meristems found?
- A. only in roots
 - B. only in shoots
 - C. in both roots and shoots
 - D. in pollen
23. In addition to seeds, which of the following characteristics is unique to seed-producing plants?
- A. Pollen
 - B. lignin present in cell walls
 - C. megaphylls
 - D. sporopollenin
24. Which of the following functions is an advantage of seeds compared to spores?
- A. using wind as a dispersal agent
 - B. relying on animals for pollination
 - C. providing nutrition for animals
 - D. containing a nutrient store for a developing sporophyte
25. If you were shipping green bananas to a supermarket thousands of miles away, removing which of the following chemicals from the plants' environment will best prevent premature fruit ripening?
- A. Auxin
 - B. Ethylene
 - C. Cytokinins
 - D. carbon dioxide
26. Immature seed cones of conifers are usually green before pollination, and flowers of grasses are inconspicuously colored. What does this indicate about how they are pollinated?

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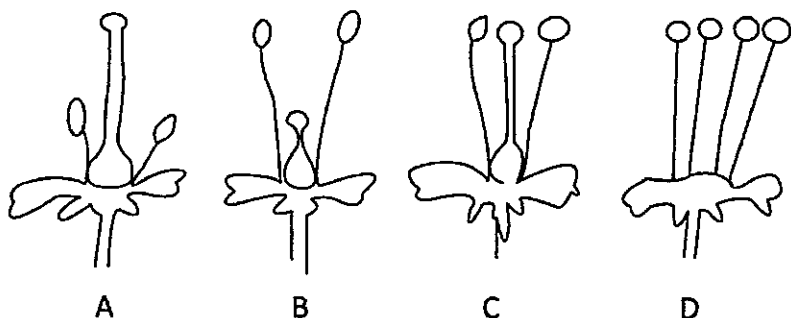
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- A. Their pollinating insects are probably color blind.
B. They probably attract pollinators using strong fragrances.
C. They probably self-fertilize and do not need pollen carried from one plant to another.
D. They are probably wind pollinated.
27. Which of the following problems will likely increase if the human population continues to increase?
A. increase in disease-causing organisms
B. reduction in available medicines
C. reduction in plant and animal diversity
D. decrease in global temperature
28. Which of the following could best be investigated by measuring fruit production in plants?
A. primary productivity
B. pollination success
C. phototropism
D. seed dispersal success
29. Auxins frequently interact with other plant hormones to cause a particular process. Which of the following processes is attributed ONLY to auxin?
A. apical dominance
B. phototropism
C. fruit development
D. xylem differentiation
30. Which of the following is the best argument for pursuing plant biotechnology?
A. Genetically modified (GM) plants can provide greater plant productivity on the same amount of land.
B. Genetic engineering can make it easier to overcome pollination incompatibility.
C. GM plants can reduce reliance on imported oil.
D. Genetic engineering can decrease genetic diversity of crop plants making them more fit for their environment.
31. If a long-day plant has a critical night length of 9 hours, which 24-hour cycle would prevent flowering?
A. 14 hours light/10 hours dark
B. 4 hours light/8 hours dark/4 hours light/8 hours dark
C. 8 hours light/8 hours dark/light flash/8 hours dark
D. 16 hours light/8 hours dark
32. Two evolutionarily unrelated plant species may live within the same type of biome but on different continents. Which of the following mechanisms would most likely result in these two species having similar traits?
A. gene flow
B. convergent evolution
C. introgression
D. allopatric speciation
33. Which of the flowers diagramed below is most likely to be self-compatible?



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- A. A
- B. B
- C. C
- D. D

34. Which elements are most often the limiting nutrients for plant growth?

- A. nitrogen, oxygen, hydrogen
- B. carbon, sodium, chlorine
- C. nitrogen, potassium, phosphorus
- D. carbon, nitrogen, oxygen

35. The feeding relationships among the species in a community determine the community's _____.

- A. ecological niche
- B. secondary succession
- C. trophic structure
- D. species richness

36. Using the symbols +, -, and 0 to indicate interspecific species interactions, where the first symbol refers to the first organism mentioned, what interactions exist between mycorrhizae and evergreen tree roots?

- A. +/-
- B. 0/0
- C. +/0
- D. +/+

37. Which of the following causes populations to shift most quickly from an exponential to a logistic population growth model?

- A. removal of predators
- B. decreased death rate
- C. competition for resources
- D. favorable climatic conditions

38. Which of the following features permits a gene to act as a molecular clock?

- A. a reliable average rate of mutation
- B. a large number of base pairs
- C. a recent origin by a gene-duplication event
- D. being acted upon by natural selection

39. Your professor wants you to construct a phylogenetic tree of a type of plant called orchids. She gives you tissue from seven orchid species and one lily plant. What is the most likely reason she gave you the lily?

- A. to see if the lily is an ancient orchid species
- B. to demonstrate likely genetic similarities
- C. to see if the lily and the orchids show all the same shared derived characters
- D. to serve as an outgroup

40. No two people are genetically identical, except for identical twins. The main source of genetic variation among humans is _____.

- A. genetic drift
- B. environmental effects
- C. new mutations that occurred in the preceding generation
- D. the reshuffling of alleles in sexual reproduction

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二、 簡答題 (每題 5 分，共 4 題 20 分)

※ 注意：請於試卷內之「非選擇題作答區」作答，並應註明作答之題號。

1. If you aim to study the function of a gene in brain development, which model organism would you choose, and what experiments would you conduct to demonstrate the gene's function?
2. Please describe what is an action potential, including depolarization, hyperpolarization, and repolarization. Please indicate the major ion driving the change in membrane potential in each phase.
3. Given the latitudinal differences in sunlight intensity, how might you expect the carrying capacity of plant species found at the equator to compare with that of plant species found at high latitudes?
4. What is a biodiversity hot spot?

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