

系所組別： 生命科學系、生物多樣性研究所、環境醫學研究所甲組

考試科目： 普通生物學、生物學

考試日期： 0308, 節次： 3

※ 考生請注意：本試題 可 不可 使用計算機

選擇題 (46 分, 每題 2 分)

- Of the followings, which one is not Darwin's theories?
A) Natural selection. B) Gradualism. C) Survival of the fittest.
D) Pangenesis. E) Descent with modification.
- In a population of 8100 individuals, 9 were born with PKU disease. There are two alleles at the gene. Given Hardy-Weinberg equilibrium, of the following which is correct?
A) Frequency of the recessive allele = 0.0005.
B) Frequency of the heterozygote = 0.0638.
C) Frequency of the dominant allele = 0.8100.
D) Frequency of dominant homozygote = 0.9980.
E) Expected number carrying heterozygote is 2493.2.
- Of the evolutionary forces, which would cause random changes of gene frequencies between generations?
A) Interspecific hybridization. B) Random mating. C) Mutation.
D) Genetic drift. E) Natural selection.
- Rapidly changing environments generally are favorable to
A) K-selected species.
B) Species that reproduce numerous times in their lives.
C) Small body-sized species.
D) Species that practice exploitative competition.
E) All the above.
- Areas with low primary production include
A) Estuaries. B) Tundra. C) Desert.
D) Coral reefs. E) A and B.
- You are trying to identify an organism. It is an animal, but it does not have nerve or muscle tissue. It is *neither* diploblastic nor triploblastic. It is probably a
A) Flatworm. B) Jelly. C) Comb jelly.
D) Sponge. E) Nematode.
- An arthropod has all the following characteristics *except*
A) Protostome development. B) Bilateral symmetry. C) A pseudocoelom.
D) Three embryonic germ layers. E) An open circulatory system.
- A stalked, sessile marine organism has several feathery feeding structures surrounding an opening through which food enters. The organism could potentially be a cnidarian, a lophophorate, a tube-dwelling worm, a crustacean, or an echinoderm. Finding which of the following in this organism would allow the greatest certainty of identification?
A) The presence of what seems to be radial symmetry.
B) A hard covering made partly of calcium carbonate.
C) A digestive system with mouth and anus separate from each other.
D) A water vascular system. E) A nervous system.

(背面仍有題目, 請繼續作答)

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9. Which of the following is the main reason why bird lungs are more efficient at extracting oxygen from air than the best mammalian lungs?
- A) Air passes through the bird lung under pressure, "supercharging" the blood with oxygen.
 - B) Because of the air sac system, each breath of air passes through the bird lung twice.
 - C) The bird lung has a higher surface area and capillary density than the lung of a mammal of the same size.
 - D) The bird lung has no residual volume because it is composed of tiny tubes through which air passes in only one direction.
 - E) None of the choices are correct.
10. Which of these carries the most highly oxygenated blood?
- A) Right atrium.
 - B) Anterior vena cava.
 - C) Posterior vena cava.
 - D) Pulmonary veins.
 - E) Pulmonary arteries.
11. Which of the following choices best describes the life history of a plasma cell?
- A) It is generated by multiplication of a B cell in response to an antigen and lives several months.
 - B) It is present before an antigen appears and multiplies in response to it.
 - C) It is produced during a primary immune response, persists, and multiplies in response to a reappearance of the antigen.
 - D) It is generated from bone marrow stem cells in response to an antigen and lives about a week.
 - E) It is generated by multiplication of a B cell in response to an antigen and lives several days.
12. The way that cells behave during pattern formation is most like
- A) The blending together of different paints to form a new paint color.
 - B) Mixing together ingredients to bake cookies.
 - C) Washing clothes to remove the dirt and stains that are not wanted.
 - D) A person finding their way home by noticing familiar sights and sounds.
 - E) Mowing the grass in a yard to trim back the growth and keep a pretty regular grass thickness.
13. Which of the following is/are mostly involved in the regulation of salt and water balance?
- A) Androgens.
 - B) Glucocorticoids.
 - C) Mineralocorticoids.
 - D) Melatonin.
 - E) Oxytocin.
14. How do action potentials relay different intensities of information?
- A) By changing in amplitude relative to the strength of the stimulus.
 - B) By changing in duration relative to the strength of the stimulus.
 - C) By changing in speed of travel relative to the strength of the stimulus.
 - D) By changing in frequency relative to the strength of the stimulus.
 - E) By changing in shape relative to the strength of the stimulus.
15. To create recombinant DNA with long-term stability, it is necessary to have which of the following in the test tube?
- A) Hydrogen bonding.
 - B) DNA ligase.
 - C) Reverse transcriptase.
 - D) DNA polymerase.
 - E) Heat-resistant DNA polymerase.

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16. The dideoxynucleotide chain-termination method _____.
- A) Produces a ladder of DNA fragments, with each individual band labeled with one of four different fluorescent tags.
 - B) Can be used to sequence entire eukaryotic chromosomes in a single reaction.
 - C) Is very slow, requiring several weeks to determine a sequence of about 200 nucleotides.
 - D) Does not involve electrophoresis.
 - E) Is difficult to automate and must be performed under close human supervision.
17. There is about 1,000 times as much DNA in a human cell as in an *E. coli* cell, but only about 10 times as many genes. What accounts for this discrepancy?
- A) A human cell has much more noncoding DNA.
 - B) The DNA packing is much more complex in a prokaryotic cell.
 - C) Most of the genes in a human cell are turned off.
 - D) *E. coli* bacteria are less able to respond to their environment than humans.
 - E) Human cells are much larger than *E. coli* cells.
18. The translation process in eukaryotes requires all of the following, **except** _____.
- A) Ribosomes.
 - B) RNA polymerase.
 - C) Aminoacyl-tRNA synthetase enzymes.
 - D) Transfer RNA.
 - E) AUG codons.
19. Which is a key difference between gene expression in eukaryotic and prokaryotic cells?
- A) In prokaryotes, proteins are assembled directly from DNA.
 - B) RNA polymerases are involved only in initiation in eukaryotes.
 - C) In prokaryotic cells, the mRNA transcript is immediately available as mRNA without processing.
 - D) In eukaryotic cells, transcribed RNA sequences function as termination signals.
 - E) Prokaryotes do not contain ribosomes.
20. When a cell in S phase is fused with a cell in G₁, _____.
- A) DNA synthesis begins immediately in the original G₁ nucleus.
 - B) The replication of DNA occurring in the original S nucleus is terminated.
 - C) The two nuclei fuse and further division is arrested.
 - D) The chromosomes of the original G₁ nucleus condense in preparation for mitosis.
 - E) The original G₁ cell will divide immediately.
21. Observations of cancer cells in culture support the hypothesis that cancer cells _____.
- A) Do not exhibit density-dependent inhibition.
 - B) Produce molecules that inhibit the growth factors required for cell division.
 - C) Exhibit anchorage dependence.
 - D) Spend the majority of their time in the G₀ phase.
 - E) Do all of the above.

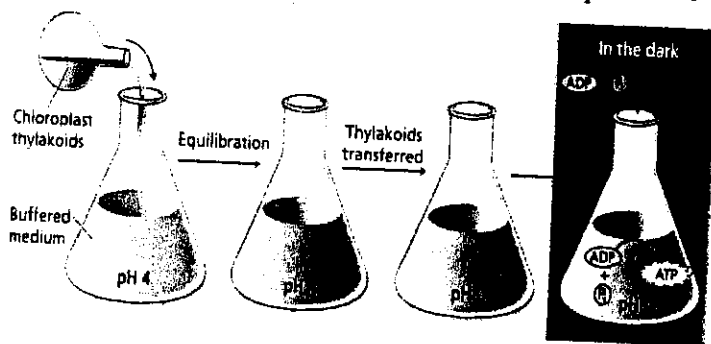
(背面仍有題目,請繼續作答)

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22. Which of the following are likely to limit the maximum size of a cell?
- The time it takes a molecule to diffuse across a cell.
 - The cell's surface-to-volume ratio.
 - The presence of a nucleus in the cell.
 - The first two answers are correct.
 - The first three answers are correct.
23. Which one of the following organelles is **unlikely** to show enhanced abundance in the pancreatic cells that secrete large amounts of digestive enzymes?
- Rough endoplasmic reticulum.
 - Free cytoplasmic ribosomes.
 - Golgi apparatus.
 - Transport vesicles.
 - All of the above will increase in pancreatic cells secreting digestive enzymes.

簡答題 (54 分)

- What is "flower" in a general concept? (3%)
- What is the major function of the cambium in a vascular plant? (3%)
- What are the two key events in the life cycle of Angiosperms? (4%)
- Please define 'natural selection' (4%)
- Define "**succession**" in an ecological context, and distinguish the difference between **primary succession** and **secondary succession**? (6%)
- What characteristics do hagfishes have lancelets and tunicates lack? (3%)
- Please describe two adaptations that have enabled insects to thrive on land. (2%)
- If the ventral cells of an early frog gastrula are experimentally induced to express large amounts of a protein that inhibits BMP-4, could a second embryo develop? Explain. (4%)
- Why is it easier to identify mutations affecting courtship than those affecting other essential behaviors? (4%)
- The following diagram represents an experiment with isolated chloroplast thylakoids. The thylakoids were first equilibrated with an acidic solution (pH 4), then treated with a basic solution (pH 8) before transferred to dark. Please **explain** why ATP can be generated in the dark when ADP and Pi were added to the chloroplast thylakoid solution? Why the experiment was kept under dark? (5%)



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11. Light-induced de-etiolating (greening) of potato shoots is the best example how light can trigger morphology and physiology changes of plant. Can you describe how plant detects light change and elicit a response? (5%)
12. For cellular respiration to generate ATP, what are the main three steps? Where do these steps occur inside the cell? (6%)
13. What are the main functions of membrane proteins? Please give 5 examples. (You can draw cartoons) (5%)