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

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選擇題 (46 分，每題 2 分)

1. 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.

2. 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.

3. 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.

4. 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.

5. Areas with low primary production include
   A) Estuaries. B) Tundra. C) Desert.
   D) Coral reefs. E) A and B.

6. 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.

7. 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.

8. 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 G_1, _____.
A) DNA synthesis begins immediately in the original G_1 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 G_1 nucleus condense in preparation for mitosis.
E) The original G_1 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 G_0 phase.
E) Do all of the above.

(背面仍有題目，請繼續作答)

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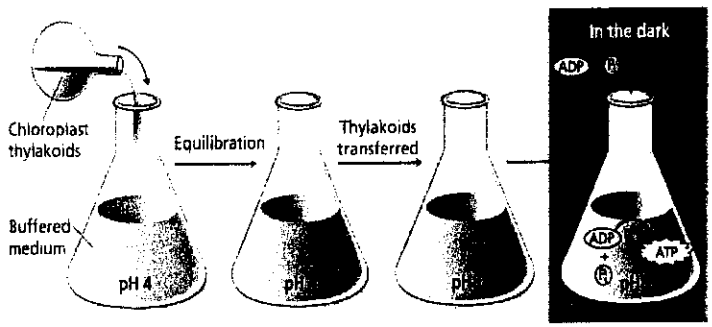
22. Which of the following are likely to limit the maximum size of a cell?
A) The time it takes a molecule to diffuse across a cell.
B) The cell's surface-to-volume ratio.
C) The presence of a nucleus in the cell.
D) The first two answers are correct.
E) The first three answers are correct.

23. Which one of the following organelles is **unlikely** to show enhanced abundance in the pancreatic cells that secrete large amounts of digestive enzymes?
A) Rough endoplasmic reticulum.
B) Free cytoplasmic ribosomes.
C) Golgi apparatus.
D) Transport vesicles.
E) All of the above will increase in pancreatic cells secreting digestive enzymes.

簡答題 (54 分)

1. What is "flower" in a general concept? (3%)
2. What is the major function of the cambium in a vascular plant? (3%)
3. What are the two key events in the life cycle of Angiosperms? (4%)
4. Please define 'natural selection' (4%)
5. Define "**succession**" in an ecological context, and distinguish the difference between **primary succession** and **secondary succession**? (6%)
6. What characteristics do hagfishes have lancelets and tunicates lack? (3%)
7. Please describe two adaptations that have enabled insects to thrive on land. (2%)
8. 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%)
9. Why is it easier to identify mutations affecting courtship than those affecting other essential behaviors? (4%)
10. 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%)