

本試題是否可以使用計算機: 可使用, 不可使用 (請命題老師勾選)

[I] Selection the best one, 80%

1. Eukaryotic cells are typically larger than prokaryotic cells because
(A) their plasma membrane has more control over the movement of materials into the cell.
(B) their internal membrane system allows compartmentalization of functions and extra surface area for nutrient exchange and placement of enzymes. (C) their DNA is localized in the nucleus, whereas protein synthesis occurs in the cytoplasm, separating these competing functions. (D) they have more chromosomes and a mitotic process of cell division. (E) they have a cytoskeleton composed of microtubules and microfilaments.
2. Which of the following would likely move through the lipid bilayer of a plasma membrane most rapidly?
(A) CO₂ (B) an amino acid (C) glucose (D) K⁺ (E) starch
3. Two similar-sized animal cells are placed in a 0.5% sucrose solution. Cell A enlarges in size for a while, then stops; cell B continues to enlarge and finally ruptures. Which of the following was true at the beginning of the experiment?
(A) Cell A was hypotonic to the solution and cell B was hypertonic. (B) Cell A was hypertonic to the solution and cell B was hypotonic. (C) Cell A was hypertonic to cell B. (D) Cell A and B were isotonic to each other. (E) Cells A and B were isotonic to each other.
4. The direct energy source that drives ATP synthesis during respiratory oxidative phosphorylation is
(A) oxidation of glucose to CO₂ and water. (B) the thermodynamically favorable flow of electrons from NADH to the mitochondrial electron transport carriers. (C) the final transfer of electrons to oxygen. (D) the difference in H⁺ concentrations on opposite sides of the inner mitochondrial membrane. (E) thermodynamically favorable transfer of phosphate from glycolysis and Krebs cycle intermediate molecules of ADP.
5. You have a friend who lost 15 pounds of fat on a diet. Where did the fat go (how was it lost)?
(A) It was released as CO₂ and H₂O. (B) Chemical energy was converted to heat and then released. (C) It was converted to ATP, which weight much less than fat. (D) It was broken down to amino acids and eliminated from the body. (E) It was converted to urine and eliminated from the body.
6. Which of the following is NOT a useful function of the light reactions?
(A) releasing oxygen for photorespiration (B) splitting water (C) synthesis of NADPH

(背面仍有題目, 請繼續作答)

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- (D) harvesting photons of light (E) converting light energy to chemical energy
7. You are a research scientist studying photosynthesis. In an experiment performed during the day, you provided a new plant, just discovered in South America, with radioactive carbon (^{14}C) dioxide as a metabolic tracer. The ^{14}C is incorporated first into oxaloacetic acid. The plant is best characterized as
(A) a C_4 plant. (B) a C_3 plant. (C) a CAM plant. (D) a heterotroph. (E) a chemoautotroph.
8. The signaling system in an animal cell lacking the ability to produce GTP
(A) would not be able to activate and inactivate the G protein on the cytoplasmic side of the plasma membrane. (B) could active only the epinephrine system. (C) was discovered by Sutherland, who won the Nobel Prize for this work. (D) would be able to carry out reception and transduction, but would not be able to respond to a signal.
9. Measurements of the amount of DNA per nucleus were taken on a large number of cells from a growing fungus. The measured DNA levels ranged from 3 to 6 picograms per nucleus. One nucleus had 5 picograms of DNA. What stage of the cell was this nucleus in?
(A) G_0 (B) G_1 (C) S (D) G_2 (E) M
10. A cell has a diploid chromosome number of $2n=4$. We will designate these four as chromosomes A, B, C, and D. If meiosis occurred WITH the formation of homologous pairs AC and BD, and the chromosomes were then distributed randomly between the resulting cells, how many gametes could be formed?
(A) 2 (AB and CD) (B) 3 (AB, BC and CD) (C) 4 (AB, AD, BC and CD) (D) 5 (AB, AC, AD, BC and CD) (E) 6 (AB, AC, AD, BC, BD and CD)
11. How many unique gametes could be produced through independent assortment by an individual with the genotype $AaBbCCDdEE$?
(A) 4 (B) 8 (C) 16 (D) 32 (E) 1/64
12. A recessive allele on the X chromosome is responsible for red-green color blindness in humans. A woman with normal vision whose father is color-blind marries a color-blind male. What is the probability that this couple's son will be color-blind?
(A) 0% (B) 25% (C) 50% (D) 75% (E) 100%
13. DNA ligase functions in
(A) elongation of the $5' \rightarrow 3'$ strand. (B) elongation of the $3' \rightarrow 5'$ strand. (C) DNA repair.

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(D) unwinding of the double helix. (E) Both B and C are correct.

14. What is the relationship among DNA, a gene, and a chromosome?

(A) A chromosome contains hundreds of genes, which are composed of protein. (B) A chromosome contains hundreds of genes, which are composed of DNA. (C) A gene contains hundreds of chromosome, which are composed of protein. (D) A gene is composed of DNA, but there is no relationship to a chromosome. (E) A gene contains hundreds of chromosome, which are composed of DNA.

15. If proteins were composed of only 12 different kinds of amino acids, what would be the smallest possible codon size in a genetic system with four different nucleotides?

(A)1 (B)2 (C)3 (D)4 (E)12

16. A virus injects its DNA into a cell. Some genes are transcribed quite rapidly. Those genes are probably involved in

(A) producing DNA polymerase. (B) producing viral capsule proteins. (C) producing repressor proteins to control the bacterial cell. (D) producing proteins that lyse the bacterial cell. (E) producing various enzymes to alter cellular metabolism.

17. All of the following are usually associated with transposons EXCEPT

(A) inverted repeats. (B) probable presence in all organisms. (C) an enzyme that catalyzes insertion into new sites. (D) acquisition of resistance to antibiotics by bacteria. (E) insertion into DNA by recombination of homologs.

18. *Eco* RI and *Hin* dIII are two different restriction endonucleases. If the DNA of different animals were cut with either *Eco* RI and *Hin* dIII, which of the cut DNAs would not join together easily so that they could be sealed with ligase?

(A) human DNA cut with *Eco* RI and chimp DNA cut with *Eco* RI (B) prokaryotic DNA cut with *Hin* dIII and eukaryotic DNA cut with *Hin* dIII (C) mouse liver DNA cut with *Eco* RI and mouse kidney DNA cut with *Eco* RI (D) *E. coli* DNA cut with *Eco* RI and mouse DNA cut with *Hin* dIII (E) mouse DNA cut with *Hin* dIII and chimp DNA cut with *Hin* dIII

19. Bob Gordon has isolated a new piece of DNA but has no idea of its function. He is MOST likely to use which technique?

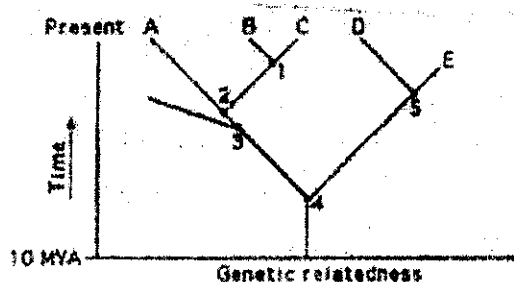
(A) RFLP analysis (B) *in situ* hybridization (C) *in vivo* mutagenesis (D) DNA microarray assays (E) use of antisense nucleic acids

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20. Concerning our present understanding of evolutionary processes, which of the following occur by chance?
 (A) natural selection (B) artificial selection (C) reproduction (D) variation (E) descent with modification
21. In a population that is in Hardy-Weinberg equilibrium, the frequency of the allele a is 0.3. What is the percentage of the population that is homozygous for this allele?
 (A) 3 (B) 9 (C) 21 (D) 30 (E) 42
22. The formation of a land bridge between North and South America about three million years ago resulted in which of the following?
 I. allopatry of marine populations that were previously sympatric
 II. sympatry of marine populations that were previously sympatric
 III. sympatry of terrestrial populations that were previously sympatric
 (A) I only (B) II only (C) III only (D) I and II (E) I and III

23.



The most closely related species are

- (A) A and B (B) B and D (C) C and B (D) D and E (E) E and A
24. Which of the following would most likely occur if all prokaryotes were suddenly to perish?
 (A) All life would eventually perish due to disease. (B) All life would eventually perish because chemical cycling would stop. (C) All life would eventually perish because of increased global warming due to the greenhouse effect. (D) Only the organisms that feed directly on prokaryotes would suffer any deleterious effects. (E) Very little change would occur because prokaryotes are not of significant ecological importance.
25. Why is the filamentous body form of the slime and water molds considered a case of convergent evolution with the hyphae of fungi?
 (A) Fungi are closely related to the slime and water molds. (B) Body shape reflects ancestor-descendant relationships among organisms. (C) Filamentous shape is an

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- adaptation for a nutritional mode as a decomposer. (D)Hyphae and filaments are necessary for locomotion in both groups. (E)Filamentous body shape is evolutionarily primitive for all eukaryotes.
26. A land plant produces flagellated sperm and has a dominant diploid generation. The plant is probably a
(A) moss. (B)green alga. (C)fern. (D)conifer. (E)flowering plant.
27. Which of the following flower parts develops into a fruit after pollination?
(A) stigma (B)style (C)ovule (D)ovary (E)receptacle
28. A new disease arises in humans who live near monkeys in the rain forest. Which of the following might be a first attempt at determining whether the disease is caused by fungus?
(A) Treat affected people with an enzyme that digests chitin. (B)Treat affected people with extracts from the gut of a termite. (C)Bring affected and unaffected people together in both rain forest and desert locations. (D)Grind up tissue from affected people and feed it to unaffected people. (E)Quarantine the entire area until the affected people die or get well.
29. You find a small animal with eight legs crawling up your bedroom wall. Closer examination will reveal that this animal has
(A) Both C and E below are correct (B) Both D and E below are correct (C)antennae
(D)no antennae (E)chelicera
30. Humans and apes are presently classified in the same category at all of the following levels EXCEPT
(A) class. (B)genus. (C)kingdom. (D)order. (E)phylum.
31. Plant physiologists often incubate plant tissue in an extract of termite gut to dissolve the cell wall. After this incubation treatment, the structure left is called
(A)the parenchyma (B)a guard cell (C)a companion cell (D)the endodermis (E)a protoplast
32. Which of the following best explains why no tall trees seem to be CAM plants?
(A) They would be unable to move water and minerals to the top of the plant during the day.
(B)They would be unable to supply sufficient sucrose for active transport of minerals into the roots during the day or night. (C)Transpiration occurs only at night, and this would cause a highly negative Ψ in the roots of a tall plant during the day. (D)Since the stomates
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- are closed in the leaves, the Casparian strip is closed in the endodermis of the root.
(E) With the stomates open at night, the transpiration rate would limit plant height.
33. At the summit of a high mountain, the atmospheric pressure is only half of its normal value of 760 mm Hg. If the atmosphere is still composed of 21% oxygen, what is the partial pressure of oxygen at this altitude?
(A) 0 mm Hg (B) 80 mm Hg (C) 160 mm Hg (D) 380 mm Hg (E) 760 mm Hg
34. The secretion of hormone A causes an increase in activity X in an organism. If this mechanism works by positive feedback, which of the following statements represents that fact?
(A) An increase in X produces an increase in A (B) An increase in A produces an increase in X (C) An increase in X produces a decrease in A (D) A decrease in A produces an increase in X (E) Both A and B are correct
35. In vertebrate animals, spermatogenesis and oogenesis differ, in that
(A) oogenesis begins at the onset of sexual maturity. (B) oogenesis produces four haploid cells, whereas spermatogenesis produces only one functional spermatozoon.
(C) oogenesis produces one functional gamete, whereas spermatogenesis produces four functional spermatozoon. (D) spermatogenesis begins before birth. (E) spermatogenesis is not complete until fertilization occurs.
36. A group of cells, destined to form cartilage, begins producing a protein, type II collagen. At this point, these cells have just completed which developmental process?
(A) determination (B) differentiation (C) organogenesis (D) morphogenesis
(E) pattern formation
37. If the concentration of potassium in the cytoplasm of a nerve cell with a resting membrane potential of -70mV were elevated above normal, the new resting potential would
(A) still be -70mV . (B) be -69mV or higher. (C) be -71mV or lower. (D) be 0mV .
(E) reverse polarity
38. Receptor cells have all of the following functions in common EXCEPT
(A) increased permeability to sodium and potassium ions. (B) conversion of stimulus energy to membrane potential. (C) strengthening of stimulus energy to nervous system.
(D) processing information through graded potentials. (E) conduction of impulses to the central nervous system.

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39. In which of the following habitats would you expect to find the largest number of *K*-selected individuals?

- (A) an abandoned field in Ohio (B) the sand dunes south of Lake Michigan (C) the rain forests of Brazil (D) south Florida after a hurricane (E) a newly emergent volcanic island

40. Which of the following statements related to genetic variation is TRUE?

- (A) Genetic variation does not contribute to biodiversity. (B) Population size is always positively correlated with genetic variation. (C) Populations with low N_e are relatively susceptible to effects of bottlenecking and genetic drift. (D) Recent increases in population size of the northern sea elephant are probably related to high levels of genetic variation.

[II] Answer the following questionis: 20%

1. What is DNA microarray assays? What is the major value of DNA microarray analysis for studying gene expression? 14%
2. In general, what is effect of histone acetylation and DNA methylation on gene expression? 6%