

選擇題，共 50 題（每題 2 分）

1. Emerging viruses may arise by  
(A) mutation of existing viruses. (B) the spread of existing viruses to a new host species. (C) broader dissemination of an existing virus within the current host population. (D) all of the above. (E) none of the above.
2. During conjugation between an Hfr cell and an  $F^-$  cell,  
(A) all the  $F^-$  cells become  $F^+$  cells. (B) all the  $F^-$  cells become Hfr cells. (C) the chromosome of the  $F^-$  cell is completely replaced by the chromosome of the Hfr cell. (D) genes from the Hfr cell may replace genes of the  $F^-$  cell by recombination. (E) DNA from the  $F^-$  cell transfers to the Hfr cell and DNA from the Hfr cell transfers to the  $F^-$  cell.
3. In a nucleosome, the DNA is wrapped around  
(A) polymerase molecules. (B) ribosomes. (C) histones. (D) the nucleolus. (E) satellite DNA.
4. Which of the following is not an example of a possible step in the transcriptional control of gene expression?  
(A) the addition of methyl groups to cytosine bases of DNA. (B) the binding of transcription factors to a promoter. (C) the removal of introns and splicing together of exons. (D) histone acetylation. (E) activation of enhancers.
5. Which kind of DNA is most widely used as cloning vector?  
(A) transposon. (B) satellite DNA. (C) plasmid. (D) oncogene. (E) proto-oncogene.
6. PCR technique can not be used in the enrichment of  
(A) DNA fragment. (B) RNA fragment. (C) bacteria genes. (D) virus genes. (E) bacteria growth.
7. An epitope of antigen can associate with which part of an antibody?  
(A) the antibody-binding site. (B) the heavy chain constant regions only. (C) the variable regions of a heavy chain and light chain combined. (D) the light-chain constant regions only. (E) the antibody tail.
8. The graft versus host reaction (GVHR) may occur due to unmatched HLA in  
(A) bone marrow transplantation. (B) liver transplantation. (C) kidney transplantation. (D) cornea transplantation. (E) heart transplantation.
9. The elimination of virus infectivity mediated by antibody is called  
(A) agglutination. (B) neutralization. (C) precipitation. (D) immunodiffusion. (E) complement fixation.

（背面仍有題目，請繼續作答）

10. Which of the following statements is wrong?  
(A) Helper T cells function in both humoral and cellular immunity by the action of IL-2. (B) Helper T cells function in both humoral and cellular immunity by the action of IL-1. (C) B cells can also act as antigen presenting cells. (D) CD4 is the marker of helper T cell. (E) Macrophage is an antigen presenting cell.
11. In a human population, the numbers for MM, MN, and NN are 721, 958, and 321, respectively. The frequency of M is  
(A) 0.8. (B) 0.2. (C) 0.9. (D) 0.72. (E) 0.6.
12. In a human population, the numbers for MM, MN, and NN are 321, 958, and 721, respectively. If the population is under Hardy-Weinberg equilibrium, the frequency of heterozygote three generations from now is  
(A) 0.4790. (B) 0.1605. (C) 0.3605. (D) 0.8000. (E) 0.4000.
13. The smallest biological unit that can evolve over time is  
(A) an ecosystem. (B) a cell. (C) an organ. (D) a species. (E) a population.
14. Who adopted a system for grouping similar species into a hierarchy of increasingly general categories?  
(A) Linnaeus. (B) Mendel. (C) Aristotle. (D) Cuvier. (E) Lamarck.
15. Selection acts directly on  
(A) genotype. (B) the entire genome. (C) each allele. (D) gene pool. (E) phenotype.
16. Plant species A of  $2n = 40$  hybridizes with plant species B of  $2n = 42$  would yield a hybrid with a chromosome number of  
(A) 80. (B) 41. (C) 82. (D) 56. (E) 44.
17. The speciation episode described in the above question is most likely a case of  
(A) speciation via sexual selection. (B) allopatric speciation. (C) sympatric speciation. (D) adaptive radiation. (E) anagenesis.
18. Which morphological feature characterizes the Order Carnivora?  
(A) meat-eating teeth. (B) hair. (C) retractable claws. (D) ability to purr. (E) four limbs.
19. In a village of the United States, one out of 10,000 babies is born with phenylketonuria (PKU), a metabolic disorder. The disease is caused by a recessive allele. (There are two alleles at this locus) If the population is under Hardy-Weinberg equilibrium, what is frequency of heterozygote three generations from now?  
(A) 0.0198. (B) 0.010. (C) 0.990. (D) 0.0001. (E) 0.980.

20. One current debate raises the issue that, rather than beginning in shallow pools, life could have begun  
(A) in Asia. (B) in northern Africa. (C) from viruses. (D) on dry land. (E) near deep-sea vents.
21. The family that contains composite flowers is the  
(A). mustard (Cruciferae) (B). nightshade (Solanaceae) (C). gourd (Cucurbitae)  
(D). sunflower (Compositae) (E). grass (Gramineae)
22. Plants that complete their entire life cycle in two growing seasons are called  
(A). annuals (B). biennials (C). diurnal (D). perennials (E). deciduous
23. The female gametophyte is in which flower part?  
(A). anther (B). ovary (C). stigma (D). stamen (E). petal
24. Which of the following terms does NOT refer to one of the parts of the embryo?  
(A). radicle (B). endosperm (C). plumule (D). hypocotyl (E). cotyledone
25. Which of the following is a dry, indehiscent fruit?  
(A). berry (B). follicle (C). legume (D). samara (E). capsule
26. Bryophytes differ from most other land plants in that  
(A). bryophytes do not photosynthesize while other land plants do  
(B). bryophytes do not reproduce sexually while other land plants do  
(C). bryophytes do not have a vascular system while other land plants do  
(D). bryophytes eat insects while other land plants do not  
(E). bryophyte do not have seed while land plants do
27. The plant tissue that is involved in food transport is the  
(A). epidermis (B). phloem (C). sclerenchyma (D). xylem (E). stomata
28. Blue-green bacteria belong to the kingdom  
(A). Animal (B). Monera (C). Planta (D). Protista (E). Fungi
29. An organism that consists of an algae and a fungus is a  
(A). lichen (B). liverwort (C). moss (D). ground pine (E). hornwort
30. The meristematic tissue that is used to form the outer bark in woody plants is the  
(A). apical meristem (B). cork cambium (C). intercalary meristem  
(D). vascular cambium (E). ground meristem
31. In addition to skeletal differences, cartilaginous fishes can be distinguished from bony fishes by  
(A) the presence in bony fishes of a cranium. (B) the presence in bony fishes of a lateral line.  
(C) the presence in cartilaginous fishes of unpaired fins. (D) the absence in cartilaginous

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- fishes of a swim bladder. (E) the absence in cartilaginous fishes of paired sensory organs.
32. In the evolutionary history of Subphylum Vertebrate, which of the following orders of appearance of derived characters is correct ?  
 (A) legs--- amniotic egg--- milk--- feather. (B) vertebral column --- jaws--- feather--- milk.  
 (C) jaw--- leg--- lung or lung derivatives--- milk. (D) lung or lung derivatives--- amniotic egg--- leg---feather. (E) lung or lung derivatives--- amniotic egg--- leg--- placenta.
33. The current global population size of humans is close to  
 (A) 2 billion. (B) 4 billion. (C) 6 billion. (D) 8 billion. (E) 10 billion.
34. A mother bird is gathering food for her chicks, constrained by the fact that she can not leave her chicks for more than 15 minutes. There are five plots with different conditions listed in the table below for her to choose. If everything else being equal, according to Optimal foraging theory, which plot will you predict this mother bird will go for foraging?

Plot	Time for traveling (min)	# of prey / m <sup>2</sup>	chance of being eaten
1	5	10	0.1
2	5	15	0.1
3	10	20	0.2
4	10	25	0.2
5	20	50	0

- (A) Plot 1. (B) Plot 2. (C) Plot 3. (D) Plot 4. (E) Plot 5.
35. According to the theory of island biogeography, species richness would be greater on an island that is  
 (A) large and remote. (B) small and remote. (C) large and close to mainland. (D) small and close to mainland. (E) environmentally homogeneous.
36. In the logistic model of population growth, how carrying capacity ( $K$ ) and population size ( $N$ ) can influence growth rate ( $dN/dt$ ) of a population?  
 (A) as  $N$  approaches  $K$ ,  $dN/dt$  approaches zero. (B) as  $N$  approaches  $K$ , the birth rate approaches zero. (C) as  $N$  approaches  $K$ , the death rate approaches zero. (D) as  $N$  approaches  $K$ , the intrinsic rate of increase approaches zero. (E) as  $N$  approaches  $K$ , the difference of immigration and emigration rate approaches zero.
37. Sexually mature offspring of Taiwan blue Magpies usually stay with parents and help raising other siblings. All of the following statements about this behavior are considered correct except  
 (A) this is a case of altruism. (B) kin selection is the selection force for this type of behavior. (C) group selection is the selection force for this type behavior. (D) natural selection is the selection force for this type behavior. (E) this behavior increases the inclusive fitness of the

helper.

38. Food chains are usually short in communities because  
(A) human disturbances prevent building up of long food chains. (B) there is not enough evolutionary time for higher predators to evolve. (C) competitive exclusion prevents two predator species to coexist in one place. (D) energy is greatly lost as it passes from one trophic level to the next higher level. (E) larger predators were already extinct in the five mass extinctions in the history of earth.
39. Dr. Dolittle wanted to estimate the population size of lizards on campus. He set up a transect line, and 50 lizards were captured, marked, and released. After a week, he surveyed again along the transect line and caught 60 lizards, and 10 of the 60 lizards were previously marked. If all the assumptions for this mark-recapture method are met, approximately how many lizards there are on campus?  
(A) 100. (B) 200. (C) 300. (D) 400. (E) 500.
40. **Allopatric** populations of species A and B have beaks of similar size, but on an island where both species occur, a significant difference in beak size has been observed. This case suggests the following statements except that  
(A) resource partitioning occurs between two species in sympatry. (B) it is a case of character displacement. (C) it violate the competitive exclusion principle. (D) it may be an evolutionary outcome of past competition. (E) it enables the two species to reduce or avoid competition by feeding on seeds of different sizes.
41. Some nutrients are considered "essential" in the diets of certain animals because  
(A) only those animals use the nutrients. (B) they are subunits of important polymers. (C) they cannot be manufactured by the organism. (D) they are necessary coenzymes. (E) only some foods contain them.
42. In which group of animals would you expect to find a relatively long cecum?  
(A) carnivores (B) herbivores (C) autotrophs (D) heterotrophs (E) humans
43. If, during protein starvation, the osmotic pressure on the venous side of capillary beds drops below the hydrostatic pressure, then  
(A) hemoglobin will not release oxygen. (B) fluids will tend to accumulate in tissues. (C) the pH of the interstitial fluids will increase. (D) most carbon dioxide will be bound to hemoglobin and carried away from tissues. (E) plasma proteins will escape through the endothelium of the capillaries.
44. Which of the following occurs with the exhalation of air from human lungs?  
(A) The volume of the thoracic cavity decreases. (B) The residual volume of the lungs

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- decreases. (C) The diaphragm contracts. (D) The epiglottis closes. (E) The rib cage expands.
45. Breathing is usually regulated by  
(A) erythropoietin levels in the blood. (B) the concentration of red blood cells. (C) hemoglobin levels in the blood. (D) CO<sub>2</sub> and O<sub>2</sub> concentration and pH-level sensors. (E) the lungs and the larynx.
46. 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 ovum, whereas spermatogenesis produces four functional spermatozoa. (D) spermatogenesis begins before birth. (E) spermatogenesis is not complete until fertilization occurs.
47. All of the following structures are correctly paired with their function except  
(A) seminiferous tubules-add fluid containing mucus, fructose, and prostaglandin to semen  
(B) scrotum-encases testes and holds them below the abdominal cavity (C) epididymis-stores sperm (D) prostate gland-adds alkaline secretions to semen (E) ovary-secretes estrogen and progesterone
48. All of the following statements about fertilization are correct except:  
(A) It reinstates diploidy. (B) It invaginates the blastula to form the gastrula. (C) Egg cell depolarization initiates the cortical reaction. (D) Gamete fusion depolarizes the egg cell membrane and sets up a fast block to polyspermy. (E) A slow block to polyspermy occurs when cortical granules erect a fertilization membrane.
49. What is the process called that involves the movement of cells into new relative positions in an embryo and results in the establishment of three tissue layers?  
(A) determination (B) cleavage (C) fertilization (D) induction (E) gastrulation
50. Extraembryonic membranes develop in which of the following?  
I. mammals II. birds III. lizards  
(A) I only (B) II only (C) I and II only (D) II and III only (E) I, II, and III