

※請將選擇題作答於試卷內之「選擇題作答區」。

一、單選題 (60%)

1. When classifying life-forms into increasingly inclusive groups, what is the correct hierarchy from small to bigger groups?
(A). Genus, family, order, class, phylum
(B). Phylum, order, class, family, genus
(C). Order, class, family, genus, phylum
(D). Genus, order, family, phylum, class
(E). Phylum, class, order, family, genus
2. The extracellular matrix in animal cells is attached to membrane integrins by
(A) Cholesterol (B) Proteoglycans (C) Collagen
(D) Fibronectin (E) Microfilaments
3. The presence of which of the following distinguishes the protists, Paramecium, and Euglena?
(A) Mitochondrial DNA (B) Lysosomes (C) Nuclear DNA
(D) Glia cells (E) Chloroplasts
4. A competitive inhibitor in an enzymatic reaction
(A) mimic the normal substrate
(B) binds to the enzyme away from the active site
(C) cannot bind to the active site of the enzyme
(D) alters the shape of the enzyme making binding of the normal substrate impossible
(E) both B and D are correct.
5. Cell signaling is of the paracrine type when
(A) Immune cells secrete proteins which stimulates themselves to be activated.
(B) endocrine cells secrete hormones
(C) signaling cells secrete a regulator acting on a distant cell
(D) signaling cells secrete a regulator acting on a nearby cell
(E) none of above
6. What is an incorrect statement about brown fat?
(A) It generates heat in hibernating animals
(B) It generates heat from store fats without ATP production
(C) It is made up cells packed with mitochondria
(D) It is found in human body
(E) It does not generate heat in human
7. Plastids that are surrounded by more than two membranes are evidence of
(A) evolution from mitochondria
(B) fusion of plastids
(C) origin of the plastids from archaea
(D) secondary endosymbiosis
(E) all of above

8. The evolution of complex multicellularity in eukaryotes
- (A) occurred only once, in the common ancestor of all eukaryotes.
 - (B) occurred only once, in the common ancestor of all multicellular eukaryotes.
 - (C) occurred only once, in the animal lineage.
 - (D) occurred independently in several eukaryotic lineages.
 - (E) no evidence to support any of above statements.
9. Among the organisms listed here, which are thought to be the closest relatives of fungi?
- (A) slime molds (B) vascular plants (C) animals
 - (D) mosses (E) archaea
10. The innermost layer of the root cortex is the
- (A) Core (B) pericycle (C) endodermis
 - (D) pith (E) epidermis
11. Compared with a cell with few aquaporin proteins in its membrane, a cell containing many aquaporin proteins will have a
- (A) faster rate of osmosis
 - (B) lower water potential
 - (C) higher water potential
 - (D) faster rate of active transport
 - (E) both A and B are correct
12. A seed develops from an
- (A) ovum (B) embryo (C) ovule
 - (D) ovary (E) oviduct
13. If a long-day plant has a critical night length of 9 hours, which 24-hour cycle would prevent flowering?
- (A) 16 hours light/8 hours dark
 - (B) 14 hours light/10 hours dark
 - (C) 4 hours light/8 hours dark/4 hours light/8 hours dark
 - (D) 8 hours light/8 hours dark/light flash/8 hours dark
 - (E) all of above are flowering
14. Many endotherms use a countercurrent exchange system to conserve heat. How does this function?
- (A) Heat is transferred from arteries to veins against a thermal gradient.
 - (B) Heat is transferred from veins to arteries against a thermal gradient.
 - (C) Heat is transferred from arteries to veins along a thermal gradient.
 - (D) Heat is transferred from veins to arteries along a thermal gradient.
 - (E) Heat is transferred either from-veins-to-arteries or from-arteries-to-veins, as long as it is along a thermal gradient.
15. After surgical removal of the gallbladder, a person might need to limit his or her dietary intake of
- (A) protein (B) fat (C) sugar (D) starch (E) cellulose

16. Which of the following respiratory system is not closely associated with the blood supply?
(A) the lung of a vertebrate (B) the gills of a fish
(C) the tracheal system of an insect (D) the skin of an earthworm
(E) none of above
17. Which of the following should be the same in identical twins?
(A) the set of antibodies produced
(B) the set of MHC molecules produced
(C) the set of T cell antigen receptors produced
(D) the set of fingerprints for each person
(E) the set of immune cells eliminated as self-reactive
18. Contact of a sea urchin egg with signal molecules on sperm causes the egg to undergo a brief _____.
(A) mitosis (B) membrane depolarization (C) spermatogenesis
(D) acrosomal reaction (E) endocytosis
19. Circannual rhythms in birds are influenced by _____.
(A) periods of food availability
(B) lunar cycles
(C) magnetic fields
(D) periods of daylight and darkness
(E) moon lights
20. Suppose researchers marked 800 turtles and later were able to trap a total of 300 individuals in that population, of which 150 were marked. What is the estimate for total population size?
(A) 200 (B) 400 (C) 1250 (D) 1600 (E) 2100

※ 注意：請於試卷上「非選擇題作答區」標明題號並依序作答。

二、解釋名詞 (每題 5 分) (30%)

1. alternation of generation
2. reverse transcription
3. ecological niche
4. action potential
5. CRISPR
6. second messengers

三、問答題 (10%)

1. 新冠肺炎(COVID-19)是一種由 RNA 病毒引起的嚴重傳染病，目前已知疫苗施打可以讓人體產生對抗此病毒的免疫力。
 - (1) 請說明在新冠疫苗種類中 mRNA 疫苗的作用原理，為什麼可以讓受施打者產生對抗病毒的免疫力 (5%)
 - (2) 請比較此種 mRNA 疫苗與傳統死病毒疫苗和次蛋白疫苗的差異。(5%)

試題隨卷繳回