

請清楚標示題號並依序作答於試卷上

I. 單選題：(每題 2 分，共 40 分) ※請作答於試卷內之「選擇題作答區」

1. What kind of (part of) the structure of the protein would be considered that a hydrogen bond between the constitutive amino acid (*R* groups) of two different polypeptide chains in a four-chain protein?
A) primary B) secondary C) tertiary D) quaternary E) nonlinear
2. Which molecules of the followings are the most important that a cell must protect from damage in order to stay alive and reproduce?
A) proteins B) nucleic acids C) carbohydrates D) phospholipids E) amino acids
3. Plant cells permit ions and small molecules to move between adjacent cells by means of cytoplasmic channels in their cell walls known as _____.
A) gap junctions B) desmosomes C) plasmodesmata D) tight junctions E) tonoplasts
4. If photosynthetic eukaryotic cells are provided with CO₂ synthesized with heavy oxygen (¹⁸O), the ¹⁸O label may be found in all but one compound. That compound is _____.
A) 3-phosphoglycerate B) cellulose C) glucose D) O₂ E) RuBP (ribulose biphosphate)
5. If a plant synthesized a molecule of sugar that has 12 carbons, how many turns of the Calvin cycle would be needed?
A) 2 B) 3 C) 4 D) 12 E) 24
6. Just after the DNA replication in S phase, a diploid cell with 46 chromosomes will have _____ chromosomes and _____ sister chromatids.
A) 23; 46 B) 23; 23 C) 46; 46 D) 46; 92 E) 92; 92
7. Which pattern of diploid and haploid phases reflects the life cycle in some fungi and algae, but not plants or animals?
A) alternation between haploid and diploid generations
B) two haploid generations followed by a diploid generation
C) one haploid generation followed by two diploid generations
D) a life cycle that limits the diploid state to a single cell produced by fertilization
E) a life cycle that limits the haploid state to a single cell which is immediately fertilized
8. In which of the following events the small ribonucleoprotein particles (snRNPs) are involved?
A) mRNA splicing B) initiation of transcription C) aminoacylation of tRNA
D) initiation of translation E) termination of translation
9. When lactose is present in the medium, RNA polymerase will bind to the _____ of the *E. coli* lac operon.
A) *lacI* gene B) operator C) promoter D) transcription initiation site E) first codon of the *lacZ* gene
10. Steroid hormones can trigger gene expression in a select number of target cells because _____.
A) only target cells allow the steroid hormone to cross the plasma membrane
B) nontarget cells have a steroid hormone response element encoded in their DNA
C) only target cells have the correct receptor in their cytosol or nuclei to bind to the hormone
D) nontarget cells lack the genes found in target cells
E) only target cells have the genes that steroid hormones activate
11. Which process sets the developmental fate of an embryonic cell?
A) fertilization B) meiosis C) induction D) differentiation E) determination
12. Long noncoding RNAs _____.
A) are transcribed by RNA polymerase I rather than by RNA polymerase II
B) do not have their introns removed C) are missing a 5' cap and 3' poly(A) tail
D) may regulate the expression of protein-coding genes E) encode large proteins

見背面

13. How could you increase the magnitude of inhibitory postsynaptic potentials (IPSPs) generated at a synapse?
- A) increase sodium-potassium pump activity B) increase K^+ permeability
C) increase the influx of calcium D) increase Na^+ permeability E) All of the above apply.
14. A man and woman are each heterozygous for the autosomal recessive disorder cystic fibrosis. If they want to have three children, what is the probability that only one of the children will have cystic fibrosis?
- A) 1/4 B) 3/4 C) 9/16 D) 9/64 E) 27/64
15. The ____ prevents important substances in the xylem from leaking into the root cortex.
- A) primary xylem B) root hairs C) endodermis D) tonoplasts E) pericycle
16. Marine biologists tagged and released 50 marlin. Later, fishermen caught 300 marlin, 15 of which had tags. What is the estimate for the number of marlin in the population?
- A) 315 B) 365 C) 1000 D) 2500 E) 5000
17. Keystone species are those species ____.
- A) that live primarily on or under rocks and stones
B) whose absence would cause major disruption in an ecosystem
C) with the largest number of individuals in an ecosystem
D) that have provided key foods in an ecosystem
E) that none of the above applies to
18. Anesthetics block pain by blocking the transmission of nerve signals. Which of the following chemicals might work as anesthetics?
- A) a chemical that opens the Ca^{++} channels at nerve terminals
B) a chemical that inhibits the enzymes that degrade neurotransmitters
C) a chemical that stimulates the free nerve endings of nociceptor afferent fibers
D) a chemical that prevents the opening of voltage-gated Na^+ channels in membrane
E) a chemical that inhibits the reuptake of neurotransmitters by transporters
19. In which of the following vessels is the blood pressure lowest?
- A) arteries B) arterioles C) capillaries D) venules E) veins
20. Where along the nephron is most filtrate reabsorbed back into the blood?
- A) Bowman's capsule B) proximal convoluted tubule C) loop of Henle
D) distal convoluted tubule E) collecting duct

II. 解釋名詞 (每題 4 分，共 20 分)

1. leptin 2. ecological niche 3. endotherm 4. synaptic potential 5. helper T cell

III. 簡答題 (每題 5 分，共 40 分)

1. If prokaryotic cells do not have mitochondria, in which cellular region is cellular energy produced?
2. What is the key difference between the cellular structure and function of taste receptors and olfactory receptors?
3. What is a major similarity and difference between photorespiration and aerobic respiration?
4. What is the importance of fertilization for the embryonic development in human?
5. What are the types of base-pairing mutations affecting a protein-coding gene?
6. Why does vaccination work? Why do people need to get a new flu shot every year?
7. What is the ordinary route for a secreted protein from its production site to its exit from a human cell?
8. What is mycorrhiza, and why are mycorrhizal associations so vital to many plants?