

一、選擇題 (Choose the one best answer) (每題 2 分) ※請作答於試卷內之「選擇題作答區」。

1. A plant cell has 16 chromosomes at the end of mitosis. How many chromosomes would it have in the G2 phase of its next cell cycle? (A) 8 (B) 12 (C) 16 (D) 32
2. A phosphate in DNA (A) hydrogen-bonds to a base (B) covalently links to two bases (C) covalently links to two deoxyriboses (D) hydrogen-bonds to two additional phosphates
3. Which of the following is not an example of the control of gene expression that occurs after transcription? (A) mRNA stored in cytoplasm needing a control signal to initiate translation (B) the length of the time mRNA lasts before it is degraded (C) rRNA gene amplified in tandem arrays (D) alternative RNA splicing before mRNA exits from the nucleus (E) splicing or modification of a polypeptide
4. Which of the following is descriptive of a cell that is differentiated? (A) The cell's fate has been decided, although it may not look any different from another precursor cell. (B) The cell has been induced to transcribe all its genes. (C) The cell has developed cell surface receptors that allow it to receive signals from other cells. (D) The cell is producing tissue-specific proteins and its characteristic structure.
5. The smallest unit that can evolve is (A) an individual (B) a species (C) a population (D) a community
6. Which of the following combinations of phylum and characteristics is *incorrect*? (A) Cnidaria -- radial symmetry (B) Nematoda -- gastrovascular cavity (C) Arthropoda -- segmentation (D) Echinodermata -- endoskeleton
7. What is a motor unit? (A) the bundle of axons that goes from the spinal cord to a muscle (B) a bundle of axons and all of the muscle fibers they control (C) the muscle or group of muscles that accomplish a specific movement (D) a motor neuron and all of the muscle fibers it controls
8. All of the following are adaptations to an herbivorous diet except (A) broad, flat teeth (B) a rumen (C) ingestion of feces (D) bile salts
9. All of the following are functions of the circulatory system except (A) oxygen, nutrient, and waste transport (B) temperature regulation (C) synthesis of blood cells (D) hormone transport (E) blood clotting
10. The membrane of a resting neuron is much more permeable to which of the following ion than any other ion? (A) Cl^- (B) K^+ (C) Na^+ (D) Ca^{++} (E) H^+
11. The site of primary sensory integration in the brain is called the (A) medulla oblongata (B) thalamus (C) basal ganglia (D) corpus callosum (E) hypothalamus
12. Interstitial fluid (A) is the internal environment found in animal cells (B) is found inside the small intestine (C) provides for the exchange of materials between blood and cells (D) is composed of plasma (E) forms the extracellular matrix of connective tissue
13. A cell that is affected by a particular steroid hormone would be expected to have (A) DNA sites that interact with the hormone (B) an intracellular receptor protein that binds the hormone (C) a cell-surface receptor protein that binds the hormone (D) enzymes that are activated or inactivated by the intracellular hormone-receptor complex (E) enzymes that are activated or inactivated by the hormone's 2nd messenger

14. A freshwater fish tends to _____ water by osmosis. As a consequence, its kidney excretes _____.
(A) gain -- large amounts of dilute urine (B) lose -- small amounts of concentrated urine (C) gain -- large amounts of concentrated urine (D) lose -- large amounts of dilute urine (E) gain -- small amounts of concentrated urine
15. Which of the following best describes a nerve signal? (A) flow of electricity along a neuron (B) passage of ions through the membrane of a neuron (C) flow of neurotransmitter along a neuron (D) change in a neuron so that the inside becomes more negatively charged
16. Which of the following is not matched? (A) cone cells--- vision (B) organ of Corti--- motion (C) Elongation of muscle spindle fiber--- muscle contraction (D) Taste bud--- taste
17. The secretory phase of the menstrual cycle (A) is associated with dropping levels of estrogen and progesterone (B) is when the endometrium begins to degenerate and menstrual flow occurs (C) corresponds with the luteal phase of the ovarian cycle (D) corresponds with the follicular phase of the ovarian cycle
18. Migrating animals are thought to navigate using (A) photoreceptors in the brain to detect the sun's direction (B) olfactory receptors in the ear to distinguish environmental changes (C) magnetite to align them with the Earth's magnetic fields (D) electroreceptors to interpret electrical currents
19. The area over which an animal moves in the course of daily activity, but which it does not necessarily defend against other animals, is its (A) niche (B) home range (C) foraging space (D) territory
20. Biologists figure that the carrying capacity of a particular river is 100,000 trout. They want to manage the catch of trout so that the trout population is at a size where replacement of the fish that are caught will happen at the fastest rate. Would you recommend that they catch fish until the trout population stands at
(A) 90,000 (B) 80,000 (C) 50,000 (D) 20,000

※下列題目請標明題號(不必抄題)，依序作答於試卷內「非選擇題作答區」。

二、問答題 (每題 10 分)

1. (a) 細菌和其他微生物之遺傳變異(genetic variation)的主要來源為何？ (b) 動物和植物之遺傳變異的主要來源為何？(a) (b)兩問題的答案為何不同？
2. 接受心臟移植手術後的患者，其心臟上並無神經的支配，休息時的心跳速率約為 100 次/分鐘。此人進行踩腳踏車運動時，其心跳速率仍可持續上升，原因為何？一般正常人休息時的心跳速率約為 60-70 次/分鐘，請問自主神經系統如何調節心臟，使維持此心跳速率？
3. 請簡要說明達爾文演化理論之主要構成要素。
4. AIDS(acquired immune deficiency syndrome)為何如此致命？為何如此難以預防和治癒？

三、名詞解釋 (每題 4 分)

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| 1. chemiosmosis | 4. ectotherm |
| 2. biodiversity | 5. apoptosis |
| 3. genomics | |