【不可使用計算機】＊作答前請先核對試題、答案卷(試卷)與准考證之所組別與考科是否相符！！

Part I. Multiple choices (80%, 2 points per question, 40 questions) : 選擇題請使用答案卡作答

1. Where would you expect to find tight junctions?
   (A) in the plasma membrane of prokaryotes
   (B) between the smooth endoplasmic reticulum and the rough endoplasmic reticulum
   (C) between plant cells in a woody plant
   (D) in the epithelium of an animal's stomach

2. Plasmodesmata in plant cells are most similar in function to which of the following structures in animal cells?
   (A) extracellular matrix
   (B) tight junctions
   (C) gap junctions
   (D) desmosomes

3. A mutation that disrupts the ability of an animal cell to add polysaccharide modifications to proteins would most likely cause defects in its _____.
   (A) mitochondria and Golgi apparatus
   (B) nuclear matrix and extracellular matrix
   (C) Golgi apparatus and extracellular matrix
   (D) nuclear pores and secretory vesicles

4. Which of the following statements about the cytoskeleton is true?
   (A) Movement of cilia and flagella is the result of motor proteins causing microtubules to move relative to each other.
   (B) Chemicals that block the assembly of the cytoskeleton would have little effect on a cell's response to external stimuli.
   (C) The cytoskeleton of eukaryotes is a static structure most resembling scaffolding used at construction sites.
   (D) Although microtubules are common within a cell, actin filaments are rarely found outside of the nucleus.

5. According to the fluid mosaic model of cell membranes, phospholipids _____.
   (A) frequently flip-flop from one side of the membrane to the other
   (B) can move laterally along the plane of the membrane
   (C) occur in an uninterrupted bilayer, with membrane proteins restricted to the surface of the membrane
   (D) have hydrophilic tails in the interior of the membrane

6. Vinblastine, a drug that inhibits microtubule polymerization, is used to treat some forms of cancer. Cancer cells given vinblastine would be unable to _____.
   (A) maintain the shape of the nucleus
   (B) migrate by amoeboid movement
   (C) form cleavage furrows during cell division
   (D) separate chromosomes during cell division

7. Diffusion _____.
   (A) requires an expenditure of energy by the cell
   (B) is very rapid over long distances
   (C) is a passive process in which molecules move from a region of higher concentration to a region of lower concentration
   (D) requires integral proteins in the cell membrane

8. Which of the following statements about NAD^+ is true?
   (A) NAD^+ has more chemical energy than NADH.
   (B) NAD^+ is reduced to NADH during glycolysis, pyruvate oxidation, and the citric acid cycle.
   (C) NAD^+ can donate electrons for use in oxidative phosphorylation.
   (D) In the absence of NAD^+, glycolysis can still function.

9. When hydrogen ions are pumped from the mitochondrial matrix across the inner membrane and into the intermembrane space, the result is the _____.
   (A) reduction of NAD^+
   (B) creation of a proton-motive force
   (C) lowering of pH in the mitochondrial matrix
   (D) formation of ATP

10. Following glycolysis and the citric acid cycle, but before the electron transport chain and oxidative phosphorylation, the carbon skeleton of glucose has been broken down to CO_2 with some net gain of ATP. Most of the energy from the original glucose molecule at that point in the process, however, is in the form of _____.
   (A) NADH
   (B) acetyl-CoA
   (C) glucose
   (D) pyruvate

11. In liver cells, the inner mitochondrial membranes are about five times the area of the outer mitochondrial membranes. What purpose must this serve?
   (A) It increases the surface for substrate-level phosphorylation.
   (B) It allows for an increased rate of glycolysis.
   (C) It increases the surface for oxidative phosphorylation.
   (D) It allows for an increased rate of the citric acid cycle.

12. Fatty acids usually have an even number of carbons in their structures. They are catabolized by a process called beta-oxidation. The end products of the metabolic pathway are acetyl groups of acetyl CoA molecules. These acetyl groups _____.
   (A) directly enter the energy-yielding stages of glycolysis
   (B) directly enter the citric acid cycle
   (C) directly enter the electron transport chain
   (D) are directly decarboxylated by pyruvate dehydrogenase

13. Plants photosynthesize _____.
   (A) only in the light but respire in light and dark
   (B) only in the light but respire only in the dark
   (C) only in the dark but respire only in the light
   (D) and respire only in the light

14. Scientists isolate cells in various phases of the cell cycle. They find a group of cells that have $1\frac{1}{2}$ times more DNA than G1 phase cells. The cells of this group are _____.
   (A) between the G1 and S phases in the cell cycle
   (B) in the S phase of the cell cycle
   (C) in the G2 phase of the cell cycle
   (D) in the M phase of the cell cycle

15. Photorespiration_____.
(A) generates oxygen and consumes ATP, carbon dioxide, and sugars
(B) generates carbon dioxide and consumes ATP and oxygen
(C) consumes carbon dioxide and generates ATP, sugars, and oxygen
(D) generates ATP and sugars and consumes oxygen and carbon dioxide

16. A ribozyme is _____.
(A) an RNA with catalytic activity
(B) an enzyme that synthesizes RNA as part of the transcription process
(C) a catalyst that uses RNA as a substrate
(D) an enzyme that catalyzes the association between the large and small ribosomal subunits

17. Why are C4 plants able to photosynthesize with no apparent photorespiration?
(A) They do not participate in the Calvin cycle.
(B) They conserve water more efficiently.
(C) They exclude oxygen from their tissues.
(D) They use PEP carboxylase to initially fix CO_2.

18. In photosynthetic cells, synthesis of ATP by the chemiosmotic mechanism occurs during _____.
(A) photosynthesis only
(B) neither photosynthesis nor respiration
(C) photosynthesis and respiration
(D) respiration only

19. In mitochondria, chemiosmosis moves protons from the matrix into the intermembrane space, whereas in chloroplasts, chemiosmosis moves protons from the _____.
(A) stroma to the thylakoid space
(B) matrix to the stroma
(C) thylakoid space to the stroma
(D) intermembrane space to the matrix

20. As a research scientist, you measure the amount of ATP and NADPH consumed by the Calvin cycle in 1 hour. You find that 30,000 molecules of ATP were consumed, but only 20,000 molecules of NADPH were consumed. Where did the extra ATP molecules come from?
(A) photosystem I
(B) linear electron flow
(C) photosystem II
(D) cyclic electron flow

21. Which of the following are directly associated with photosystem I?
(A) generation of molecular oxygen
(B) passing electrons to the cytochrome complex
(C) receiving electrons from the thylakoid membrane electron transport chain
(D) extraction of hydrogen electrons from the splitting of water

22. It has been observed that organisms on islands are different from, but closely related to, similar forms found on the nearest continent. This is taken as evidence that____.
(A) the island forms and mainland forms are converging
(B) common environments are inhabited by the same organisms
(C) island forms and mainland forms have identical gene pools
(D) island forms are descended from mainland forms

23. A biologist studied a population of squirrels for fifteen years. During that time, the population was never fewer than thirty squirrels and never more than forty-five. Her data showed that over half of the squirrels born did not survive to reproduce, because of both competition for food and predation. In a single generation, 90% of the squirrels that were born lived to reproduce, and the population increased to eighty. Which inference(s) about this most recent surge in the population size might be true?
(A) The amount of available food may have increased.
(B) The amount of available food may have increased and/or the predators that prey upon squirrels may have decreased.
(C) The number of predators that prey upon squirrels may have decreased.
(D) The parental generation of squirrels developed better eyesight due to improved diet; the subsequent squirrel generation inherited better eyesight.

24. Your brother has just purchased a new plastic model airplane. He places all the parts on the table in approximately the positions in which they will be located when the model is complete. His actions are analogous to which process in development?
(A) determination
(B) pattern formation
(C) differentiation
(D) morphogenesis

25. A mutant bacterial cell has a defective aminoacyl-tRNA synthetase that attaches a lysine to tRNAs with the anticodon AAA instead of the normal phenylalanine. The consequence of this for the cell will be that _____.
(A) none of the proteins in the cell will contain phenylalanine
(B) the cell will compensate for the defect by attaching phenylalanine to tRNAs with lysine-specifying anticodons
(C) the ribosome will skip a codon every time a UUU is encountered
(D) proteins in the cell will include lysine instead of phenylalanine at amino acid positions specified by the codon UUU

26. Which of the following does not occur in prokaryotic gene expression, but does occur in eukaryotic gene expression?
(A) A cap is added to the 5′ end of the mRNA.
(B) RNA polymerase requires a primer to elongate the molecule.
(C) RNA polymerase binds to the promoter.
(D) mRNA, tRNA, and rRNA are transcribed.

27. In autumn, the leaves of deciduous trees change colors. This is because chlorophyll is degraded and _____.
(A) carotenoids and other pigments are still present in the leaves
(B) the degraded chlorophyll changes into many other colors
(C) sugars are sent to most of the cells of the leaves
(D) water supply to the leaves has been reduced

28. How is plant cell cytokinesis different from animal cell cytokinesis?
(A) Plant cells divide after metaphase but before anaphase; animal cells divide after anaphase.
(B) The structural proteins of plant cells separate the two cells; in animal cells, a cell membrane separates the two daughter cells.
(C) Plant cells deposit vesicles containing cell-wall building blocks on the metaphase plate; animal cells form a cleavage furrow.
(D) The contractile filaments found in plant cells are structures composed of carbohydrates; the cleavage furrow in animal cells is composed of contractile phospholipids.

29. During which phase of mitosis do the chromatids become chromosomes?
(A) prophase
(B) metaphase
(C) telophase
(D) anaphase

30. Once a cell completes mitosis, molecular division triggers must be turned off. What happens to MPF during mitosis?
(A) It is completely degraded.
(B) The cyclin component of MPF is degraded.
(C) It is exported from the cell.
(D) The Cdk component of MPF is degraded and exported from the cell.

31. Which of the following is a difference between B cells and T cells?
(A) T cells are produced in the thymus and B cells are produced in the bone marrow.
(B) One has a major role in antibody production, while the other has a major role in cytotoxicity.
(C) B cells are activated by free-floating antigens in the blood or lymph. T cells are activated by membrane-bound antigens.
(D) One binds a receptor called BCR (B-cell receptor), while the other recognizes a receptor called TCR (T-cell receptor).

32. B cells interacting with helper T cells are stimulated to differentiate when _____.
(A) helper T cells release cytokines
(B) cytotoxic T cells present the class II MHC molecule-antigen complex on their surface
(C) B cells release cytokines
(D) B cells produce IgE antibodies

33. The "threshold" potential of a membrane is the _____.
(A) minimum hyperpolarization needed to prevent the occurrence of action potentials
(B) peak amount of depolarization seen in an action potential
(C) lowest frequency of action potentials a neuron can produce
(D) minimum depolarization needed to operate the voltage-gated sodium and potassium channels

34. Every morning at the same time, John went into the den to feed his new tropical fish. After a few weeks, he noticed that the fish swam to the top of the tank when he entered the room. This is an example of _____.
(A) classical conditioning
(B) imprinting
(C) operant conditioning
(D) cognition

35. Blood is best classified as connective tissue because _____.
(A) it contains more than one type of cell
(B) its cells can move from place to place
(C) its cells are separated from each other by an extracellular matrix
(D) it is found within all the organs of the body

36. Which of the following is correctly paired with its structure and function?
(A) periderm — parenchyma cells functioning in photosynthesis in leaves
(B) sclerenchyma — supporting cells with thick secondary walls
(C) guard cells — waterproof ring of cells surrounding the central stele in roots
(D) ground meristem — protective coat of woody stems and roots

37. You find a plant unfamiliar to you and observe that it has vascular bundles scattered throughout the stem cross section. What do you conclude about the plant?
(A) It is probably a monocot.
(B) It will probably get annual rings of wood.
(C) It could be either a young eudicot or a monocot.
(D) It is probably an herbaceous eudicot.

38. Which of these activities is part of the development of crop plants from wild relatives?
I) people planting seeds of the plants with the characteristic wanted
II) people making observations of desired plant characteristics
III) people eating products from only the plants with desired characteristics
IV) people developing several varieties of crops from a wild relative

(A) I, III, and IV
(B) I, II, and IV
(C) I and II
(D) I and IV

39. What is typically the result of double fertilization in angiosperms?
(A) Two embryos develop in every seed.
(B) A triploid zygote is formed.
(C) The endosperm develops into a diploid nutrient tissue.
(D) Both a diploid embryo and triploid endosperm are formed.

40. Canada thistle is a dicot that spreads via growth from lateral roots. You want to use a root miner insect for weed control. What would you need to observe in the underground growth to verify that this weed spreads via lateral roots and not by underground stems?
(A) meristematic tissue at the tips of the branches
(B) a vascular bundle in the center surrounded by parenchyma tissue
(C) vascular bundles in a ring around the outside of a cross section
(D) an epidermis at the periphery

國立交通大學107學年度碩士班考試入學試題

科目：普通生物(6082)　　考試日期:107年2月1日 第3節

系所班別：教育研究所　　組別：教育所丙C組　　

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二、簡答題（20%）**非選擇題請用答案卷作答**

1. 請描述神經細胞動作電位的產生及傳導機制。(10%)

2. 大隅良典教授發現細胞自噬作用機制而獲頒2016年諾貝爾生理或醫學獎。請描述細胞自噬（autophagy）過程及其對人類健康與疾病之影響。(10%)