說明：一、請一律以「答案卷」作答，作答時不得使用鉛筆，違者該科答案卷不予計分；限用黑色或藍色墨水的筆書寫。
二、考生應在答案卷上規定範圍內作答，且不得書寫任何與答案無關之文字、符號，違者該科不予計分。
三、答案卷以每人一張為限，不得要求增補；試題與答案卷必須繳回，不得攜出試場。

1. Which of the following is the proper order of cells for water and minerals to travel from the soil into the xylem?
   A) Root hair, cortex, epidermis, endodermis
   B) Endodermis, cortex, epidermis, endodermis
   C) Root hair, endodermis, cortex, xylem
   D) Root hair, cortex, endodermis, xylem
   E) Root hair, cortex, endodermis, phloem, xylem

2. *Plasmodium*, the organism that causes malaria, is a(n)
   A) amoeba.
   B) apicomplexan.
   C) spirochete.
   D) cellular slime mold.
   E) dinoflagellate.

3. If you placed a red blood cell in a *hypotonic* solution, you would predict that its volume would ____ while the solute concentration in its cytoplasm would ____.
   A) increase, increase
   B) increase, decrease
   C) decrease, increase
   D) decrease, decrease
   E) decrease, not change

4. Transduction is
   A) the transfer of bacterial genes to another bacteria by a virus.
   B) the transfer of viral genes to another bacteria by a virus.
   C) the use of bacterial replication machinery to produce viral particles.
   D) the transfer of bacterial genes from one bacteria to another.
   E) the transfer of bacterial genes to another via a pilus.

5. Which of the following is true of both neurotransmitters and hormones?
   A) They are both involved in paracrine signaling.
   B) They both interact with receptors inside or on the surface of target cells.
   C) They are both produced in glands.
   D) They both travel through the bloodstream to target cells.
   E) They both influence the activity of multiple organs simultaneously.

6. The organisms that most specifically utilize light energy to make organic molecules from inorganic molecules are
   A) photochemitrophs.
   B) chemoheterotrophs.
   C) photoautotrophs.
   D) auxophototrophs.
   E) photoheterotrophs.

7. Where does the Calvin cycle occur?
   A) thylakoid lumen
   B) thylakoid membrane
   C) chloroplast outer membrane
   D) chloroplast stroma
   E) chloroplast inner membrane

8. Unlike bacteria, archaea cell walls ***not*** contain a substance called
   A) cellulose.
   B) peptidoglycan.
   C) phospholipid.
   D) glycogen.
   E) proteinoid.

9. The critical function of the sodium-potassium pump of neurons is to move
   A) Na^+ and K^+ into the cell.
   B) Na^+ and K^+ out of the cell.
   C) Na^+ into the cell and K^+ out of the cell.
   D) Na^+ out of the cell and K^+ into the cell.
   E) Na^+ and K^+ into the cell and H^+ out of the cell through an antiport mechanism.

10. Which of the following characteristics is common to both viruses and bacteria
   A) infection pathway
   B) generalized transduction
   C) lytic replication
   D) genetic variation by mutation
   E) intracellular parasites

11. The neurotransmitter released at neuromuscular junctions in vertebrates is
   A) acetylcholine.
   B) serotonin.
   C) epinephrine.
   D) GABA.
   E) endorphin.

12. The lacteal, a lymphatic vessel in the center of each intestinal villus, functions in digestion by absorbing
   A) carbohydrates.
   B) proteins.
   C) nucleic acids.
   D) vitamin C.
   E) lipids.

13. Which of the following is a true statement about virus
   A) all viruses have capsids and membrane envelope
   B) viral RNA genome can be reversely transcribed into DNA by retrovirus
   C) RNA viruses can serve as a template for DNA synthesis
   D) viruses have lysogenic cycle
   E) all of the above

14. Which of the following is not the components of an operon

A) operator.

B) promoter.

C) co-repressor.

D) structural genes.

E) None of above.

15. Which of the followings is **NOT** true for cilia or flagella?

A) They are involved in cell motility.

B) They require ATP to work.

C) They are composed of microfilaments.

D) They require motor proteins to work.

E) They are composed of an internal structure called the axoneme.

16. Which of the following scientist-discoveries is mismatched?

A) Watson and Crick – DNA structure.

B) Griffith – DNA is genetic material.

C) Meselson and Stahl – DNA replication mechanism.

D) Mendel – genetic inheritance.

E) None of above.

17. Which of the following statements best describes DNA polymerase?

A) It is an enzyme required to produce a primer needed for DNA replication.

B) It is an enzyme that catalyzes the addition of nucleotides to the 5′ end of a growing DNA strand.

C) It is an enzyme that catalyzes the addition of nucleotides to the 3′ end of a growing DNA strand.

D) It is an enzyme required to glue pieces of DNA fragments together.

E) It is an enzyme that polymerizes the DNA and keeps the replication fork open.

18. A DNA specimen that contains 30% guanine has _____ thymine.

A) 10%

B) 20%

C) 30%

D) 40%

E) The amount of thymine cannot be determined.

19. Bile is crucial for _____ digestion because of its function in _____.

A) protein, protecting the stomach lining

B) fat, solubilizing glycerol:fatty acid bonds

C) nucleic acids, uncoiling DNA strands

D) fat, emulsification

E) protein, lyophilization

20. Which animal would you predict would have the highest mass-specific metabolic rate?

A) a lizard

B) a squid

C) an elephant

D) a goose

E) a hummingbird

21. Which structure prevents blood flowing back into the atria during ventricular contractions?
A) atrioventricular valves
B) semilunar valves
C) sinoatrial node
D) carotid blood shunts
E) foramen ovale

22. Which of the following statements about RNA polymerase in bacteria is INCORRECT?
A) It binds the promoter region of a gene.
B) It is bound to a sigma factor during initiation of transcription.
C) It synthesizes RNA.
D) It catalyzes the addition of nucleotides to the 5′end of a growing RNA strand.
E) It dissociates from the DNA at the terminator.

23. Surgical removal of the pancreas would
A) increase the acidity of the small intestine.
B) prevent the production of chyme in the stomach.
C) eliminate the ability to store bile in the gallbladder.
D) block the secretion of bile.
E) All of these changes would be a result of pancreas removal.

24. What protein is involved in synthesizing messenger RNA in eukaryotes?
A) RNA polymerase I
B) RNA polymerase II
C) RNA polymerase III
D) sigma factor
E) both RNA polymerase I and II

25. The respiratory centers that control ventilation of the lungs in mammals are located in the
A) brainstem.
B) hypothalamus.
C) cerebral cortex.
D) bronchi.
E) neck.

26. The ascending portion of the loop of Henle is
A) permeable to water and impermeable to sodium.
B) permeable to water and permeable to sodium.
C) impermeable to water and permeable to sodium.
D) impermeable to water and impermeable to sodium.
E) the site of active transport of water.

27. MicroRNAs (miRNAs)
A) are long RNA molecules.
B) promotes post-translational modification of proteins.
C) are found only in animals.
D) are cut by an enzyme called transcriptase.
E) silence the expression of specific mRNAs.

28. Which of these hormone-effect pairs is mismatched?
    A) growth hormone-linear growth
    B) glucagon-blood pressure
    C) aldosterone-blood osmolality
    D) thyroid hormone-metabolism
    E) glucagon-glucose regulation

29. Alternation of generations means
    A) One phase of the life cycle takes place on land and the other in water.
    B) One phase of the life cycle is photosynthetic and the other is heterotrophic.
    C) One phase of the life cycle is diploid and the other is haploid.
    D) One phase of the life cycle is unicellular and the other is multicellular.
    E) One phase of the life cycle is motile and the other is stationary.

30. The tracheae of adult terrestrial insects have been a factor in the great abundance of insects because they serve the same function in terms of the delivery of respiratory gases to the cells as do
    A) the gills of aquatic insects.
    B) the lungs of mammals.
    C) the book lungs of spiders.
    D) the closed circulatory system of cephalopods.
    E) the Malpighian tubules of spiders.

31. Sister chromatids separate during
    A) prophase of meiosis I.
    B) metaphase of meiosis I.
    C) metaphase of meiosis II.
    D) prometaphase of meiosis I.
    E) anaphase of meiosis II.

32. The nearest living relatives of crocodiles and alligators are
    A) snakes.
    B) birds.
    C) turtles.
    D) lizards.
    E) manatees.

33. Collagen is most likely found in which tissue type?
    A) Nervous
    B) Muscle
    C) Epithelial
    D) Connective
    E) Epithelial and connective tissue

34. What is the function of the poly A tail?
    A) The poly A tail is required for the termination of translation, it is recognized by the release factor proteins
    B) The poly A tail is required for the mRNA to resume its double helical structure
    C) The poly A tail increases mRNA stability in eukaryotes.
    D) The poly A tail increases mRNA stability in prokaryotes.
    E) The poly A tail serves as a termination sequence for RNA polymerase III.

35. Parathyroid hormone's main function is to

A) increase glucose mobilization during stress or fasting.

B) increase calcium by mobilizing the ion from bone.

C) increase sodium through reabsorption from kidney.

D) increase insulin-like growth factor I and linear body growth.

E) synergize with thyroid hormone in various functions.

36. Which of the choices lists the three phases of the ovarian cycle in the correct order?

A) follicular, luteal, ovulation

B) follicular, proliferative, secretory

C) luteal, ovulation, secretory

D) luteal, secretory, ovulation

E) follicular, ovulation, luteal

37. Which of the following components of a virus is not encoded by its own genome?

A) capsid

B) lipid bilayer of viral envelope

C) spike glycoproteins of viral envelope

D) bacteriophage anchoring structures

E) tail fibers

38. Place the events of parturition in the correct order.

(1) Stretch-sensitive neurons send signals to the hypothalamus.

(2) Oxytocin receptors increase in the uterus.

(3) Prostaglandin levels increase.

(4) Estradiol levels increase.

(5) Oxytocin levels increase.

(6) Uterine muscles start to contract.

A) 1,2,4,5,3,6

B) 4,2,1,5,6,3

C) 5,2,4,1,3,6

D) 1,6,4,2,5,3

E) 4,3,1,2,5,6

39. Antigen-presenting cells include

A) macrophages.

B) macrophages and B cells.

C) dendritic cells and macrophages.

D) dendritic cells and B cells.

E) macrophages, B cells and dendritic cells.

40. Several butterfly species that are edible to birds have very similar color patterns to the generally inedible monarch butterfly. This is best described as an example of what?

A) Batesian mimicry

B) Müllerian mimicry

C) Crypsis

D) Intimidation

E) aposematic coloration

41. Which of the following germ layer-structure is mismatched?
    A) mesoderm-notochord
    B) endoderm-lungs or respiratory tube
    C) ectoderm-epidermis
    D) mesoderm-digestive tract
    E) ectoderm-brain

42. The seeds of many plant species are dispersed by a harmless temporary attachment to an animal's fur or feathers. This form of dispersal can be classified as
    A) ectoparasitism.
    B) amensalism.
    C) mutualism.
    D) pollination.
    E) phoresy.

43. Which of these types of islands is predicted to have the lowest number of species?
    A) small island near mainland
    B) large island near mainland
    C) large island far from mainland
    D) small island far from mainland
    E) the island closest to mainland regardless of size

44. Primary production is generally highest in
    A) tundra.
    B) desert.
    C) wetlands.
    D) tropical rain forests.
    E) tropical oceans.

45. DNA methylation
    A) increases transcription.
    B) inhibits transcription.
    C) increases crossover events.
    D) decreases crossover events.
    E) promotes post-translational modification of proteins.

46. These are the only vertebrates in which blood flows directly from respiratory organs to body tissues without first returning to the heart.
    A) Amphibians
    B) Birds
    C) Fishes
    D) Mammals
    E) Reptiles

47. The clonal selection theory is an explanation for
    A) how a single type of stem cell can produce both red blood cells and white blood cells.
    B) how antibody proteins can be molded to fit antigens after the antigen interacts with the antibody-producing type of cell.
    C) how an antigen can induce the multiplication of B cells to result in production of high levels of specific antibodies.
    D) how HIV can disrupt the immune system.
    E) how macrophages can recognize specific T cells and B cells.

48. _____ is a water-soluble hormone derived from the nervous system that regulates blood volume and blood pressure?

A) Antidiuretic hormone

B) Aldosterone

C) Cortisol

D) Oxytocin

E) Adrenocorticotropic hormone

49. Active transcription occurs on

A) centromere

B) telomere

C) cytosome

D) heterochromatin

E) euchromatin

50. Which of the followings is an example of post-transcriptional gene processing?

A) DNA methylation

B) histone acetylation

C) RNA splicing

D) proteasome regulation

E) chromatin modification