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. What substance could be expected to accumulate in soil as a result of increased acid rain?
A) Ammonia.
B) Sodium.
C) Oxygen.
D) Calcium.
E) Iron.

2. Which one is the best answer that how do corals react when sea water temperatures are too high?
A) They reproduce in large numbers.
B) They slow down their shell-building processes.
C) They migrate to areas with lower water temperatures.
D) They expel their symbiotic algae.
E) They produce more pigment.

3. Which one of the following is the best example of a +/- interaction?
A) Competition.
B) Predation.
C) Commensalism.
D) Mutualism.
E) Parasitism.

4. Metagenomics is a new research field that offers a DNA-based approach to understand _____.
A) the history of species diversity
B) the Shannon Diversity Index
C) the organismic model of communities
D) microbial stability
E) microbial diversity

5. The probable extinction of the ivory-billed woodpecker was mainly driven by_____.
A) genetic drift
B) climate change
C) habitat destruction
D) introduced species
E) direct exploitation

6. Living organisms can be used to detoxify aquatic ecosystems after an oil spill, a technique known as___.
A) rehabilitation
B) restoration
C) replacement
D) bioremediation
E) nutrient cycling

7. Albinism in most animals is an epistatic trait characterized by a lack of melanin pigment in the eyes, skin, and hair. If the allele for albinism is “a”, the allele for brown coat color is “B”, and the allele for red coat color is “b”. Which one of the following could be the most possible result in an albino cow?
   A) Aabb.
   B) aaBB.
   C) aabb.
   D) AaBb.
   E) aaBB and aabb.

8. The Y substance is needed for the proper phenotypic expression of the A, B, and AB blood types in the ABO blood typing system in humans. Individuals who are recessive for the Y substance (yy) will have a type O phenotype, even if they have the A and/or B alleles. Two individuals, each with type AB blood and heterozygous at the H locus have children. What is the probability they will have a child who is phenotypically type O?
   A) 1/8.
   B) 3/8.
   C) 3/16.
   D) 4/16.
   E) 6/16.

9. Two molecules with identical molecular formulas but that have different structures are called _____.
A) isomers
B) polymers
C) carbohydrates
D) lipids
E) hydrocarbons

10. The_____ functional group can possibly provide covalent bond and then promote the tertiary structure of proteins?
A) NH_2
B) SH
C) PO_4
D) OH
E) COOH

11. If a specimen contains 30% adenine in its DNA then how much cytosine will there be_____.
A) 15%
B) 20%
C) 30%
D) 35%
E) 60%

12. The Endosymbiosis Theory best describes the origins of _____ in eukaryotes.
A) endoplasmic reticulum
B) peroxisome
C) mitochondria
D) nucleus
E) Golgi body

13. Sucrose and H^+ can move into the cell by a common membrane protein reflects transport through a ____.
A) voltage-gated channel
B) uniporter
C) antiporter
D) symporter
E) Shear flow channel

14. Which one of the following processes will both occur in the presence or absence of oxygen?
A) Glycolysis.
B) Electron transport chain.
C) Oxidative phosphorylation.
D) Cellular respiration.
E) TCA cycle.

15. Which one of the following is the most correct of the TCA cycle?
A) In the reaction of electron transport, the concentration of H^+ is increased in the matrix space.
B) It produces oxygen.
C) The reaction starts from the binding of 4-carbon complex and acetyl CoA.
D) It occurs on the intermembrane space of the mitochondria.
E) It produces ATP as the primary energy intermediate.

16. About the mitochondria, which one of the following is more incorrect?
A) The most cells contain at least one mitochondria.
B) Mitochondria can translate proteins by ribosome at the matrix space.
C) Mitochondria have DNA polymerase.
D) Mitochondrial DNA exhibits a circular form.
E) The genome size of mitochondria in the muscle cell is larger than skin cell.

17. About the light reaction of photosynthesis, which one of the following is the best answer?
A) Photosystem II contains both chlorophyll *a* and chlorophyll *b* molecules.
B) Photons with wave length 680 nm can push the phosphor atom to attach on ADP.
C) Photons with wave length 680 nm can push the phosphor atom to attach on ATP.
D) Cyclic electron flow can produce ATP and NADPH.
E) Cyclic electron flow is triggered by photosystem II.

18. About the ATP production in the light reaction of photosynthesis, which one of the following is the best answer?
A) The concentration of H^+ in the stroma is higher than thylakoid space during non-cyclic electron flow.
B) H^+ can transport across membrane through plastocyanin (Pc) and ATP synthase.
C) H_2O can continuously supply new H^+ to elevate the H^+ gradient between thylakoid membranes.
D) The final electron acceptor of non-cyclic electron flow is NADH reductase.
E) The ATP is produced inside the thylakoid space.

19. In C4 plants, the gaseous CO_2 can be fixed by _____.
A) oxaloacetate
B) phosphoenolpyruvate
C) malate
D) pyruvate
E) acetyl CoA

20. About the nutrient translocation (source-sink) during photosynthesis, which one of the following is the best answer?
A) Mesophyll cells can transport the sugar into phloem by passive transport.
B) Junior leaf is considered as a source tissue.
C) Companion cell can provide ATP to facilitate the phloem sugars transport into sink tissue.
D) The concentration of sugar in photosynthetic mesophyll cells is lower than phloem.
E) The concentration of sugar in the apical meristem is higher than phloem.

21. About the phytochrome, which one of the following is the best answer?
A) Pr and Pfr are the same protein.
B) Pr can trigger the flower gene of long-day plant.
C) Pfr can trigger the flower gene of short-day plant.
D) During the night time, the flash of light can increase the level of Pr
E) The night-length can be broken by the flash of light, likewise, the day-length can be broken by covering the black tank.

22. Polysaccharide _____ is an important ECM component for the exoskeleton of many insects and shellfish.
A) collagen
B) laminin
C) proteoglycan
D) chitin
E) glycosaminoglycans

23. The heart is a(n) _____ composed mainly of _____ tissue?
A) tissue, endothelial
B) tissue, connective
C) organ, muscle
D) organ, connective
E) organ, epithelial

24. Which one of the following proteins is involved in synthesizing messenger RNA in eukaryotes?
A) DNA polymerase I
B) DNA polymerase II
C) DNA polymerase III
D) RNA polymerase I
E) RNA polymerase II

25. Which one of the following is the best characteristic of microRNAs (miRNAs)?
A) MicroRNAs are short RNA molecules that encoded by genome.
B) MicroRNAs can target the genome to suppress gene expression.
C) MicroRNAs can edit the RNA sequence.
D) MicroRNAs can edit DNA sequence.
E) MicroRNAs can edit amino acid sequence of protein.

26. Bacteria are grown in isotopic ^{15}N (heavy) medium and then transferred to ^{14}N (light) medium and allowed to replicate for 2 generations. The DNA is subsequently isolated and centrifuged in a $CsCl_2$ gradient to yield what type of gradient band(s)?
A) One heavy and one half-heavy band.
B) One light and one half-heavy band.
C) One half-heavy (intermediate to heavy and light) band.
D) One heavy band.
E) One light band.

27. Where would one expect to find the most abundant/active telomerase?
A) Male germ cells that give rise to gametes.
B) A nerve cell from a 2-year-old individual.
C) A nerve cell from a 40-year-old individual.
D) Skin cells from a 2-year-old individual.
E) Skin cells from a 60-year-old individual.

28. _____ is a type of physical mutagens could induce thymine dimer mutations.
A) Gamma rays
B) X-rays
C) Microwave
D) Ultraviolet light
E) Ionizing radiation

29. Which one of the following is the cancer of epithelial cells?
A) Sarcoma.
B) Myeloma.
C) Leukemia.
D) Lymphoma.
E) Carcinoma.

30. When cancer cells can migrate to other parts of the body, they are always said to be____.
A) benign
B) invasive
C) metastatic
D) oncogenic
E) genetic

31. Humans have _____ different types of autosomes.
A) 11
B) 22
C) 33
D) 44
E) 46

32. Meiosis I produces _____, and meiosis II produces _____ cells.
A) 2 diploid, 2 haploid
B) 2 haploid, 2 haploid
C) 2 diploid, 4 haploid
D) 2 haploid, 4 haploid
E) 2 somatic, 2 gametic

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

34. What enzyme does the *lacZ* gene encode?
A) DNase.
B) Carbonic anhydrase.
C) β-galactosidase.
D) Glucose dehydrogenase.
E) Succinate dehydrogenase.

35. Which one of the following is the best statement about genomic library and cDNA library?
A) A cDNA library is derived from mRNA by using reverse transcriptase.
B) A genomic library is derived from mRNA by using reverse transcriptase.
C) The number of DNA fragment in genomic library is the same to cDNA library.
D) One DNA sequence can generate one cDNA.
E) Most of DNA sequences from cDNA library are longer than that from genomic library.

36. The Hardy-Weinberg equation stats that $p^2 + 2pq + q^2 = 1$; the genotype frequency of heterozygotes is represented by _____.
A) q^2
B) p^2
C) 2pq
D) $2pq+ p^2$
E) $p^2 +q^2$

37. Animals that lack a vertebral column are known as_____.
A) invertebrates
B) inarticulates
C) supinates
D) aspinates
E) retrogrades

38. Which one of the following hormones are not derived from cholesterol?
A) Testosterone.
B) Melatonin.
C) Cortisol.
D) Estradiol.
E) Aldosterone.

39. _____ is a water-soluble hormone derived from the nervous system that regulates blood volume and blood pressure?
A) Cortisol
B) Oxytocin
C) Aldosterone
D) Antidiuretic hormone
E) Adrenocorticotropic hormone

40. Which of the following correctly describes the path of urine from formation to excretion in the mammalian kidney?
A) collecting duct → ureter → urinary bladder → renal pelvis → urethra
B) renal pelvis → ureter → urinary bladder → urethra → collecting duct
C) ureter → collecting duct → renal pelvis → urinary bladder → urethra
D) collecting duct → renal pelvis→ ureter → urinary bladder → urethra
E) urethra → collecting duct → renal pelvis → ureter → urinary bladder

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

42. The change in the concentration of _____ is the major factor that affects the breathing control centers.
A) hemoglobin
B) hydrogen ions
C) bicarbonate ions
D) carbon dioxide
E) oxygen

43. In vertebrates with four-chambered hearts, the ____ receives oxygenated blood directly from the _____.
A) left atrium, left ventricle
B) left ventricle, lungs
C) left ventricle, left atrium
D) right ventricle, lungs
E) right ventricle, right atrium

44. The most possible chemical compound for increasing cardiac output when animals are exercising is ___.
A) epinephrine
B) serotonin
C) dopamine
D) glutamate
E) acetylcholine

45. The stomach is majorly surrounded by which type of muscle?
A) Skeletal muscle.
B) Smooth muscle.
C) Cardiac muscle.
D) Voluntary muscle.
E) Striated muscle.

46. The _____ protein might contains an ATP binding site for further activation.
A) tropomyosin
B) troponin
C) myosin
D) actin
E) All of the choices are correct

47. The perception of a certain pitch of sound is possibly depends on which of the following?
A) Whether it is the round window or oval window that vibrates.
B) Which bones of the middle ear are moved.
C) The amplitude of the sound waves.
D) Where particles settle in the semicircular canals.
E) Which hair cells of the cochlea are stimulated.

48. The tough outer covering of the eye is mainly referred to as the ____.
A) sclera
B) retina
C) pupil
D) iris
E) fovea

49. Injury to the cerebellum could dominantly result in which one of the following?
A) Diminished thermoreceptive sensation.
B) Decreased ability to balance.
C) Loss of vision.
D) Loss of taste sensation.
E) Loss of hearing.

50. During the rapid increase in membrane potential seen in the upsweep of the action potential, which description of the following is most correct?
A) The sodium/potassium pump has reversed directions and is pumping sodium in and potassium out.
B) Both the activation and inactivation gates of the voltage-gated sodium channels are open.
C) The potassium leak channels are closed.
D) The sodium leak channels are closed.
E) The voltage-gated potassium channel is open.