

選擇題 (單選，共 50 題，每題 2 分，無倒扣，請作答在答案卡上)

1. All organic molecules contain
 - A. oxygen and carbon.
 - B. nitrogen and oxygen.
 - C. hydrogen and oxygen.
 - D. carbon and nitrogen.
 - E. hydrogen and carbon.

2. A protein's _____ structure contains helixes and sheets that result from hydrogen bonding between carboxyl and amino groups of the polypeptide chain.
 - A. primary
 - B. secondary
 - C. tertiary
 - D. quaternary
 - E. both secondary and quaternary

3. In animal cells, microtubules grow from
 - A. the plasma membrane.
 - B. the outer membrane of the nuclear envelope.
 - C. centrosomes containing centrioles.
 - D. dimerization centers located throughout the cytosol.
 - E. the tips of the chromosomes.

4. The nucleus is to eukaryotes as the _____ is to prokaryotes.
 - A. plasmid
 - B. RNA strand
 - C. ribosome
 - D. nucleoid
 - E. nucleolus

5. Two "magic" solutions are sold by a research supply company. "Magic Solution A" promises to extract all proteins, including integral membrane proteins, from the plasma membrane. "Magic Solution B" promises to simply extract all peripherally associated membrane proteins. What is the likely composition of "Magic Solution A" and "Magic Solution B"?
 - A. "Solution A" and "Solution B" both contain high salt buffers that disrupt hydrogen bonds and ionic interactions
 - B. "Solution A" and "Solution B" both include membrane solubilizing detergent(s)
 - C. "Solution A" is a membrane solubilizing detergent, "Solution B" is a high salt buffer that disrupts hydrogen bonds and ionic interactions
 - D. "Solution A" is a high salt buffer that disrupts hydrogen bonds and ionic interactions, "Solution B" is a membrane solubilizing detergent
 - E. "Solution A" is a reducing buffer that disrupts disulfide bonds in proteins, "Solution B" is a membrane solubilizing detergent

6. What would be an expected feature of a plasma membrane that had no integral membrane proteins?
- The membrane would be unable to transport sodium ions
 - The membrane would collapse
 - The membrane would have no fluidity
 - The membrane would have no cholesterol
 - The membrane would not associate with peripheral membrane proteins
7. In the equation, $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$, ATP and heat would be on which side of the reaction?
- The products because this is an exergonic reaction.
 - The reactants because this is an endergonic reaction.
 - It could appear on either side because this reaction is in equilibrium.
 - The reactants because this is an exergonic reaction.
 - The products because this is an endergonic reaction.
8. How is a gradient of H^+ ions formed across the inner mitochondrial membrane?
- The electron transport chain uses energy from transfer of an electron donated by NADH to pump H^+ across the inner mitochondrial membrane against its electrochemical gradient.
 - ATP synthase generates a H^+ gradient across the inner mitochondrial membrane.
 - Electrons move from NADH to a chain of proteins with lower electronegativities.
 - The electron transport chain uses ATP to pump H^+ across the inner mitochondria membrane against its electrochemical gradient.
 - The electron transport chain of proteins contains pores that are leaky to H^+ .
9. When a cell secretes a growth factor that binds to receptors on its own membrane preventing it from proliferating, this is an example of ____.
- direct intercellular signaling
 - endocrine signaling
 - contact-dependent signaling
 - paracrine signaling
 - autocrine signaling
10. The monomers of DNA and RNA are
- monosaccharides.
 - nucleotides.
 - bases
 - nucleic acids.
 - pentoses.
11. Why does a DNA strand grow only in the 5' to 3' direction?
- because DNA polymerases can only add nucleotides to the 3' end of the growing molecule
 - because DNA polymerases can only add nucleotides to the 5' end of the growing molecule
 - because the DNA molecule only unwinds in the 5' to 3' direction
 - because DNA polymerase requires the addition of a starter nucleotide at the 5' end
 - because the 5'-end is capped

12. _____ is to transcription as _____ are to translation.
- A. RNA spliceosome; ribosomes
 - B. RNA polymerase; ribosomes
 - C. Primer; ribozymes
 - D. DNA polymerase; RNA polymerase
 - E. DNA polymerase; ribozymes
13. Which sequence of events CORRECTLY describes the initiation and elongation steps of translation in prokaryotic cells?
- (1) initiator tRNA binds start codon on mRNA
 - (2) small ribosomal subunit binds to mRNA
 - (3) large ribosomal subunit binds
 - (4) tRNA entry and peptidyl transfer reaction
 - (5) translocation of ribosome and release of tRNA
- A. 1, 2, 3, 4, 5
 - B. 1, 2, 3, 5, 4
 - C. 1, 3, 2, 4, 5
 - D. 2, 3, 1, 5, 4
 - E. 2, 1, 3, 4, 5
14. Genes organized into an operon are beneficial to certain bacteria because the operon allows for
- A. differential regulation of individual genes that encode proteins with a common function.
 - B. coordinated regulation of a group of genes that encode proteins with a common function.
 - C. separate regulation of individual genes that encode proteins with different functions.
 - D. coordinated regulation of a group of genes that encode proteins with different functions.
 - E. coordinated regulation of a group of proteins involved in numerous cellular activities.
15. DNA methylation
- A. increases transcription.
 - B. inhibits transcription.
 - C. increases crossover events.
 - D. decreases crossover events.
 - E. increases post-translational modification of proteins.
16. A researcher determined that a strain of *E. coli* is producing a shortened version of a protein required for glucose metabolism. What type of mutation could be responsible for this shorter than normal protein?
- A. nonsense mutation
 - B. missense mutation
 - C. silent mutation
 - D. sense mutation
 - E. frameshift mutation

17. _____ can convert proto-oncogenes into oncogenes.
- A. Gene amplifications
 - B. Retroviral insertions
 - C. Chromosomal translocations
 - D. Missense mutations
 - E. All of these choices are correct
18. Which of the following is NOT a checkpoint that controls the progression of the cell cycle?
- A. Cyclins and cyclin-dependent kinases are proteins that are responsible for advancing a cell through the phases of the cell cycle.
 - B. The G2 checkpoint checks for DNA damage and determines if all of the DNA is replicated.
 - C. The metaphase checkpoint determines if all chromosomes are attached to the spindle apparatus.
 - D. Cytokinesis involves the formation of cleavage furrow to separate the cells.
 - E. The restriction point determines if conditions are favorable for cell division and if the DNA is undamaged.
19. Which of the following statements regarding the differences between mitosis and meiosis is *false*?
- A. In meiosis four daughter cells are produced, whereas in mitosis two daughter cells are produced.
 - B. Cells produced by mitosis are normally diploid, whereas cells produced by meiosis are normally haploid.
 - C. In mitosis cytokinesis occurs once, whereas in meiosis cytokinesis occurs twice.
 - D. Crossing over is a phenomenon that happens only in meiosis.
 - E. In mitosis the chromosomes replicate only once, whereas in meiosis the chromosomes replicate twice.
20. Type 1 fucosidosis is a rare human disease. Patients cannot hydrolyze the disaccharide fucose, and as a result have severe neurological decline and die by age 6. The disease is due to a defect in the gene that encodes the lysosomal enzyme that breaks down fucose (α -1-fucosidase), and is inherited in an autosomal recessive manner. Jane and John have a child who has Type 1 fucosidosis. What is the probability that their next two children will all NOT have the disease?
- A. None (all of their children will have the disease)
 - B. 1/2
 - C. 3/4
 - D. 1/8
 - E. 9/16
21. If the recombination frequency between gene *A* and *B* is 10 out of 100 offspring, gene *A* and *C* is 30 out of 100 offspring, and gene *B* and *C* is 40 out of 100 offspring, what is the location of these genes in relation to each other on a chromosome?
- A. *CAB*
 - B. *BAC*
 - C. *ABC*
 - D. *CBA*
 - E. either *CAB* or *BAC*

22. Which of the following phrases INCORRECTLY finishes this statement?

Stem cells

- A. can undergo mitosis.
- B. can differentiate into more than one type of specialized cell.
- C. vary in their potency.
- D. are only found in embryos.
- E. can sometimes only differentiate into one cell type.

23. Survivin is an apoptosis inhibitor in humans. If the *survivin* gene is mutated so that it produces too much of the survivin protein, which of the following would be the most likely effect on limb formation?

- A. Mitosis of the limb bud cells would not occur.
- B. Cells would not migrate to their correct position.
- C. Cell determination would not occur.
- D. Cell differentiation would not occur.
- E. Webbing between digits would not be removed.

24. Primers are used in both PCR and in DNA sequencing. What is the purpose of the primers?

- A. to separate the DNA template strands.
- B. to provide a 3'-OH for DNA polymerase to build a new DNA strand.
- C. to terminate synthesis of the growing DNA strand.
- D. to separate various-sized DNA products.
- E. to add nucleotides to a growing DNA strand.

25. If a plasmid lacks an origin of replication what will happen when it is transformed into bacteria?

- A. As the bacteria divide they will lose the plasmid.
- B. There will not be regions to clone genes into the plasmid.
- C. Bacteria containing the plasmid will not be able to grow in the presence of antibiotics.
- D. The plasmid will not be useful in producing a protein because it lacks an RNA polymerase binding site.
- E. The plasmid cannot be cut with restriction enzymes.

26. Neurons contain _____ to receive signals, contain _____ to send out signals.

- A. axons, dendrites
- B. nucleus, axon
- C. dendrites, axons
- D. axon hillock, axon
- E. axon, axon hillock

27. The action potential does not move backward from the terminal to hillock because

- A. close of the inactivation gate of Na^+ channels
- B. delayed open of the K^+ channels
- C. close of the inactivation gate of K^+ channels
- D. increase of the threshold to induce action potential
- E. open of the voltage-gated Ca^{2+} channels

28. It is correct to say that neural transmission across mammalian synaptic clefts is the result of
- A. neural impulses involving the flow of K^+ and Na^+ across the cleft.
 - B. neural impulses traveling across the gap as electrical currents.
 - C. neural impulses causing the release of chemicals that diffuse across the cleft.
 - D. neural impulses traveling across the cleft in both directions.
 - E. the calcium within the axons and dendrites of nerves adjacent to a synapse acting as the neurotransmitter.
29. In the peripheral nervous system, groups of neuronal cell bodies that are clustered together to perform basic functions are known as
- A. nuclei.
 - B. ganglia.
 - C. nerves.
 - D. spinal cords.
 - E. somata.
30. Damage to the cerebellum could result in
- A. decreased ability to balance.
 - B. loss of hearing.
 - C. loss of vision.
 - D. loss of taste sensation.
 - E. diminished thermoreceptive sensation.
31. What would a scientist see when looking through a microscope at a piece of shoulder muscle?
- A. striations with unbranched fibers
 - B. striations with branched fibers
 - C. no striations and unbranched fibers
 - D. no striations and branched fibers
 - E. The scientist would see none of the above features in shoulder muscle.
32. In muscle function at the sarcomere level, the formation of cross-bridges is regulated by the binding of ___ ions to ____.
- A. calcium, troponin
 - B. calcium, tropomyosin
 - C. calcium, myosin
 - D. sodium, troponin
 - E. sodium, tropomyosin
33. Imagine a red blood cell leaving the right ventricle of your heart. To which chamber of the heart will that cell return first?
- A. right atrium
 - B. right ventricle
 - C. left atrium
 - D. left ventricle
 - E. impossible to say from information given

34. What is the correct sequence (left to right) of structures through which air passes through on the way into the mammalian lung?
- A. pharynx larynx trachea bronchi bronchioles alveoli
 - B. larynx pharynx trachea bronchi bronchioles alveoli
 - C. pharynx trachea larynx bronchi bronchioles alveoli
 - D. bronchi bronchioles pharynx larynx trachea alveoli
 - E. alveoli bronchioles bronchi trachea larynx pharynx
35. What is the correct rank order for relative toxicity (most to least) of the primary nitrogenous wastes generated by different animals?
- A. ammonia urea uric acid
 - B. uric acid ammonia urea
 - C. urea uric acid ammonia
 - D. ammonia uric acid urea
 - E. urea ammonia uric acid
36. What is the path (left to right) of urine from formation to excretion in the mammalian kidney?
- A. collecting duct renal pelvis ureter urinary bladder urethra
 - B. renal pelvis ureter urinary bladder urethra collecting duct
 - C. ureter collecting duct renal pelvis urinary bladder urethra
 - D. collecting duct ureter urinary bladder renal pelvis urethra
 - E. urethra collecting duct renal pelvis ureter urinary bladder
37. 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.
38. Which of these gland-hormone pairs is mismatched?
- A. pancreas-insulin
 - B. anterior pituitary-growth hormone
 - C. thyroid-thyroid hormone
 - D. adrenal-parathyroid hormone
 - E. ovaries-progesterone
39. 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

40. What cell is haploid?

- A. oogonium
- B. zygote
- C. primary oocyte
- D. ovum
- E. spermatogonium

41. 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. follicular, ovulation, luteal
- E. luteal, secretory, ovulation

42. Which event of fertilization occurs first?

- A. fast block to polyspermy
- B. the entry of sperm DNA into the egg
- C. the slow block to polyspermy
- D. the acrosomal reaction
- E. the cortical reaction

43. Which of the following is TRUE of a morphogen? It is a signaling molecule that

- A. is required for cell-to-cell contact within the embryo.
- B. induces the differentiation of cells within the embryo.
- C. induces blastulation of the developing embryo.
- D. induces implantation of the embryo into the uterus of mammals.
- E. that separates out cytoplasmic factors to their respective cells within the developing embryo.

44. Vaccinations are effective in combating future infections because they induce the production of

- A. helper T cells.
- B. neutrophils.
- C. prostaglandins.
- D. mutations in the host genome.
- E. memory cells.

45. All of the following are components of nonspecific immunity EXCEPT

- A. skin.
- B. phagocytes.
- C. complement.
- D. lysozyme.
- E. B cells.

46. Which of the following is true of T cells and B cells?

- A. They are effector cells against specific pathogens.
- B. They are produced from stem cells of the bone marrow.
- C. They can help attack and destroy invading pathogens.
- D. They typically have a short life span.
- E. All of these statements are true.

47. In the Hardy-Weinberg equation, the genotype frequency of heterozygotes is represented by
- A. p^2
 - B. $2pq$
 - C. q^2
 - D. $p^2 + q^2$
 - E. $p^2 + 2pq$
48. What mechanism leads to changes in allele frequencies due to random chance?
- A. Genetic drift
 - B. Natural selection
 - C. Sexual selection
 - D. Neutral variation
 - E. inbreeding
49. A major disadvantage of using DNA or RNA sequences to identify species is that
- A. it can only be used for sexually reproducing organisms.
 - B. it cannot be used for extinct species.
 - C. there are no rules for determining the number of sequence differences needed for a new species.
 - D. it can be misleading because many species exhibit large variation in phenotype.
 - E. it is expensive to sequence genomic DNA
50. Adaptive radiation is likely to have led to which of the following?
- A. The divergence of a single pea aphid population into two distinct species.
 - B. The evolution of the horse via changes in climate and food supply.
 - C. The long period of equilibrium in a bat species in the Mariana Islands.
 - D. The 1,000 species of *Drosophila* found dispersed throughout the Hawaiian Islands.
 - E. A population of mountain goats are split because of the formation of a glacier.