

I. Choose the most appropriate answer for the following questions, 2 points each. (80%)

1. What type of bonds does carbon have a tendency to form?
 - A) polar covalent
 - B) hydrogen
 - C) covalent
 - D) ionic
 - E) both hydrogen and ionic
2. Which type of lipid is most important in biological membranes?
 - A) fats
 - B) wax
 - C) phospholipids
 - D) oils
 - E) triglycerides
3. Which of the following is the most randomized form of energy?
 - A) light
 - B) electrical
 - C) thermal (heat)
 - D) mechanical
 - E) chemical potential energy
4. What is the innermost portion of mature plant cell walls called?
 - A) primary cell wall
 - B) secondary cell wall
 - C) middle lamella
 - D) glycocalyx
 - E) tonoplast
5. Of the following, which is the most important role of exocytosis?
 - A) to remove away from danger
 - B) to release substances from the cell
 - C) to incorporate nutrients
 - D) to pump protons
 - E) to create new cells

(背面仍有題目,請繼續作答)

6. All of the following substances are produced in a muscle cell under anaerobic conditions EXCEPT
- A) ATP
 - B) Pyruvate
 - C) Lactate
 - D) Acetyl CoA
 - E) NADH
7. Which of the following would you expect to see as products of the dark reaction of photosynthesis?
- A) carbon dioxide, NADPH and ATP
 - B) NADPH, Pi and ATP
 - C) carbon dioxide, ATP and glucose
 - D) glucose, NADP⁺ and ADP
 - E) water, carbon dioxide and light
8. Which statement about photosynthesis in C₄ plants is NOT true?
- A) the first product of carbon dioxide fixation is a compound with 4 carbon atoms.
 - B) C₄ photosynthesis is an adaptation for plants living in hot, arid climates.
 - C) carbon dioxide is initially fixed in mesophyll cells, but the Calvin cycle is active in bundle sheath cells in leaves of C₄ plants.
 - D) less ATP is used overall for sugar biosynthesis in C₄ than in C₃ plants
 - E) photorespiration is minimal in C₄ plants compared to C₃ plants.
9. Ligand-gated ion channels
- A) are important in the nervous system
 - B) lead to changes in sodium and calcium concentrations in cells
 - C) open or close in response to a chemical signal
 - D) None of these describe ligand-gated ion channels
 - E) All of these describe ligand-gated ion channels
10. Enzymes that control the activities of other proteins are called
- A) ATPases
 - B) Microtubules
 - C) Kinetochores
 - D) Chromatin
 - E) Protein kinases

11. A mammalian zygote with which of the following chromosomal abnormalities will NEVER develop into a viable embryo?
- A) YO
 - B) XO
 - C) XXX
 - D) XXY
 - E) XXXY
12. What kind of chemical bonds are found between paired bases of the DNA double helix?
- A) hydrogen
 - B) ionic
 - C) covalent
 - D) sulfhydryl
 - E) phosphate
13. All of the following are transcribed from DNA EXCEPT
- A) protein
 - B) exons
 - C) rRNA
 - D) tRNA
 - E) mRNA
14. Which of the following does NOT consist of a sequence of bases?
- A) structural gene
 - B) repressor
 - C) promoter
 - D) regulator gene
 - E) operator
15. A eukaryotic gene typically has all of the following features EXCEPT
- A) introns
 - B) an operator
 - C) a promoter
 - D) a start base triplet
 - E) a transcriptional stop message
16. Restriction fragments of DNA are separated from one another by which process?

- A) filtering
- B) centrifugation
- C) gel electrophoresis
- D) chromatography
- E) electron microscopy

17. Which of the following is LEAST related to the others?

- A) cytoplasmic determinants
- B) morphogen
- C) totipotent
- D) induction
- E) homeotic genes

18. Which of the following disciplines has contributed LEAST to the body of evidence for evolution?

- A) biogeography
- B) molecular biology
- C) mycology
- D) taxonomy
- E) paleontology

19. In a population with two alleles, A and a, the frequency of a is 0.6. What would be the frequency of heterozygotes if the population is in Hardy-Weinberg equilibrium?

- A) 0.16
- B) 0.36
- C) 0.4
- D) 0.48
- E) 0.64

20. A new plant species formed from hybridization of a plant with a diploid number of 16 with a plant with a diploid number of 12 would probably have a gamete chromosome number of

- A) 28
- B) 22
- C) 16
- D) 14
- E) 12

21. A randomly selected group of organisms from a family would show more genetic variation than a randomly selected group from a
- A) class
 - B) genus
 - C) kingdom
 - D) order
 - E) phylum
22. The antibiotics known as penicillins inhibit the ability of bacteria to
- A) forms spores
 - B) synthesize cell walls
 - C) perform respiration
 - D) replicate DNA
 - E) synthesize proteins
23. The largest seaweeds belong to which group?
- A) Cyanobacteria
 - B) Phaeophyta (brown algae)
 - C) Rhodophyta (red algae)
 - D) Chlorophyta (green algae)
 - E) Euglenoids
24. All of the following have similar life cycles EXCEPT
- A) fern
 - B) mosses
 - C) hornworts
 - D) liverworts
25. Which of the following flower parts develops into a seed after fertilization?
- A) ovule (embryo sac)
 - B) ovary
 - C) fruit
 - D) style
 - E) stamen
26. Which of the following is NOT a fungal disease?
- A) AIDS
 - B) Athlete's foot

- C) Rhodoturula
 - D) Candida
27. The blastopore denotes the presence of an endoderm-lined tube in the developing embryo known as the
- A) archenteron
 - B) blastula
 - C) coelom
 - D) germ layer
 - E) diploblast
28. Muscles and nerves in their simplest forms occur in the
- A) cnidarians
 - B) sponges
 - C) nematodes
 - D) flatworms
 - E) ribbon worms
29. All of the following are derived from ground meristem EXCEPT
- A) collenchyma
 - B) sclerenchyma
 - C) parenchyma
 - D) sclereids
 - E) phloem
30. In flowering plants, pollen is released from the
- A) pollen tube
 - B) stigma
 - C) carpel
 - D) sepal
 - E) anther
31. There is some experimental evidence that a hypothetical flowering hormone may be produced by
- A) flowers
 - B) leaves
 - C) roots
 - D) seeds

- E) floral buds
32. The functional unit of nervous tissue is the
- A) cell body
 - B) neuron
 - C) axon
 - D) dendrite
 - E) brain
33. A digestive juice with a pH of 2 probably came from the
- A) mouth
 - B) stomach
 - C) pancreas
 - D) esophagus
 - E) small intestine
34. Tracheal systems for gas exchange are found in
- A) crustaceans
 - B) earthworms
 - C) insects
 - D) jellyfish
 - E) vertebrates
35. In the production of monoclonal antibodies, B lymphocytes are fused with
- A) T lymphocytes
 - B) Hybridoma cells
 - C) Myeloma cells
 - D) Mast cells
 - E) Memory cells
36. The digestion and utilization of which nutrient creates the greatest need for osmoregulation by the kidneys?
- A) protein
 - B) starch
 - C) fat
 - D) oil
 - E) cellulose

37. The main target organ of ADH is the
- A) kidney
 - B) posterior pituitary
 - C) adrenal gland
 - D) bladder
 - E) anterior pituitary
38. Which part of the genitalia of a human female develops from the same embryonic structure as the male's scrotum?
- A) labia majora
 - B) clitoris
 - C) urethra
 - D) hymen
 - E) ovary
39. Heart rate is controlled by the
- A) neocortex
 - B) medulla
 - C) thalamus
 - D) pituitary
 - E) cerebellum
40. Which of the following is a density-independent factor limiting human population growth?
- A) social pressure for birth control
 - B) earthquakes
 - C) plaques
 - D) famines

II. Answer the following questions. (20 %)

1. Will there be anything left for genetic researchers to do once the Human Genome Project has determined the nucleotide sequences of all of the human chromosomes? Explain. (10%)
2. How do most biologists think that the mitochondria and chloroplasts of eukaryotic cells originated? What is the evidence for this idea? (10%)