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?

(背面仍有題目,請繼續作答)

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) Rhodophya (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

(背面仍有題目,請繼續作答)

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%)