

注意事項：不必抄題，但須依題號依序作答，答案一律寫在答案卷上，  
否則不予計分。

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

1. Why are biologists so interested in chemistry?
  - a. Chemicals are the fundamental parts of all living things.
  - b. Most chemicals are harmful to living things.
  - c. They know little about life except the chemicals it is made from.
  - d. If you understand the chemistry of life, you can make a lot of money.
  - e. Everything about life can be known by understanding its chemistry.
2. The four main categories of macromolecules in a cell are
  - a. proteins, DNA, RNA, and steroids.
  - b. monosaccharides, lipids, polysaccharides, and proteins.
  - c. proteins, nucleic acids, carbohydrates, and lipids.
  - d. nucleic acids, carbohydrates, monosaccharides, and proteins.
  - e. RNA, DNA, proteins, and carbohydrates.
3. An acid is a substance that
  - a. contains hydrogen.
  - b. forms covalent bonds with other substances.
  - c. donates hydrogen ions to solutions.
  - d. is a versatile solvent.
  - e. removes hydrogen ions from solutions.
4. \_\_\_ is an example of the cellular work accomplished with the free energy of ATP hydrolysis.
  - a. Mechanical work, such as beating cilia,
  - b. Transport work, such as the movement of glucose into an adipose cell,
  - c. Chemical work, such as the synthesis of new protein,
  - d. Mechanical work, such as pumping blood through the circulatory system
  - e. all of the above
5. The maximum size of a cell is limited by
  - a. its need for enough surface area for exchange with its environment.
  - b. the number of organelles that can be packed inside.
  - c. the materials needed to build it.

(背面仍有題目,請繼續作答)

- d. the amount of flexibility it needs to be able to move.
  - e. the amount of food it needs to survive.
6. Diffusion of water across a selectively permeable membrane is called
- a. active transport.
  - b. osmosis.
  - c. exocytosis.
  - d. passive transport.
  - e. facilitated diffusion.
7. The main function of cellular respiration is
- a. breaking down toxic molecules.
  - b. making ATP that powers cell activities.
  - c. making food.
  - d. producing chemical "building blocks" for cell structures.
  - e. breaking down ATP, so that ADP and P can be reused.
8. In photosynthesis, plants use carbon from \_\_\_\_ to make sugar and other organic molecules.
- a. water
  - b. the air
  - c. chlorophyll
  - d. the sun
  - e. soil
9. Which of the following is not a function of mitotic cell division in animals?
- a. asexual reproduction
  - b. growth
  - c. repair of damaged organs
  - d. production of gametes
  - e. cell replacement
10. Which of the following is a normal human female?
- a. X Y
  - b. X X Y
  - c. X X X
  - d. X
  - e. X X
11. Why is sickle cell disease so called?
- a. because it makes people sick
  - b. its named after a special type of white blood cell
  - c. pH changes in the blood cells make them collapse into a sickle shape
  - d. because its caused by an infectious microorganism that has sickle shaped cells

- e. the cells lining the arteries become deformed and sickle-shaped
12. Each cell in an individual with Down syndrome contains \_\_\_\_ chromosomes.
- 3
  - 22
  - 24
  - 45
  - 47
13. The flow of information in a cell proceeds
- from RNA to DNA to protein.
  - from protein to RNA to DNA.
  - from DNA to protein to RNA.
  - from RNA to protein to DNA.
  - from DNA to RNA to protein.
14. A microbiologist found that a clone of bacteria infected by phages had developed the ability to make a particular amino acid that they could not make before. This new ability was probably a result of
- transformation.
  - natural selection.
  - conjugation.
  - spontaneous mutation.
  - transduction.
15. Your bone cells, muscle cells, and skin cells look different because
- different kinds of genes are present in each kind of cell.
  - they are present in different organs.
  - different genes are active in each kind of cell.
  - they contain different numbers of genes.
  - different mutations have occurred in each kind of cell.
16. A genomic library is
- where you look to find out how to make recombinant DNA.
  - a listing of the known nucleotide sequences for a particular species.
  - all the genes contained in one kind of cell.
  - a collection of cloned DNA pieces of recombinant DNA.
  - a place where one can obtain DNA samples from various species.
17. Cells from the root of a carrot can be removed and placed in a culture medium, and will develop into a normal adult. This demonstrates that carrot cells
- differ genetically at maturity.
  - differentiate.
  - differ as mature cells.

(背面仍有題目,請繼續作答)

- d. have genomic equivalence.  
e. are undifferentiated as adult cells.
18. In evolutionary terms, an organism's fitness is measured by its
- health.
  - contribution to the gene pool of the next generation.
  - mutation rate.
  - genetic variability.
  - stability in the face of environmental change.
19. The ultimate source of all genetic variation is
- natural selection.
  - genetic drift.
  - sexual recombination.
  - the environment.
  - mutation.
20. Biologists have found more than 500 species of fruit flies on the various Hawaiian Islands, all apparently descended from a single ancestor species. This example illustrates
- polyploidy.
  - temporal isolation.
  - adaptive radiation.
  - hybrid breakdown.
  - meiotic failure.
21. If you want to see a dinosaur, it would be best to set the controls of your time machine for the
- Mesozoic era.
  - Paleozoic era.
  - Pleistocene epoch.
  - Carboniferous era.
  - Precambrian era.
22. Chemotaxis is the movement
- from a stimulus such as a toxic substance.
  - toward a stimulus such as food.
  - from a stimulus such as oxygen.
  - toward a stimulus such as oxygen.
  - All of the above are examples of chemotaxis.
23. Glycolysis is the only metabolic pathway common to nearly all organisms. To scientists, this suggests that it
- evolved many times during the history of life.

- b. was first seen in early eukaryotes.
  - c. first appeared early in the history of life.
  - d. must be very complex.
  - e. appeared rather recently in the evolution of life.
24. Protists are a diverse group of organisms that include
- a. plants.
  - b. algae.
  - c. protozoans.
  - d. fungi.
  - e. b and c
25. Ferns and mosses are mostly limited to moist environments because
- a. their pollen is carried by water.
  - b. they lack a cuticle and stomata.
  - c. they lack vascular tissue.
  - d. they have swimming sperm.
  - e. their seeds do not store much water.
26. In contrast to plants, the cell walls of fungi are composed of
- a. lignan.
  - b. cellulose.
  - c. peptidoglycan.
  - d. lignin.
  - e. chitin.
27. Which of the following animals does not have a body cavity?
- a. flatworm
  - b. ant
  - c. mouse
  - d. clam
  - e. earthworm
28. There are three major groups of mammals, categorized on the basis of their
- a. size.
  - b. habitat.
  - c. method of locomotion.
  - d. the presence or absence of hair.
  - e. method of reproduction.
29. The last thing all water and solute molecules must pass through before they can enter the vascular system and move upward to the leaves is
- a. a stoma.
  - b. a root hair cell.

(背面仍有題目,請繼續作答)

- c. an endodermal cell.  
d. an epidermal cell.  
e. a protoderm cell.
30. In the process of pollination, pollen grains are transferred from the \_\_\_\_\_ to the \_\_\_\_\_.
- a. ovary . . . anther  
b. stigma . . . ovary  
c. anther . . . sepal  
d. carpel . . . stigma  
e. anther . . . stigma
31. Which of the following tissues produces voluntary body movements?
- a. smooth muscle  
b. simple cuboidal epithelium  
c. cardiac muscle  
d. skeletal muscle  
e. fibrous connective tissue
32. Which of the following lists the four stages of food processing in order?
- a. ingestion, digestion, absorption, elimination  
b. digestion, ingestion, absorption, elimination  
c. ingestion, absorption, elimination, digestion  
d. ingestion, digestion, elimination, absorption  
e. absorption, digestion, ingestion, elimination
33. \_\_\_\_\_ in carbon dioxide in your blood, which causes \_\_\_\_\_ in pH, would cause your breathing to speed up.
- a. An increase . . . a rise  
b. An increase . . . a drop  
c. A decrease . . . a rise  
d. A decrease . . . a drop  
e. Actually, it is rise and fall of oxygen, not carbon dioxide, that controls breathing.
34. When you are immune to a disease,
- a. antibodies against the disease are constantly circulating in your blood.  
b. certain lymphocytes are able to make the proper antibodies quickly.  
c. your nonspecific defenses are strengthened.  
d. B cells are stimulated to quickly engulf invaders.  
e. antigens are altered so invaders can no longer attack your tissues.
35. Which of the following is the most accurate and comprehensive description of the function of the kidneys?

- a. breaking down body wastes
  - b. excreting wastes
  - c. regulating body fluid composition
  - d. filtering the blood
  - e. producing urine
36. Which of the following hormones have antagonistic (opposing) effects?
- a. thyroxin and calcitonin
  - b. insulin and glucagon
  - c. growth hormone and epinephrine
  - d. ACTH and glucocorticoids
  - e. epinephrine and norepinephrine
37. Which of the following hormones is the first to increase significantly every 28 days or so and initiates the ovarian cycle?
- a. progesterone
  - b. follicle-stimulating hormone (FSH)
  - c. estrogen
  - d. lutenizing hormone (LH)
  - e. human chorionic gonadotropin
38. A stimulus triggers an action potential by
- a. causing sodium ions to enter the neuron.
  - b. triggering the release of neurotransmitter.
  - c. causing potassium ions to enter the neuron.
  - d. activating the sodium-potassium pump.
  - e. causing sodium ions to leak out of the neuron.
39. Eating carrots is good for your eyes. Carrots contain vitamin A, which is used to make a substance called retinal, which
- a. is a visual pigment that absorbs light.
  - b. provides energy for the function of rods and cones.
  - c. colors the iris of the eye.
  - d. stimulates the neurons in the retina to form branches and connections.
  - e. keeps the lens clear and transparent.
40. A frog may at first be startled by tree branches swaying in the wind, but it soon stops responding to these kinds of unimportant changes in its environment. This is an example of
- a. a fixed action pattern.
  - b. imprinting.
  - c. altruism.
  - d. habituation.

(背面仍有題目,請繼續作答)

e. trial-and-error learning.

(II) Answer the following questions. (20%)

- 1) Draw a diagram to show the homeostasis maintained by insulin and glucagon during low and high blood glucose level.
- 2) What is enzyme and describe the basic principle for enzyme catalytic reactions.