

一、單選題 (請選擇一個最適合的答案; 每題 3 分; 共計 60 分)

- Which of the following best describes the general structure of a cell membrane?
 - Protein embedded in two layers of phospholipid
 - A layer of protein coating a layer of phospholipid.
 - Protein sandwiched between two layers of phospholipid.
 - Phospholipid embedded in two layers of protein.
 - Any of the above.
- Which of the following statements for proteins is *false*?
 - They are made from 20 different amino acids.
 - All proteins have enzymatic activities.
 - The four levels of structure of a protein are determined by its primary sequence.
 - Secondary structure includes mainly α helix and β sheet.
 - Collagen has four levels of structure.
- To produce one molecule of glucose, the Calvin cycle needs to be run through _____ time(s).
 - one (B) three (C) six (D) eight (E) none is correct
- Which one of the following statements is *false*?
 - Mitosis provides for growth and tissue repair.
 - Meiosis provides for asexual reproduction.
 - In mitosis, the chromosomes replicate only once in the preceding interphase.
 - In meiosis, the chromosomes replicate only once in the preceding interphase.
 - All the events unique to meiosis occur during meiosis I.
- Which of the following human activities has contributed to an increase in the number of bacteria having R plasmids?
 - Nitrogen fixation by genetically engineered plants.
 - Widespread use of childhood vaccination in developing countries.
 - Heavy use of antibiotics in medicine.
 - Heavy use of antibiotics in agriculture.
 - Heavy use of antibiotics in medicine and in agriculture.
- Dr. Smith's parents have normal hearing. However, Dr. Smith has an inherited form of deafness. Deafness is a recessive trait that is associated with the abnormal allele *d*. The normal allele at this locus, associated with normal hearing, is *D*. Dr. Smith's parents could have which of the following genotypes?
 - DD* and *dd*.
 - dd* and *dd*.
 - Dd* and *Dd*.
 - DD* and *DD*.
 - dd* and *DD*.
- Vinblastine is a standard chemotherapeutic drug used to treat cancer because it can interfere with the assembly of microtubules. Thus we can conclude that its effectiveness should be related to
 - inhibition of cleavage furrow formation.

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- (B) inhibition of regulatory protein phosphorylation.
(C) disruption of mitotic spindle formation.
(D) inhibition of DNA synthesis.
(E) None of above is correct.
8. The increase in girth (width) of trees occurs as a consequence of
(A) growth in apical meristems.
(B) primary growth.
(C) increase in width of vessel elements.
(D) secondary growth.
(E) sexual reproduction.
9. Which one of the following statements is *false*?
(A) The terminal bud in many plants produces hormones that inhibit growth in the axillary buds.
(B) Roots depend upon sugars produced in leaves.
(C) Stems and leaves depend on the water and minerals absorbed by the roots.
(D) The part of the stem where a leaf attaches is called the internode.
(E) The shoot system of a plant consists of the stems, leaves, and adaptations for reproduction.
10. Lactose is formed
(A) by a reaction catalyzed by lactase.
(B) by a $\beta 1 \rightarrow 4$ linkage between a galactose and a glucose molecule.
(C) when ionic bonds link two monosaccharides.
(D) when water molecules are added to two monosaccharides.
(E) when glucose and fructose are combined.
11. Respiration _____, and cellular respiration _____
(A) produces glucose . . . produces oxygen.
(B) produces glucose . . . is gas exchange.
(C) is gas exchange . . . produces ATP.
(D) produces ATP . . . is gas exchange.
(E) uses glucose . . . produces glucose.
12. Countercurrent gas exchange in the gills of a fish
(A) maintains a gradient that enhances gas diffusion.
(B) indicates that the arterial side of capillaries exchanges O_2 more efficiently than the venous side of capillaries.
(C) speeds up the flow of blood in the gills.
(D) means that blood and water flow at different rates.
(E) allows O_2 to diffuse against its partial-pressure gradient.
13. Which of the following can increase red blood cell concentration?
(A) Training at low altitudes.
(B) Increasing blood levels of EPO.
(C) Blood donation.
(D) Drinking more water.

- (E) Eating more meat.
14. Which of the following techniques is best for detecting problems in spinal cord?
- (A) X-rays.
 - (B) Computed tomography (CT).
 - (C) Magnetic resonance imaging (MRI).
 - (D) Magnetic resonance microscopy (MRM).
 - (E) Positron-emission tomography (PET).
15. Which of the following hormones is/are produced in the apical meristems of shoots and roots?
- (A) auxins.
 - (B) cytokinins.
 - (C) gibberellins.
 - (D) abscisic acid.
 - (E) ethylene.
16. Which of the following is an example of sensory adaptation of receptors?
- (A) going into deep sleep.
 - (B) distinguishing between different colors.
 - (C) ignoring the shoes on your feet.
 - (D) thinking about what you would do with a million dollars.
 - (E) detecting sound and light simultaneously.
17. A deficiency of which of the following hormones is associated with Parkinson's disease?
- (A) serotonin (B) epinephrine (C) dopamine (D) endorphins (E) acetylcholine
18. Which one of the following is *not* a function of parenchyma cells?
- (A) Long-distance water conduction.
 - (B) Aerobic respiration.
 - (C) Photosynthesis.
 - (D) Regeneration of injured parts.
 - (E) Food storage.
19. If a population has a birth rate of 40 individuals per 1,000 per year and a death rate of 30 individuals per 1,000 per year, how will the population change each year? (Assume that the population is below carrying capacity and that there is no immigration or emigration.)
- (A) It will increase by 100%.
 - (B) It will increase by 1%.
 - (C) It will increase by 5%.
 - (D) It will increase by 70%.
 - (E) It will decrease by 70%.
20. The recessive allele of a gene causes cystic fibrosis. For this gene among Caucasians, $p = 0.98$. If a Caucasian population is in Hardy-Weinberg equilibrium with respect to this gene, what proportion of babies is born homozygous recessive, and therefore suffers cystic fibrosis?
- (A) $0.02^2 = 0.0004$

- (B) 0.02
- (C) $0.98^2 = 0.9604$
- (D) $2(0.02 \times 0.98) = 0.0392$
- (E) 0.98

二、簡答題 (共計 40 分)

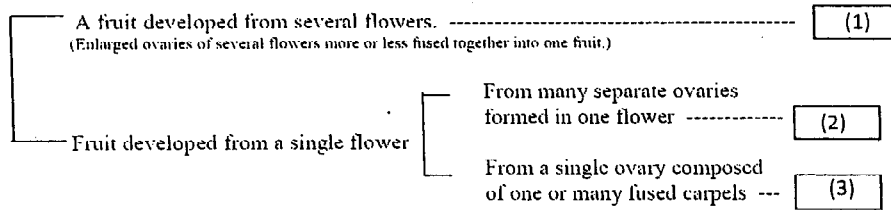
1. Please fill in the letters representing the terms corresponding to the questions. Each question has only one answer. (10 points; 2 points for each question)

- _____ 1. A piece of DNA other than chromosome that can replicate autonomously
- _____ 2. A plant pathogen that is employed to generate transgenic plants
- _____ 3. Enzyme that can make DNA using RNA template
- _____ 4. Enzymes that can generate DNA fragments with sticky ends
- _____ 5. A DNA profiling technique by examining single nucleotide polymorphism

- (A) *Agrobacterium tumefaciens* (B) Complementary DNA (C) *Escherichia coli*
- (D) Plasmid (E) Polymerase chain reaction (F) Restriction enzyme
- (G) Restriction fragment length polymorphism (H) Reverse transcriptase
- (I) Satellite DNA (J) Short tandem repeats analysis

2. Please describe and compare the difference between prokaryotes and eukaryotes in terms of (A) size; (B) nucleus; (C) mitochondria, (D) ER; (E) nucleic acid. (10 points)

3. Simple match: Please complete the key and diagrams of the plant flower and fruits by filling in the boxes with letters representing the correct terms. (12 points; 2 points for each question)



Strawberry

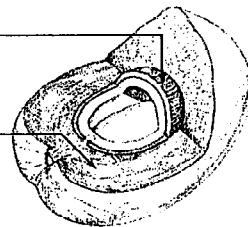


(6)

(4)

(5)

Coconut
A drupe



- (A) achene (B) carpel (C) endosperm (D) endocarp (E) locule (F) mesocarp
- (G) exocarp (H) placenta (I) receptacle (J) multiple fruit (K) aggregate fruit
- (L) simple fruit (M) receptacle (N) seed (O) ovary

4. Please fill in the letter representing the term corresponding to the description. Each question has only one

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answer. (8 points; 2 points for each question)

- (1) _____ Broadleaf trees such as hickory and birch
- (2) _____ Spruce, fir, pine, and hemlock trees
- (3) _____ The most complex and diverse biome
- (4) _____ Home of ants, antelopes, and lions

(A) Chaparral (B) savanna (C) taiga (D) temperate forest
(E) temperate grassland (F) tropical rain forest (G) tundra