國立中山大學九十一學年度轉學生招生考試試題

科目：普通生物(上)【生科系二、三年級】

一、Multiple choice: (Choose only the best answer, 60%)

1. A plant cell placed in a hypotonic solution will
   A. become flaccid B. become turgid C. lyse D. plasmolyze E. shrivel
2. Noncyclic electron flow in the chloroplast results in the production of
   A. ATP only B. ATP and G3p C. ATP and NADPH
   D. ATP, NADPH and O_2 E. ATP and O_2
3. How many chromatids would the cell with 24 chromosomes have in the G2 phase of its cell cycle?
   A. 12 B. 18 C. 24 D. 48 E. 96
4. Whose paper on natural selection was presented together with Darwin's abstract to the Linnean Society in 1858?
   A. Cuvier B. Hutton C. Lamarck D. Lyell E. Wallace
5. In a population that is in Hardy-Weinberg equilibrium for two alleles, A and a, what would be the frequency of heterozygotes if the allele frequency of a is 0.3?
   A. 0.9 B. 0.21 C. 0.42 D. 0.49 E. 0.7
6. Which species concept would be most useful for a field biologist to identify new species in a tropical rain forest?
   A. biological B. cohesion C. evolutionary
   D. morphological E. recognition
7. The person who study fossil is a?
   A. botanist B. geologist C. paleontologist D. physiologist E. taxonomist
8. The half-life of carbon-14 is 5600 years. A fossil that is 22,400 years old would have what amount of the normal proportion of C-14 to C-12?
   A. 1/2 B. 1/4 C. 1/8 D. 1/16 E. 1/256
9. Which of the following plant groups is heterosporous ?
   A. Psilotum B. Lycopodium C. Selaginella
   D. Equisetum E. Ferns (water ferns excluded)
10. Which of the following groups is regarded as the ancestor of plants ?
    A. brown algae B. Euglena C. golden algae
    D. green algae E. red algae
11. The protective coat of vascular plant surface made of cork and cork cambium is
    A. collenchyma B. endodermis C. fiber
    D. periderm E. pericycle
12. A seed is a mature
    A. embryo B. flower C. ovary D. ovule E. pollen
13. Plant growth toward light is related to
    A. abscisic acid B. auxin C. cytokinin D. gibberellins E. ethylene

14. Which level of ecology considers energy flow and chemical cycling?
A. biosphere B. ecosystem C. community D.organismal E. population

15. Under a normal condition, you will not hear your own heart-beating because of
A. habituation B. imprinting C. insight D. learning E. maturation

16. A tree population within a "climax" community is most likely in the form of
A. exponential growth model B. high reproduction rate
C. increased fecundity D. K-selection E. r-selection

17. Ion diffuse across membranes down their
A. concentration gradient B. electrochemical gradient
C. electrogenic gradient D. electrical gradient E. osmotic gradient

18. Plasmodesmata in plant cells are similar in function to
A. cytoskeletons B. desmosomes C. gap junctions
D. integrins E. tight junctions

19. The innermost portion of a mature plant cell wall is the
A. middle lamella B. plasma membrane C. plasmodesmata
D. primary cell wall E. secondary cell wall

20. Where the glycolysis takes place?
A. cytosol B. mitochondria C. nucleus D. plastid E. ribosomes

21. The reproductive barrier between horse and donkey is a
A. behavioral isolation B. gametic isolation C. hybrid breakdown
D. mechanical isolation E. postzygotic barrier

22. Athlete's foot is caused by a
A. alga B. bacterium C. fungus D. protist E. slime mold

23. How many cotyledons are found in a pine embryo?
A. 0 B. 1 C. 2 D. 3 E. many

24. A vegetation with evergreen shrub majority and fire adapted is usually found in?
A. chaparral B. desert C. savanna D. taiga E. tundra

25. Animal appear to maximize their energy intake-to-expenditure ratio. What is this behavior called?
A. a fixed-action pattern B. learning C. maturation
D. optimal foraging E. territoriality

26. A crow that aids its parents in raising siblings is increasing its
A. altruistic behavior B. certainty of paternity
C. coefficient of relatedness D. inclusive fitness E. reproductive success

27. The most common dispersion pattern of a biological population is
A. clumped B. dense C. random
D. uniform E. unpredictable

28. Which of the following is the most serious threat to biodiversity?
A. commercial harvesting B. competition from exotic species
C. habitat destruction D. overexploitation E. pollution

29. Chemosynthetic bacteria found around deep-sea vents are examples of
A. chemical cycling B. decomposers C.decomposers
D. secondary productivity E. upwellings that make nutrients available

30.A serious effect of the thinning of the ozone layer is
A. acid precipitation B. an increase in UV radiation reaching earth
C. a reduction in species diversity D. cultural eutrophication
E. global warming

二、Answer the following questions:

1. Draw a schematic diagram of a plant root cross section with structures and routes of water transport identified. (20%)

2. Summarize Darwin's theory of natural selection. (20%)

一、Multiple choice: (Choose only the best answer, 60%)

1. Primary lymphoid tissue includes:
   A. thymus B. spleen C. tonsil D. adenoid E. lymph node
2. Which of the following animals has a gastrovascular cavity?
   A. bird B. hydra C. mammal D. insect E. nematode
3. Pregnancy tests are based on the detection of which of the following hormones?
   A. HCG B. FSH C. GnRH D. estrogen E. progesterone
4. Impulses leave a neuron via the:
   A. dendrites B. nucleus C. axon D. cell body E. myelin sheath
5. Which kingdom consists of eukaryotes that nourish themselves mainly by decomposing organic material?
   A. Monera B. Protista C. Plantae D. Fungi E. Animalia
6. You start a batch culture of bacteria with 5 bacterial cells, how many bacterial cells will be present after 6 hours if the generation time of this bacterium is 20 minutes?
   A. 5×2^{18} B. 2×2^{18} C. 2×10^{18} D. 5×10^{18} E. 5×2^{6}
7. The developmental process of which of the following animals involves a process called incomplete metamorphosis?
   A. starfish B. butterfly C. spider D. crayfish E. grasshopper
8. An organ that is characteristic of mollusks is the
   A. chelicera B. mandible C. radula D. nematocyst E. parapodium
9. Cartilage is which of the following types of tissues ?
   A. Adipose B. Epithelial C. Nervous D. Connective E. Reproductive
10. Which would you utilize as the insert source to produce a bacterial DNA library?
    A. cDNA B. mDNA C. mRNA D. plasmid DNA E. genomic DNA
11. The notochord is derived from the:
    A. ectoderm B. mesoderm C. endoderm D. neural tube E. neural crest
12. All of the following animal groups have evolved terrestrial life forms *except*:
    A. Mollusca B. Crustacea C. Reptilia D. Arthropoda E. Echinodermata
13. Nerve nets are characteristic of:
    A. annelids B. insects C. flatworms D. cnidarians E. vertebrates
14. The terms anterior and posterior only apply to animals that:
    A. have a true coelom B. have a digestive system C. have bilateral symmetry
    D. form planula larvae E. undergo schizocoelous development
15. Proton pumps of bacteria probably functioned first for:
    A. pH regulation B. ATP synthesis C. photosynthesis
    D. reduction of CO_2 E. oxidation of food

16. The HIV virus compromises the immune system by primarily attacking the
A. B cells B. L cells C. helper T cells
D. cytotoxic T cells E. suppressor T cells

17. A shared characteristic of chordates is the:
A. notochord B. skull C. hair
D. vertebral column E. four-chambered heart

18. A receptor that detects the position of parts of the body is called:
A. a rod B. a hair cell C. a chemoreceptor
D. a proprioceptor E. a mechanoreceptor

19. Which part of the vertebrate nephron consists of capillaries?
A. Glomerulus B. Loop of Henle C. Distal tubule
D. Bowman's capsule E. Collecting tubule

20. Trypsinogen can be activated by
A. chymotrypsin B. trypsin C. secretin
D. pepsin E. enterogastrone

21. When a person exercises hard, all of the following occur *except*:
A. CO_2 increases B. lactic acid increases C. glycogen increases
D. ADP increases E. blood glucose decreases

22. Jaws first occurred in which of the following classes?
A. Agnatha B. Chondrichthyes C. Osteichthyes
D. Ostracodermi E. Placodermi

23. Which of the following is an endocrine gland?
A. salivary gland B. sweat gland C. mammary gland
D. adrenal gland E. sebaceous gland

24. Which of the following is not a role of bones?
A. protection of internal organs B. providing attachment sites for muscles
C. production of red blood cells D. production of white blood cells
E. production of hormones to regulate calcium levels in body fluids

25. A highly successful parasite:
A. will not harm its host B. may benefit its host
C. will kill its host fairly rapidly D. may survive without its host
E. will be able to feed without killing its host

26. A decrease in the pH of human blood caused by exercise would
A. decrease breathing rate B. increase heart rate
C. decrease cardiac output D. decrease CO_2 binding to hemoglobin
E. decrease the amount of O_2 unloaded from hemoglobin

27. The metabolic rate of a poikilothermic animal increases:
   A. with increasing in size
   B. with decreasing in muscular activity
   C. with increasing in age
   D. with increasing environmental temperature
   E. with decreasing in size

28. What does transformation involve in bacteria?
   A. the infection of cells by a phage DNA molecule
   B. the transfer of DNA from one strain to another
   C. the type of semiconservative replication shown by DNA
   D. the creation of a strand of RNA from a DNA molecule
   E. the creation of a strand of DNA from an RNA molecule

29. Vaccination protects the body against catching a disease because:
   A. it provides antibodies made by another animal
   B. it makes the disease organism histocompatible with the body
   C. it provides an enlarged clone of memory cells against that disease
   D. it builds up an immunological tolerance for the disease antigen
   E. it releases large amounts of nonspecific defensive secretions

30. Which of the following characterizes parthenogenesis?
   A. an egg develops without being fertilized
   B. an organism is first a male and then a female
   C. an individual may change its sex during its lifetime
   D. specialized groups of cells may be released and grow into new individuals
   E. both members of a mating pair have male and female reproductive organs

二、Answer the following questions:

1. Draw a contrasting schematic diagram to compare a T4 phage and an HIV virus with their appropriate structures identified. (20%)
2. Describe the *trp* and *lac* operons and explain how can they work differently if they both based on the binding of a repressor that prevents transcription. (20%)

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請注意：所有選擇題均為單選題，每題 4 分。答錯不計分，並倒扣 1 分；不作答則不計分亦不倒扣。

(log2＝0.3010　　log3＝0.4771)

1. Which of the following processes is endothermic ?
   (a) freezing water　(b) boiling water　(c) combustion
   (d) condensing steam　(e) none of above

2. Which of the following molecules doesn't have a dipole moment ?
   (a) H_2O　(b) PF_3　(c) BF_3　(d) SO_2　(e) HCl

3. Assuming that all volumes are additive, how much water should be added to 25.00 mL of 6.00 F HNO_3 to prepare 0.500 F HNO_3 ?
   (a) 350mL　(b) 325mL　(c) 300mL　(d) 275mL　(e) 250mL

4. In which of the following liquids would you expect the solubility of NaCl to be the smallest ?
   (a) HF　(b) CH_3OH　(c) CH_3COCH_3 (acetone)　(d) H_2O　(e) CCl_4

5. Which of the following ions has the largest radius ?
   (a) Be^{2+}　(b) Li^{+}　(c) N^{3-}　(d) O^{2-}　(e) F^{-}

6. Which of the following has the smallest mass ?
   (a) a hydrogen nucleus　(b) an alpha particle　(c) a neutron
   (d) a helium nucleus　(e) a beta particle

7. At a given temperature the equilibrium constant for the reaction
   $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$
   is 2.4×10^{-3}. What is the equilibrium constant for the reaction
   $PCl_{3(g)} + Cl_{2(g)} \rightleftharpoons PCl_{5(g)}$
   at the same temperature ?
   (a) 2.4×10^{-3}　(b) -2.4×10^{-3}　(c) 4.2×10^{-2}　(d) 4.2×10^{2}　(e) 2.4×10^{5}

8. For the system $NH_4Cl_{(s)} \rightleftharpoons NH_{3(g)}+HCl_{(g)}$, if the concentration of NH_3 is doubled, the equilibrium constant will
   (a) double　(b) increase, but by less that a factor of 2　(c) be halved
   (d) remain the same　(e) decrease, but by less than a factor of 2.

9. The pH of 0.050 F HA solution is 5.35. What is K_a for HA ?
   (a) 2.0×10^{-11}　(b) 4.0×10^{-10}　(c) 4.5×10^{-6}　(d) 8.9×10^{-5}　(e) 5.0×10^{-2}

10. A buffer that is a mixture of acetic acid and potassium acetate has a pH=5.24. The K_a of acetic acid is 4.75. The [acetate] / [acetic acid] ratio in this buffer is
(a) 1 : 1 (b) 3 : 1 (c) 5 : 1 (d) 1 : 3 (e) 1 : 5

11. At the temperature at which the molar solubility of $PbBr_2$ in water is 2.3×10^{-2} M, what is the K_{sp} of $PbBr_2$?
(a) 5.3×10^{-4} (b) 1.2×10^{-5} (c) 2.4×10^{-5} (d) 2.3×10^{-2} (e) 4.9×10^{-5}

12. If the K_{sp} of $Cu(OH)_2$ is 2×10^{-19} and the Ksp of CuS is 8.7×10^{-36}, the equilibrium constant for the reaction

$$Cu(OH)_{2\,(s)} + S^{2-}_{(aq)} \rightleftharpoons CuS_{(s)} + 2OH^-_{(aq)}$$

is (a) 2×10^{-55} (b) 2×10^{16} (c) 4×10^{17} (d) 2×10^{18} (e) 4×10^{-17}

13. Which of the following has the highest percentage of ionic character in its bonding ?
(a) LiI (b) $MgCl_2$ (c) CsF (d) CsI (e) $AlCl_3$

14. Which of the following sets of the four quantum numbers n, ℓ, m_ℓ, and m_s describes one of the outermost electrons in a ground state strontium atom ?
(a) 5, 1, 1, 1/2 (b) 5, 0, 0, -1/2 (c) 5, 0, 1, 1/2 (d) 5, 1, 0, 1/2 (e) 5, 2, 1, -1/2

15. Which of the following diatomic species do you expect to have the longest bond length ?
(a) NO^+ (b) O^{2-} (c) CO (d) O^{2+} (e) N^{2+}

16. A sulfur-containing species that cannot be a reducing agent is
(a) SO_2 (b) SO_3^{2-} (c) SO_4^{2-} (d) S^{2-} (e) $S_2O_3^{2-}$

17. In which of the following compounds is there a carbon atom in the +3 oxidation state ?
(a) CH_3CH_2OH (b) CH_3-O-CH_3 (c) CH_3COOH

(d) $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$ (e) $CH_3-\overset{\overset{H}{|}}{C}=O$

18. Aluminum-25 decays by emitting a positron. The species immediately produced has
(a) 12p, 13n, $13e^-$ (b) 13p, 12n, $13e^-$ (c) 12p, 13n, $12e^-$
(d) 14p, 11n, $14e^-$ (e) 13p, 13n, $13e^-$

19. Which of the following cations is not paramagnetic ?
(a) $Sc^{3+}_{(aq)}$ (b) $Ti^{3+}_{(aq)}$ (c) $V^{3+}_{(aq)}$ (d) $Cr^{3+}_{(aq)}$ (e) $Mn^{3+}_{(aq)}$

20. If concentrations are measured in moles per liter and time in minutes, the units for the rate of a third-order reaction are
(a) min^{-1} (b) $L \cdot mole^{-1} min^{-1}$ (c) $L^2 mole^{-2} min^{-1}$
(d) $mole \cdot L^{-1} min^{-1}$ (e) $mole^2 L^{-2} min^{-1}$

21. For a hypothetical reaction $A+2B \rightarrow 3C+D$, $d[C]/dt$ is equal to
(a) $-d[A]/dt$ (b) $-d[B]/dt$ (c) $+3d[A]/dt$ (d) $(-3/2)\, d[B]/dt$ (e) $+ d[A]/dt$

22. For the reaction $A+2B \rightarrow 2C$, the rate law for formation of C is
(a) rate $= k[A][B]^2$ (b) rate $= k[A][B]$ (c) rate $= k[C]^2 / [A][B]^2$
(d) rate $= k[A]^2[B]$ (e) impossible to state from the data given.

23. Consider the cell $Cd_{(s)}|Cd^{2+}(1.0M)\| Cu^{2+}(1.0M)| Cu_{(s)}$. If we wanted to make a cell with a more positive voltage using the same substances, we should
(a) Increase both the $[Cd^{2+}]$ and $[Cu^{2+}]$ to 2.00M.
(b) Increase only the $[Cd^{2+}]$ to 2.00M.
(c) Decrease both the $[Cd^{2+}]$ and $[Cu^{2+}]$ to 0.100M.
(d) Decrease only the $[Cd^{2+}]$ to 0.100M.
(e) Decrease only the $[Cu^{2+}]$ to 0.100M.

24. An adiabatic process is one in which there is no transfer of heat across the boundary between system and surroundings. For such a process
(a) $P_{ext}\Delta V = 0$ (b) $q = w$ (c) $\Delta E = w$ (d) $\Delta H = 0$ (e) $\Delta E = q$

25. If a process is both endothermic and spontaneous then
(a) $\Delta S > 0$ (b) $\Delta S < 0$ (c) $\Delta H < 0$ (d) $\Delta G > 0$ (e) $\Delta E = 0$