

國立高雄大學九十六學年度轉學招生考試試題

科目：普通生物學  
考試時間：90 分鐘

系所：生命科學系  
本科原始成績：100 分

是否使用計算機：是

一、單選題 ( 57% , 每題1.5分 , 共38題 )

- 1). In a typical cell, calcium ions are A) far more abundant in the blood and other extracellular fluid than in the cytoplasm. B) rapidly released from the endoplasmic reticulum in response to G-protein-mediated signals. C) often concentrated within the endoplasmic reticulum. D) A and B only. E) A, B, and C.
- 2). What is a chromatid? A) a chromosome in  $G_1$  of the cell cycle. B) a replicated chromosome. C) a chromosome found outside the nucleus. D) a special region that holds two centromeres together. E) another name for the chromosomes found in genetics.
- 3). Which of the following occurs in meiosis but not in mitosis? A) chromosome replication. B) synapsis. C) production of daughter cells. D) alignment of tetrads at metaphase plate. E) both B and D.
- 4). One possible result of chromosomal breakage can be that a fragment reattaches to the original chromosome in a reverse orientation. This is called A) disjunction. B) translocation. C) deletion. D) inversion. E) aneuploidy.
- 5). When T2 phages infect bacteria and make more viruses in the presence of radioactive sulfur, what is the result? A) The viral DNA will be radioactive. B) The viral proteins will be radioactive. C) The bacterial DNA will be radioactive. D) both A and B. E) both A and C.
- 6). Which of the following represents a similarity between RNA and DNA? A) Both are double-stranded. B) the presence of uracil. C) the presence of an OH group on the 2' carbon of the sugar. D) nucleotides consisting of a phosphate, sugar, and nitrogenous base. E) Both are found exclusively in the nucleus.
- 7). When does translation begin in prokaryotic cells? A) after a transcription initiation complex has been formed. B) during transcription. C) after the 5' caps are converted to mRNA. D) once the pre-mRNA has been converted to mRNA. E) as soon as the DNA introns are removed from the template.
- 8). During translation, chain elongation continues until what happens? A) No further amino acids are needed by the cell. B) All tRNAs are empty. C) The polypeptide is long enough. D) A stop codon is encountered. E) The ribosomes run off the end of mRNA.

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- 9). Which of the following is (are) true about viruses? A) Viruses are classified below the cellular level of biological organization. B) A single virus particle contains both DNA and RNA. C) Even small virus particles are visible with light microscopes. D) Only A and B are true. E) A, B, and C are true.
- 10). Which of the following statements about histones is incorrect? A) Each nucleosome consists of two molecules, each of four types of histone. B) Histone H1 is not present in the nucleosome bead; instead it is involved in the formation of higher-level chromatin structures. C) The amino end of each histone extends outward from the nucleosome and is called a "histone tail." D) Histones are found in mammals, but not in other animals or in plants. E) The mass of histone in chromatin is approximately equal to the mass of DNA.
- 11). Mycoplasmas are bacteria that lack cell walls. On the basis of this structural feature, which of the statements below is true about mycoplasmas? A) They are gram-negative. B) They are subject to lysis in hypotonic conditions. C) They lack a cell membrane as well. D) They undergo ready fossilization in sedimentary rock. E) They possess typical prokaryotic flagella.
- 12). Protists are alike in that all are A) multicellular. B) photosynthetic. C) marine. D) nonparasitic. E) eukaryotic.
- 13). Which of the following is mismatched? A) apicomplexa-internal parasites. B) golden algae-planktonic producers. C) euglenozoa-unicellular flagellates. D) ciliates-red tide organisms. E) entamoeba-ingestive heterotrophs
- 14). Which of the following characteristics is not shared by both chytrids and other kinds of fungi? A) presence of hyphae. B) flagellated zoospores. C) absorptive mode of nutrition. D) chitinous cell walls. E) amino acid base sequences of some enzymes.
- 15). The symbiotic associations involving roots and soil fungi are considered A) parasitic. B) mutualistic. C) commensal. D) harmful to the plant partner. E) the beginning stages of the formation of lichens.
- 16). Natural selection is most nearly the same as A) diploidy. B) gene flow. C) genetic drift. D) nonrandom mating. E) differential reproductive success.
- 17). Heterozygote advantage should be most closely linked to which of the following? A) sexual selection. B) stabilizing selection. C) random selection. D) directional selection. E) disruptive selection.

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- 18). The origin of a new plant species by hybridization coupled with nondisjunction is an example of A) allopatric speciation. B) sympatric speciation. C) autopolyploidy. D) heterochrony. E) habitat selection.
- 19). Which of the following examples would be most likely to result in macroevolution? A) a change in a regulatory gene, which has a major and adaptive impact on morphology. B) a point mutation deep within an intron. C) DNA-DNA hybridization. D) gene flow. E) genetic drift involving a trait that seems to exhibit neutral variation.
- 20). Two closely related populations of mice have been separated for a long period by a river. Climatic change causes the river to dry up, thereby bringing the mice populations back into contact in a zone of overlap. Which of the following is not a possible outcome when they meet? A) They interbreed freely and produce fertile hybrid offspring. B) They no longer attempt to interbreed. C) They interbreed in the region of overlap, producing an inferior hybrid. Subsequent interbreeding between inferior hybrids produces progressively superior hybrids over several generations. D) They remain separate in the extremes of their ranges but develop a hybrid zone in the area of overlap. E) They interbreed in the region of overlap, but produce sterile offspring.
- 21). Organisms showing radial symmetry would likely A) be good swimmers. B) have rapid escape behavior. C) move from place to place relatively slowly, if at all. D) be able to fly. E) have many fins.
- 22). If a lung were to be found in a mollusc, where would it be located? A) mantle cavity. B) coelom. C) foot D) visceral mass. E) excurrent siphon.
- 23). What is one characteristic that separates chordates from all other animals? A) true coelom. B) dorsal, hollow nerve cord. C) blastopore, which becomes the anus. D) bilateral symmetry. E) segmentation.
- 24). What joins muscles to bones? A) ligaments. B) tendons. C) loose connective tissue. D) Haversian systems. E) spindle fibers.
- 25). Countercurrent exchange in the fish gill helps to maximize A) endocytosis. B) blood pressure. C) diffusion. D) active transport. E) osmosis.

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- 26). A bacterium entering the body through a small cut in the skin will do which of the following?  
A) inactivate the hemocytes. B) stimulate apoptosis of body cells. C) stimulate release of interferons. D) stimulate natural killer cell activity. E) activate a group of proteins called complement.
- 27). Which structure increases the reabsorption of  $\text{Na}^+$  when stimulated by aldosterone? A) loop of Henle. B) collecting duct. C) Bowman's capsule. D) proximal tubule. E) distal tubules.
- 28). Which of the following glands shows both endocrine and exocrine activity? A) pituitary. B) parathyroid. C) salivary. D) pancreas. E) adrenal.
- 29). Fertilization of human eggs usually takes place in the A) ovary. B) uterus. C) vagina. D) oviduct. E) labia minora.
- 30). As cleavage continues during frog development, the number of blastomeres A) increases as the size of the blastomeres decreases. B) increases as the size of the blastomeres increases. C) decreases as the size of the blastomeres increases. D) decreases as the size of the blastomeres decreases. E) increases as the size of the blastomeres stays the same.
- 31). Where do synaptic vesicles discharge their contents by exocytosis? A) dendrite. B) axon hillock. C) nodes of Ranvier. D) postsynaptic membrane. E) presynaptic membrane.
- 32). Which of the following does not form part of the thin filaments of a muscle cell? A) actin. B) troponin. C) tropomyosin. D) myosin. E) calcium-binding site.
- 33). Ecology as a discipline directly deals with all of the following levels of biological organization except A) population. B) cellular. C) organismal. D) ecosystem. E) community.
- 34). The time during imprinting when specific behaviors can be learned is called the A) window of imprinting. B) major period. C) sensitive period. D) timing imprint. E) significant window.
- 35). Natural selection has led to the evolution of diverse natural history strategies, which have in common A) many offspring per reproductive episode. B) limitation by density-dependent limiting factors. C) adaptation to stable environments. D) maximum lifetime reproductive success. E) relatively large offspring.

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- 36). When lichens grow on bare rock, they may eventually accumulate enough organic material around them to supply the foothold for later rooted vegetation. These early pioneering lichens can be said to do what to the later arrivals? A) tolerate. B) inhibit. C) facilitate. D) exclude. E) concentrate.
- 37). The amount of chemical energy in consumers' food that is converted to their own new biomass during a given time period is called A) biomass. B) standing crop. C) biomagnification. D) primary production. E) secondary production.
- 38). Human use of prokaryotic organisms to help detoxify a polluted wetland would be an example of A) ecosystem augmentation. B) keystone species introduction. C) biological control. D) bioremediation. E) population viability analysis.

## 二、解釋名詞 ( 16% , 每題 4 分 , 共 4 題 )

1. Adaptive radiation.
2. Gene pools.
3. Cytoplasmic determinants.
4. Stretch-gated ion channel.

## 三、問答題 ( 27% , 每題 9 分 , 共 3 題 )

1. Describe the method for reproductive cloning of a mammal by nuclear transplantation.
2. Describe types of RNA and their functions in a eukaryotic cell.
3. Describe the roles of helper T lymphocytes in both humoral and cell-mediated immunity.

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(一) 單選題：共四十五題(每題 2 分)

1. Normal body temperature is  $37^{\circ}\text{C}$ . What is the equivalent temperature in kelvins?  
A) 310 K    B) 309 K    C) 309.5 K    D) 310.5 K    E) 311 K
2. Which of the following pairs of elements should combine to give covalent compounds?  
A)  $\text{Mg} + \text{O}_2$     B)  $\text{Cl}_2 + \text{F}_2$     C)  $\text{Cl}_2 + \text{Cr}$     D)  $\text{S}_8 + \text{Na}$     E)  $\text{S}_8 + \text{Ca}$
3. What is wrong with the common names for the following compounds?  
A) tetraphosphorus trisulfide ( $\text{P}_4\text{S}_3$ )    B) silicon dioxide ( $\text{SiO}_2$ )    C) chlorine oxide ( $\text{Cl}_2\text{O}$ )  
D) copper (II) bromide ( $\text{CuBr}_2$ )    E) thionyl chloride ( $\text{SOCl}_2$ )
4. Which pair of samples contains the same number of hydrogen atoms?  
A) 1 mole of  $\text{NH}_3$  and 1 mole of  $\text{N}_2\text{H}_4$     B) 2 moles of  $\text{NH}_3$  and 1 mole of  $\text{N}_2\text{H}_4$   
C) 2 moles of  $\text{NH}_3$  and 3 moles of  $\text{N}_2\text{H}_4$     D) 4 moles of  $\text{NH}_3$  and 3 moles of  $\text{N}_2\text{H}_4$   
E) 3 moles of  $\text{NH}_3$  and 1 moles of  $\text{N}_2\text{H}_4$
5. Which of the following graphs does not give a straight line for an ideal gas?  
A)  $V$  versus  $T$     B)  $T$  versus  $P$     C)  $P$  versus  $1/V$     D)  $1/P$  versus  $1/V$     E)  $n$  versus  $1/P$
6. Which of the following transitions in the spectrum of the hydrogen atom results in the emission of light with the longest wavelength?  
A)  $n = 5$  to  $n = 4$     B)  $n = 3$  to  $n = 2$     C)  $n = 3$  to  $n = 1$   
D)  $n = 2$  to  $n = 3$     E)  $n = 3$  to  $n = 4$
7. Which of the following sets of  $n$ ,  $l$ ,  $m$ , and  $s$  quantum numbers can be used to describe an electron in a  $2p$  orbital?  
A) 2, 0, 0,  $1/2$     B) 2, 1, 0,  $-1/2$     C) 2, 2, 1,  $1/2$     D) 3, 2, 1,  $-1/2$     E) 3, 2, 0,  $-1/2$
8. Which of the following samples would have the largest volume at  $25^{\circ}\text{C}$  and 75 mmHg?  
A) 100 g  $\text{CO}_2$     B) 100 g  $\text{NO}$     C) 100 g  $\text{CH}_4$     D) 100 g  $\text{SO}_2$     E) 100 g  $\text{CO}$
9. Predict the electron configurations for zinc ( $Z = 30$ ) from their positions in the periodic table.  
A)  $[\text{Ar}]4s^13d^9$     B)  $[\text{Ar}]4s^13d^{10}$     C)  $[\text{Ar}]4s^23d^9$     D)  $[\text{Ar}]4s^23d^{10}$     E)  $[\text{Ar}]4s^03d^{10}$
10. Which of the following orbits cannot exist?  
A)  $6s$     B)  $3p$     C)  $10f$     D)  $17f$     E)  $2d$

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11. Which of the following series of elements is arranged in order of decreasing electronegativity?  
A) O, P, Al, Mg, K    B) C, Si, P, As, Se    C) Na, Li, B, N, F  
D) Li, Be, B, C, N    E) K, B, Be, N, C
12. Which of the following compounds should be the most ionic?  
A)  $\text{Ti}_2\text{O}_3$     B)  $\text{TiO}$     C)  $\text{Ti}_4\text{O}_7$     D)  $\text{TiO}_2$     E)  $\text{TiO}_3$
13. Arrange the following atoms or ions in order of increasing radius. (a) Na (b)  $\text{Na}^+$  (c) Cl (d)  $\text{Cl}^-$   
A) bacd    B) dcab    C) bcad    D) abcd    E) abdc
14. Which of the following ionization energies is the largest?  
A) 1<sup>st</sup> IE of Ba    B) 3<sup>rd</sup> IE of Al    C) 2<sup>nd</sup> IE of Al    D) 3<sup>rd</sup> IE of Mg    E) 2<sup>nd</sup> IE of Ba
15. Which of the following are exceptions to the Lewis octet rule?  
A)  $\text{CO}_2$     B)  $\text{SO}_3$     C)  $\text{PCl}_3$     D)  $\text{NO}_2$     E)  $\text{SF}_4$
16. Which of the following compounds is best described as T-shaped?  
A)  $\text{XeF}_3^+$     B)  $\text{NO}_3^-$     C)  $\text{ClO}_3^-$     D)  $\text{SF}_4$     E)  $\text{PCl}_3$
17. Predict which of the following substances should have an enthalpy of formation equal to zero.  
A)  $\text{Br}_{2(g)}$     B)  $\text{Hg}_{(l)}$     C)  $\text{H}_{(g)}$     D)  $\text{I}_{2(l)}$     E)  $\text{POCl}_3$
18. Which of the following reactions would you expect to be endothermic?  
A)  $2 \text{H}_{2(g)} + \text{O}_{2(g)} \rightarrow 2 \text{H}_2\text{O}_{(g)}$     B)  $\text{H}_2\text{O}_{(g)} \rightarrow \text{H}_2\text{O}_{(l)}$     C)  $\text{H}_{2(g)} \rightarrow 2 \text{H}_{(g)}$   
D)  $\text{HCl}_{(aq)} + \text{NaOH}_{(aq)} \rightarrow \text{NaCl}_{(aq)} + \text{H}_2\text{O}_{(l)}$     E)  $2\text{H}_{(g)} \rightarrow \text{H}_{2(g)}$
19. Which of the following would you expect to be best oxidizing agent?  
A) Na    B)  $\text{H}_2$     C)  $\text{P}_4$     D)  $\text{O}_2$     E)  $\text{NaBH}_4$
20. Which of the following molecule is paramagnetic?  
A) HF    B) CO    C)  $\text{NO}^+$     D)  $\text{SO}_3$     E) NO
21. Nitrogen has a reasonable oxidation number in all of the following compounds, and yet one of them is still impossible. Which one?  
A)  $\text{NF}_5$     B) NO    C)  $\text{NO}_3^-$     D)  $\text{NO}_2^-$     E)  $\text{NO}_2$
22. Which of the following is not a Brønsted conjugate acid-base pair?  
A)  $\text{NH}_4^+/\text{NH}_3$     B)  $\text{H}_2\text{O}/\text{OH}^-$     C)  $\text{H}_3\text{O}^+/\text{OH}^-$     D)  $\text{CH}_4/\text{CH}_3^-$
23. Which of the following compounds can act as both a Brønsted acid and a Brønsted base?  
A)  $\text{Na}_2\text{CO}_3$     B)  $\text{H}_2\text{CO}_3$     C)  $\text{H}_2\text{O}$     D)  $\text{CO}_2$     E)  $\text{Cl}_2$

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24. Which of the following is the strongest acid?  
A)  $0.10\text{ M H}_2\text{PO}_4^-$     B)  $0.10\text{ M HPO}_4^{2-}$     C)  $0.10\text{ M H}_3\text{PO}_4$   
D)  $0.10\text{ M PO}_4^{3-}$     E)  $0.10\text{ M H}_3\text{PO}_3$
25. Which structure would BeO be expected to most closely resemble?  
A) NaCl    B) CsCl    C) CaF<sub>2</sub>    D) CCl<sub>4</sub>    E) ZnS
26. In which of the following structures would a xenon atom form the largest number of induced dipole-induced dipole interactions?  
A) cubic closest-packed    B) simple cubic    C) body-centered cubic    D) simple closest-packed    (E) tetrahedron-packed
27. Tetrahedral holes and octahedral holes can be found in which of the following structures?  
A) simple cubic    B) cubic closest-packed    C) body-centered cubic    D) simple closest-packed    (E) tetrahedron-packed
28. Which of the following compounds could dissolve in water to give a solution with a pH of about 5?  
A) NH<sub>3</sub>    B) NaCl    C) NH<sub>4</sub>Cl    D) KOH    E) NaOH
29. A  $0.10\text{ m}$  solution of H<sub>2</sub>SO<sub>4</sub> in water freezes at  $-0.371\text{ }^\circ\text{C}$ . Which of the following statements agrees with this observation?  
A) H<sub>2</sub>SO<sub>4</sub> does not dissociate in water  
B) H<sub>2</sub>SO<sub>4</sub> dissociates in water to form (H<sub>2</sub>SO<sub>4</sub>)<sub>2</sub> molecules  
C) H<sub>2</sub>SO<sub>4</sub> dissociates into water to form two H<sub>3</sub>O<sup>+</sup> ions and one SO<sub>4</sub><sup>2-</sup> ion  
D) H<sub>2</sub>SO<sub>4</sub> dissociates into H<sub>3</sub>O<sup>+</sup> and HSO<sub>4</sub><sup>-</sup> ions in water
30. Which of the following pairs of ions can't coexist in aqueous solution?  
A) Na<sup>+</sup>, S<sup>2+</sup>    B) Hg<sub>2</sub><sup>2+</sup>, F<sup>-</sup>    C) Fe<sup>2+</sup>, Hg<sup>2+</sup>    D) Na<sup>+</sup>, Cl<sup>-</sup>    E) Ag<sup>+</sup>, Hg<sup>2+</sup>
31. Which of the following compounds would be the most soluble in a nonpolar solvent, such as CCl<sub>4</sub>?  
A) CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>OH    B) CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>OH  
C) CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>OH    D) CH<sub>3</sub>CH<sub>2</sub>OH    E) CH<sub>3</sub>OH

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32. Which of the following is the correct equilibrium constant expression for the reaction  $\text{Cl}_{2(g)} + 3 \text{F}_{2(g)} \rightleftharpoons 2 \text{ClF}_{3(g)}$ ?

A)  $K_c = \frac{2 [\text{ClF}_3]}{[\text{Cl}_2] + 3 [\text{F}_2]}$     B)  $K_c = \frac{[\text{ClF}_3]^2}{[\text{Cl}_2][\text{F}_2]^3}$     C)  $K_c = \frac{[\text{Cl}_2] + 3 [\text{F}_2]}{2 [\text{ClF}_3]}$     D)  $K_c = \frac{[\text{Cl}_2][\text{F}_2]^3}{[\text{ClF}_3]^2}$

33. Which of the following octahedral complexes can form *cis* / *trans* isomers?



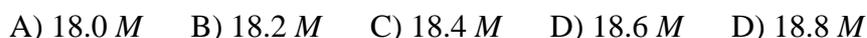
34. Calculate the solubility of  $\text{CaF}_2$  in grams per liter and comment on its potential as a fluoridating agent. ( $K_{sp} = 4.0 \times 10^{-11}$ )



35. Which of the following molecule is optically active?



36. Sulfuric acid is 96.0%  $\text{H}_2\text{SO}_4$  by weigh, and it has a density of  $1.84 \text{ g/cm}^3$ . Calculate the molarity of this solution.



37. Which of the following transition metal ions are in an oxidation state in which the electron configuration of the metal is not formally  $d^0$ ?



38. Which isotope of carbon is most likely to decay by electron emission?



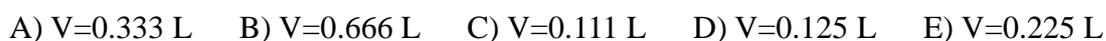
39. Which of the following nuclide is most likely to be neutron-rich?



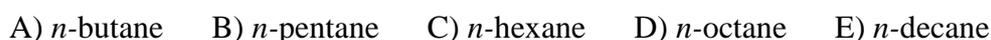
40. Which of the following is a product of the reaction between chlorine and ethylene?



41. Calculate what volume of 1.50 M HCl would react with 25.0 grams of  $\text{CaCO}_3$ .



42. Which of the following compounds has the largest octane number?



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43. Calculate the density in grams per liter of oxygen gas at 0 °C and 1.00 atm.

A) 1.56 g/L    B) 1.05 g/L    C) 1.43 g/L    D) 1.12 g/L    E) 1.33 g/L

44. If EtOH is used as the only source of carbon, which of the following can be synthesized by a Grignard reaction?

A)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$     B)  $\text{CH}_3\text{CH}_2\text{CHO}$     C)  $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$

D)  $\text{CH}_3\text{CO}_2\text{CH}_2\text{CH}_3$     E)  $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_2\text{OCH}_2\text{CH}_3$

45. Which of the following substances are not polymers?

A) cellulose    B) protein    C) teflon    D) starch    E) lipid

**(二)簡答題：共二題(每題五分)**

1. How do amino acids, peptides, and proteins differ?

2. Describe a concise but thorough explanation for the application of nanotechnology.