

國立中山大學 101 學年度轉學生招生考試試題

科目：普通化學【海資系學士班二年級】

題號：7037
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選擇題(均為單選，每題 4 分，答錯倒扣 1 分，未作答則不計分亦不倒扣。)

- Which element is commonly used in the manufacture of semiconductors ?
(A) Hg (B) Si (C) Cu (D) Zn (E) Ag
- Which of the following statements is true regarding sodium and chlorine ?
(A) Sodium has greater electronegativity and a larger first ionization energy.
(B) Sodium has a larger first ionization energy and a larger atomic radius.
(C) Chlorine has a larger atomic radius and a greater electronegativity.
(D) Chlorine has greater electronegativity and a larger first ionization energy.
(E) Chlorine has a larger atomic radius and a larger first ionization energy.
- Which of the following is true of the alkali metal elements ?
(A) They usually take the +2 oxidation state.
(B) They have oxides that act as acid anhydrides.
(C) They form covalent bonds with oxygen.
(D) They are generally found in nature in compounds.
(E) They have relatively large first ionization energies.
- Which form of orbital hybridization can form molecules with shapes that are either trigonal pyramidal or tetrahedral ?
(A) sp (B) sp^2 (C) sp^3 (D) dsp^2 (E) dsp^3
- A hydrocarbon was found to be 20% hydrogen by weight. If 1 mole of the hydrocarbon has a mass of 30 grams, what is its molecular formula ?
(A) CH (B) CH₂ (C) CH₃ (D) C₂H₄ (E) C₂H₆
- A gaseous mixture at a constant temperature contains O₂, CO₂, and He. Which of the following lists the three gases in order of increasing average molecular speed ?
(A) O₂, CO₂, He (B) O₂, He, CO₂ (C) He, CO₂, O₂ (D) He, O₂, CO₂
(E) CO₂, O₂, He
- Which of the following expressions is equal to the density of helium gas at standard temperature and pressure ?
(A) $\frac{1}{22.4}$ g/L (B) $\frac{2}{22.4}$ g/L (C) $\frac{1}{4}$ g/L (D) $\frac{4}{22.4}$ g/L (E) $\frac{4}{4}$ g/L

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8. A substance is dissolved in water, forming a 0.50-molar solution. If 4.0 liters of solution contains 240 grams of the substance, what is the molecular mass of the substance ?
(A) 60 grams/mole (B) 120 grams/mole (C) 240 grams/mole
(D) 480 grams/mole (E) 640 grams/mole
9. Given that a solution of NaCl (molar mass 58.5 g/mole) in water (molar mass 18 g/mole) has a molality of 0.5*m*, which of the following can be determined ?
I. The mass of the NaCl in the solution
II. The total mass of the solution
III. The mole fraction of the NaCl in the solution.
(A) I only (B) III only (C) I and II only (D) II and III only (E) I, II and III
10. Which of the following best describes the pH of a 0.01-molar solution of HBrO ? (For HBrO, $K_a = 2 \times 10^{-9}$)
(A) Less than or equal to 2 (B) Between 2 and 7 (C) 7 (D) Between 7 and 11
(E) Greater than or equal to 11
11. A 1-molar solution of a very weak monoprotic acid has a pH of 5. What is the value of K_a for the acid ?
(A) $K_a = 1 \times 10^{-10}$ (B) $K_a = 1 \times 10^{-7}$ (C) $K_a = 1 \times 10^{-5}$ (D) $K_a = 1 \times 10^{-2}$
(E) $K_a = 1 \times 10^{-1}$
12. Which of the following procedures will produce a buffered solution ?
I. Equal volumes of 0.5*M* NaOH and 1*M* HCl solutions are mixed.
II. Equal volumes of 0.5*M* NaOH and 1*M* CH₃COOH solutions are mixed.
III. Equal volumes of 1*M* CH₃COONa and 1*M* CH₃COOH solutions are mixed.
(A) I only (B) III only (C) I and II only (D) II and III only (E) I, II and III
13. In which of the following molecules does carbon have an oxidation state of +2 ?
(A) CH₄ (B) CH₃OH (C) HCHO (D) HCOOH (E) CO₂
14. In which process a nuclide releases a particle that is the equivalent of a helium nucleus ?
(A) Alpha decay (B) Beta (β^-) decay (C) Electron capture
(D) Gamma radiation (E) Mass defect

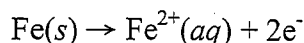
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15. When solid iron is brought into contact with water and oxygen, it undergoes the following half-reaction:



This half reaction is instrumental in the corrosion of iron. When iron is coated with solid zinc, the half-reaction above is inhibited, even if the zinc coating is incomplete. This is most likely because

- (A) $\text{Zn}(s)$ is more easily reduced than $\text{Fe}(s)$.
 - (B) $\text{Zn}(s)$ is more easily oxidized than $\text{Fe}(s)$.
 - (C) $\text{Zn}^{2+}(aq)$ is more easily reduced than $\text{Fe}(s)$.
 - (D) $\text{Zn}^{2+}(aq)$ is more easily oxidized than $\text{Fe}(s)$.
 - (E) $\text{Zn}(s)$ is more easily reduced than $\text{Fe}^{2+}(aq)$.
16. Which of the following molecule has sp^3 hybrid oxygen ?
(A) CO_2 (B) H_2O (C) SO_2 (D) NO_2 (E) O_2
17. $2 \text{MnO}_4^{-} + 5 \text{SO}_3^{2-} + 6 \text{H}^{+} \rightarrow 2 \text{Mn}^{2+} + 5 \text{SO}_4^{2-} + 3 \text{H}_2\text{O}$
Which of the following statements is true regarding the reaction given above ?
(A) MnO_4^{-} acts as the reducing agent.
(B) H^{+} acts as the oxidizing agent.
(C) SO_3^{2-} acts as the reducing agent.
(D) MnO_4^{-} is oxidized.
(E) SO_3^{2-} is reduced.
18. The boiling point of water is known to be lower at high elevations. This is because
(A) hydrogen bonds are weaker at high elevations
(B) the heat of fusion is lower at high elevations
(C) the vapor pressure of water is higher at high elevations
(D) the atmospheric pressure is lower at high elevations
(E) water is more dense at high elevations
19. The value of the equilibrium constant K_{eq} is greater than 1 for a certain reaction under standard state conditions. Which of the following statements must be true regarding the reaction ?
(A) ΔG° is negative. (B) ΔG° is positive. (C) ΔG° is equal to zero.
(D) ΔG° is negative if the reaction is exothermic and positive if the reaction is endothermic.
(E) ΔG° is negative if the reaction is endothermic and positive if the reaction is exothermic.

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20. The molecular formula of octane is
(A) C_6H_{14} (B) C_7H_{16} (C) C_8H_{18} (D) C_9H_{20} (E) $C_{10}H_{22}$
21. A beaker contains 150.0 ml of a 0.20 M $Pb(NO_3)_2$ solution. If 50.0 ml of a 0.20 M solution of $MgCl_2$ is added to the beaker, what will be the final concentration of Pb^{2+} ions in the solution?
(A) 0.20 M (B) 0.10 M (C) 0.050 M (D) 0.025 M (E) 0.012 M
22. Which of the statements below regarding elemental nitrogen is NOT true?
(A) It contains one sigma bond.
(B) It contains one pi bonds.
(C) It has a bond order of 3.
(D) It has no dipole moment.
(E) It exists as a diatomic gas.
23. Which ground state electron configuration of an atom listed below is diamagnetic?
(A) $1s^2 2s^2 2p^2$ (B) $1s^2 2s^2 2p^3$ (C) $1s^2 2s^2 2p^4$ (D) $1s^2 2s^2 2p^5$ (E) $1s^2 2s^2 2p^6$
24. Which of the following sets of quantum numbers (n, l, m_l, m_s) best describe the highest energy valence electron in a ground-state calcium ion (Ca^{2+})?
(A) $2, 1, 0, \frac{1}{2}$ (B) $3, 0, 0, \frac{1}{2}$ (C) $3, 1, 1, \frac{1}{2}$ (D) $4, 0, 0, \frac{1}{2}$
(E) $4, 1, 1, \frac{1}{2}$
25. For the reaction $A + B \rightarrow C + D$, the rate law for formation of C is
(A) $rate = k [A] [B]$
(B) $rate = k [A] [B] / [D]$
(C) $rate = k [A] [B] / [C]$
(D) $rate = k [A] [B] / [C] [D]$
(E) impossible to state from the data given.

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科目：普通生物學【海資系學士班二年級】

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(一) 單選題 (每題 5 分，共 25 分)

- (1) Which of the following correctly describes any reaction that has reached chemical equilibrium?
 - A) All of the reactants have been converted to the products of the reaction.
 - B) All of the products have been converted to the reactants of the reaction.
 - C) Both the forward and the reverse reactions have stopped with no net effect on the concentration of the reactants and the products.
 - D) The rate of the forward reaction is equal to the rate of the reverse reaction.
 - E) The concentration of the reactants equals the concentration of the products.
- (2) If cells are grown in a medium containing radioactive ^{15}N , which of these molecules will be labeled?
 - A) amylase only. B) proteins only. C) nucleic acids only. D) fatty acids only.
 - E) both proteins and nucleic acids.
- (3) Since Watson and Crick described DNA in 1953, which of the following might best explain why the function of small RNAs is still being explained?
 - A) Changes in technology as well as our ability to determine how much of the DNA is expressed have now made this possible.
 - B) The functions of small RNAs could not be approached until the entire human genome was sequenced.
 - C) Ethical considerations prevented scientists from exploring this material until recently.
 - D) Watson and Crick described DNA but did not predict any function for RNA.
 - E) As RNAs have evolved since that time, they have taken on new functions.
- (4) Diploid nuclei of the ascomycete, *Neurospora crassa*, contain 14 chromosomes. A single diploid cell in an ascus will undergo one round of meiosis, followed in each of the daughter cells by one round of mitosis, producing a total of eight ascospores. What is the ploidy of a single mature ascospore?
 - A) diploid. B) triploid. C) polyploidy. D) tetraploid. E) monoploid.
- (5) A biologist discovers an alga that is marine, multicellular, and lives at a depth reached only by blue light. This alga probably belongs to which group?
 - A) red algae. B) golden algae. C) brown algae. D) green algae. E) dinoflagellates.

(二) 問答題 (每題 15 分，共 75 分)

- (1) Why is it important that an experiment include a control group?
- (2) What are the domains in taxonomy?
- (3) Which statement describes the enzyme cooperativity?
- (4) How do cells at the completion of meiosis compare with cells that have replicated their DNA and are just about to begin meiosis?
- (5) What is (are) definition for the biological species concept?