

國立中山大學 102 學年度轉學考招生考試試題

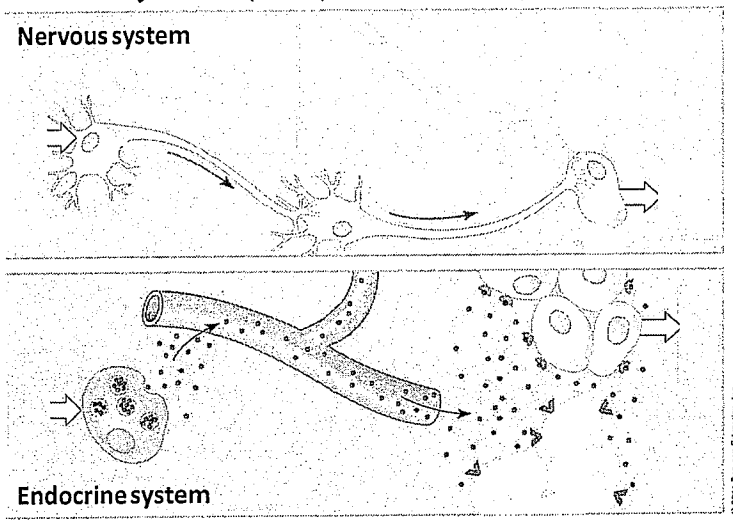
科目名稱：普通生物學【生科系二年級】

題號：721001

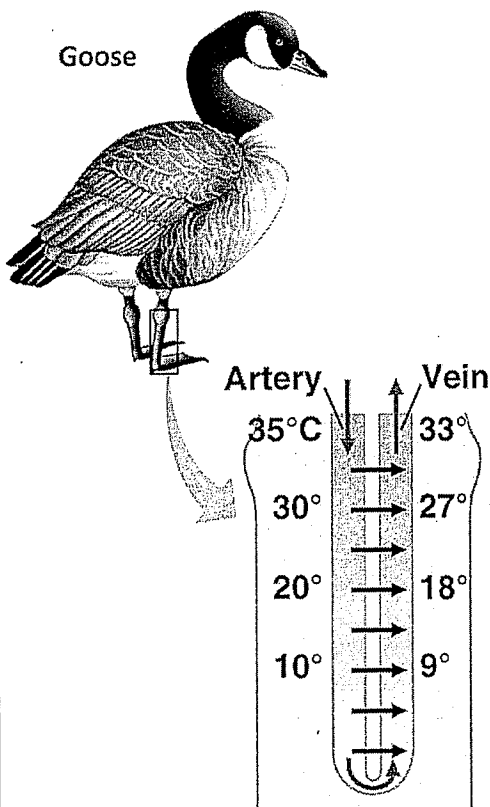
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共 2 頁 第 1 頁

1. Please compare the following three types of bulk transport. (15 %) (Phagocytosis, Pinocytosis and Receptor-mediated endocytosis)
2. The figure shows signaling in the endocrine and nervous system. Please compare differences between these two systems. (15 %)



3. Please explain the “countercurrent heat exchange” in detail after reading the following paragraph. (20 %)



1. Arteries carrying warm blood to the animal's extremities are in close contact with veins conveying cool blood in the opposite direction, back toward the trunk of the body. This arrangement facilitates heat transfer from arteries to veins along the entire length of the blood vessels.
2. Near the end of the leg, where arterial blood has been cooled to far below the animal's core temperature, the artery can still transfer heat to the even colder blood in an adjacent vein. The blood in the veins continues to absorb heat as it passes warmer and warmer blood traveling in the opposite direction in the arteries.
3. As the blood in the veins approaches the center of the body, it is almost as warm as the body core, minimizing the heat loss that results from supplying blood to body parts immersed in cold water.

Key

Warm blood → Blood flow
Cool blood → Heat transfer

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4. What is a species? List species concepts you know and compare their differences. (20%)
5. There are three models of ecological succession to explain how community changes. In these three models, how early-arriving species affect later-arriving species? (15 %)
6. Describe the life cycle of a fern species. You may use illustrations to enhance your descriptions. (15 %)

背面有題

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共 3 頁第 1 頁

(一) 單選題 (每小題 4 分, 共 60 分); 答錯不倒扣。

- (1) The vapor pressure of a liquid _____
(a) increases linearly with increasing temperature
(b) increases nonlinearly with increasing temperature
(c) decreases linearly with increasing temperature
(d) decreases nonlinearly with increasing temperature
(e) is independent on temperature
- (2) In the energy profile of a reaction, the species that exists at the maximum on the curve is called the _____
(a) product (b) activated complex (c) intermediate (d) activation energy (e) none of the above
- (3) Which of the following molecules or ions will exist delocalized bonding?
SO₂ SO₃ SO₃²⁻
(a) SO₂ and SO₃ (b) SO₂ and SO₃²⁻ (c) SO₃ and SO₃²⁻ (d) all of them (e) none of them
- (4) The O-S-O bond angle in SO₂ is
(a) $\leq 60^\circ$ (b) $60^\circ < \leq 90^\circ$ (c) $90^\circ < \leq 109.5^\circ$ (d) $109.5^\circ < \leq 120^\circ$ (e) $120^\circ < \leq 180^\circ$
- (5) [Ar]4s²3d¹⁰4p³ is the electron configuration for _____ atom.
(a) V (b) P (c) Sn (d) Sb (e) As
- (6) Of the following gases, which will have the greatest rate of effusion at a given temperature?
(a) CH₃OH (b) CO₂ (c) CH₄ (d) HCl (e) cannot judge
- (7) Which of the following liquids will have the lowest freezing point?
(a) pure water (b) aqueous glucose (0.6 m) (c) aqueous sucrose (0.6 m)
(d) aqueous FeI₃ (0.24 m) (e) aqueous KF (0.5 m)
- (8) What fraction of the volume of each corner atom is actually within the volume of a face-centered cubic unit cell?
(a) 1 (b) 1/2 (c) 1/4 (d) 1/6 (e) 1/8
- (9) Of the following, which is not a state function?
(a) entropy (b) enthalpy (c) heat (d) internal energy (e) temperature
- (10) In a voltaic cell, electrons flow from the _____ to the _____.
(a) anode, cathode
(b) cathode, anode
(c) cathode, salt bridge
(d) electrode, salt bridge
(e) anode, salt bridge
- (11) Starch and cellulose are made of repeating units of _____.
(a) glucose (b) sucrose (c) lactose (d) amino acids (e) fructose
- (12) The concentration of chloride ion in a solution that contains 35.0 ppm chloride is _____ % by mass.
(a) 3.50×10^{-3} (b) 3.50×10^2 (c) 3.50×10^{-2} (d) 3.50×10^{-6} (e) none of the above

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共 3 頁第 2 頁

- (13) K_a for HCN is 4.9×10^{-10} . What is the PH of a 0.068 M aqueous solution of NaCN?
(a) 5.2 (b) 1.74 (c) 13 (d) 8.9 (e) none of the above
- (14) What is the coefficient of Fe^{3+} when the following equation is balanced?
$$\text{Fe}^{3+} + \text{CN}^- \rightarrow \text{CNO}^- + \text{Fe}^{2+} \quad (\text{basic solution})$$

(a) 1 (b) 2 (c) 3 (d) 4 (e) none of the above
- (15) What is the temperature above which a reaction with ΔH of 123.0 kJ/mol and ΔS of 90.00 J/K·mol becomes spontaneous?
(a) 1367 K (b) 533 K (c) 533 °C (d) 1107 K (e) none of the above

(二) 複選題 (每小題 4 分, 共 40 分); 每小題全部答對才給分, 答錯不倒扣。

- (16) Which of the following are existing or potential applications of the supercritical carbon dioxide?
(a) extraction of caffeine from coffee beans
(b) use as a solvent in dry cleaning
(c) use as a coolant in refrigeration
(d) use as a reagent in fuel-cell
(e) use as a fuel for rocket launch
- (17) About the chemical kinetics, which of the following are true?
(a) Rate of reaction can be positive or negative.
(b) The overall reaction order is the sum of the order of each reactant in the rate law.
(c) The rate of a second order reaction can dependent on the concentration of more than one reactant.
(d) The half-life of a first order reaction dependent on the concentration of the reactant.
(e) Heterogeneous catalysts have different phases from reactants.
- (18) Based on the molecular orbital theory, which of the following are correct?
(a) The bond order of N_2 molecule is 3.
(b) The bond order of H_2^+ ion is 0.
(c) The bond order of C_2 is 2.
(d) An antibonding π^* orbital contains a maximum of two electrons.
(e) The O_2 molecule will gain mass in a magnetic field.
- (19) About the properties of elements, which of the followings are correct?
(a) Elements from opposite sides of the periodic table tend to form covalent compounds.
(b) The principle quantum number of the valence electrons of calcium (Ca) is 2.
(c) In nature, sulfur (S) is most commonly found in sulfuric acid.
(d) All of the halogens exist under ambient conditions as diatomic gases.
(e) Dry air is about 21% oxygen.

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- (20) For gas molecules, which of the followings are correct?
- (a) Different gases at the same temperature always have the same average kinetic energy.
 - (b) Two deviations of real gases from ideal gases are finite molecular volume and non-zero molecular attractions.
 - (c) The density of oxygen gas at 77 °C and 700 torr is about 1.01 g/L.
 - (d) A real gas will behave most like an ideal gas under conditions of high temperature and high pressure.
 - (e) Under the same conditions, CO₂ is expected to show larger deviations from ideal gas behavior than Ar.
- (21) For the properties of solutions, which of the followings are correct?
- (a) A homogeneous mixture cannot be a colloid.
 - (b) The property of a substance sticking to the surface of another is called viscosity.
 - (c) The most likely van't Hoff factor for an 0.01 m CaCl₂ solution is 2.0.
 - (d) The value of the boiling-point-elevation constant (k_b) depends on the identity of the solvent.
 - (e) A solution with a solute concentration greater than the solubility is called a supercritical solution.
- (22) For the properties of solids and liquids, which of the following statements are correct?
- (a) Metallic solids do not exhibit variable hardness.
 - (b) An ionic solids usually has a very high melting point and great hardness.
 - (c) Molecules or atoms in molecular solids are held together via intermolecular forces.
 - (d) Heats of vaporization are greater than heats of fusion.
 - (e) London dispersion forces tend to increase in strength with increasing molecular weight.
- (23) For the chemical thermodynamics, which of the following statements are correct?
- (a) The entropy of the universe is constant.
 - (b) A system that does not exchange matter or energy with its surroundings is called an isotonic system.
 - (c) The standard Gibbs free energy of formation of H₂O(l) is zero.
 - (d) The melting of a substance at its melting point is an isothermal process.
 - (e) The more negative ΔG° is for a given reaction, the larger the value of the corresponding equilibrium constant, K .
- (24) About the chemistry of coordination compounds, which of the following statements are correct?
- (a) The oxidation number of chromium in $\{[\text{Cr}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}\}$ is +3.
 - (b) Four iron atoms are coordinated in a hemoglobin molecule.
 - (c) EDTA is a hexadentate ligand.
 - (d) Two isomers exist for the octahedral complex $[\text{Co}(\text{NH}_3)_4\text{F}_2]^+$.
 - (e) $[\text{Fe}(\text{CN})_6]^{4-}$ is diamagnetic, so CN⁻ is a strong-field ligand.
- (25) About nuclear chemistry, which of the following statements are correct?
- (a) Gama radiation only changes the atomic number but not the mass number of a nucleus.
 - (b) Radioactive decay is a zero order kinetic process.
 - (c) Positron emission causes a decrease of one in the atomic number.
 - (d) The half-life for the beta decay of K-40 is 1.3×10^9 years, so the rate constant for this decay is $k=5.3 \times 10^{-10}$ / year.
 - (e) The only element with no neutrons is helium (He).