

國立中央大學98學年度碩士班考試入學試題卷

所別：水文與海洋科學研究所碩士班 一般生 科目：普通化學 共二頁 第一頁

*請在試卷答案卷(卡)內作答

Please refer to data at the end of the examination paper to answer the following questions or problems.

A. Multiple choices (2.5 points each)

- Which is the electronic configuration of a stable ferrous ion? (a) $1s^2 2s^2 2p^6$; (b) $1s^2 2s^2 2p^6 3s^2 3p^5$; (c) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6$; (d) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$; (e) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$; (f) None of the above.
- Which of the following diatomic molecules has double bond? (a) Cl_2 , (b) HCl , (c) N_2 , (d) H_2 , (e) O_2 .
- Which compound contains both ionic and covalent bonds? (a) PF_3 , (b) KF , (c) NaH , (d) $CaCO_3$, (e) C_3H_8 .
- The volume of a microsyringe is $5.0 \mu L$. This is the same as (a) $5.0 \mu g$, (b) $0.0050 m^3$, (c) $0.0050 mL$, (d) $0.0050 g$, (e) $5.0 mg$.
- The formula for potassium bicarbonate is (a) P_2CO_3 , (b) PO_2CO_3 , (c) P_2C , (d) $KHCO_3$, (e) K_2C
- If $\Delta G = -32 kJ$ for a chemical reaction, the reaction (a) occurs rapidly, (b) releases heat, (c) absorbs heat, (d) cannot occur, (e) occurs spontaneously.
- Which radiation has the longest wavelength? (a) UV, (b) X-ray, (c) Gamma ray, (d) Red light, (e) Microwave.
- Which of the following as a solid has a crystal structure containing discrete (or separate) molecules? (a) Table salt, (b) glucose, (c) gold, (d) graphite, (e) glass.
- Which of the following is a greenhouse gas? (a) H_2O , (b) N_2 , (c) O_2 , (d) H_2 , (e) Ar, (f) None of the above
- Which of the following molecules has pi-bonds? (a) Methane, (b) Water, (c) Ethanol, (d) Benzene, (e) Ammonia, (f) None of the above
- Which of the following phase changes is or are exothermic (releasing heat)? (a) Condensation of vapor, (b) Crystallization of molten salt, (c) Evaporation of water, (d) Both a and b, (e) Both b and c.
- For a reaction that has an equilibrium constant of 10^{-14} , which of the following statements must be true? (a) ΔG is negative. (b) ΔG is positive. (c) ΔH is negative. (d) ΔH is positive. (e) ΔS is negative. (f) ΔS is positive.
- Which of the following nuclear decay results in an increase in the nuclear charge? (a) alpha decay, (b) beta decay, (c) electron capture decay, (d) positron decay, (e) gamma decay, (f) none of the above.
- Which functional group does not contain an oxygen atom? (a) Alcohol, (b) Carboxylic acid, (c) Ketone, (d) Amide, (e) Methyl
- Ammonium can be oxidized to nitrate. How many moles of electrons are lost from one mole of nitrogen in the reaction? (a) 1 mole; (b) 2 moles; (c) 4 moles; (d) 6 moles; (e) 8 moles, (f) None of the above.
- Which of the following is a weak base in water? (a) Na_2SO_3 ; (b) HCl ; (c) HF ; (d) HBr ; (e) $HClO_3$, (f) $B(OH)_3$.
- Liquid nitrogen boils at $-183^\circ C$. What is its boiling point on the Kelvin scale? (a) $-90 K$. (b) $-80 K$. (c) $-70 K$. (d) $70 K$. (e) $80 K$, (f) $90 K$.
- Which of the following compounds is non-polar? (a) CH_4 , (b) H_2O , (c) HF , (d) CH_3OH , (e) NH_3 .
- Which of the following species would not function as an oxidizing agent? (a) SO_4^- , (b) Mn_2^+ , (c) H^+ , (d) S, (e) Cl^-

參考用

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所別：水文與海洋科學研究所碩士班 一般生 科目：普通化學 共二頁 第二頁

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20. Several solutions of calcium carbonate in water were prepared by students. They reported the concentrations differently. Which of the following concentration expressions may change with temperature? (a) 0.10 m; (b) 0.10 M; (c) 1.0% by weight; (d) 0.0018 mole fraction; (e) None of the above.

B. Short questions

1. Classify the following compounds into strong acids, weak acids, strong bases, weak bases, and none of the above: $B(OH)_4^+$, $CaCl_2$, $HClO_4$, $HCOOH$, HCl , $NaHCO_3$, HF , H_2S , $Mg(OH)_2$, NH_4Cl . (10 points)
2. How much silver ion may be dissolved in a solution 1.50 mM in NaCl. (10 points)
3. Draw the structure of the following compounds: H_2CO_3 ; C_3H_6 ; NH_4^+ ; CO_2 ; HNO_3 . (10 points)
4. A solution 0.1 M in hydrochloric acid and 0.2 M in sodium acetate is prepared. Write equations of reactions that may occur in the solution. Calculate the concentrations of acetate, hydronium, and hydroxide ion in the solution. Is the solution acidic or basic? (20 points)

C. Data

Please use the following information to answer the questions or solve the problems.

Gas constant: $R = 0.082 \text{ atm L mol}^{-1} \text{ K}^{-1}$

Planck constant: $h = 6.63 \times 10^{-34} \text{ Js}$

Atomic weight: H = 1.008, C = 12.01, O = 16.00, Na = 23.00, S = 32.06, Ca = 40.08

Atomic number: C = 6, Si = 14, P = 15, Ar = 18, K = 19, Fe = 26, Br = 35, U = 92

Solubility product: $AgCl$, $K_{sp} = 1.8 \times 10^{-10}$

Dissociation constant: acetic acid $K = 1.7 \times 10^{-5}$, water $K = 1.0 \times 10^{-14}$

1 mM = 10^{-3} M

參考用

注意：背面有試題