

國立屏東教育大學 102 學年度學士班轉學考試

普通化學(A) 試題

(化學生物系)

*注意事項：

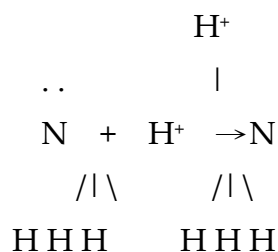
- (1) 本試題共 6 頁，答案請「橫式」書寫，並依規定上下翻頁。
(2) 不必抄題，但請依序將題號標出，並寫在答案紙上，否則不予計分。

一、選擇題 (每題 4 分，共 80 分)

1. The correct name of the compound Na_3N is _____.
- (A) sodium nitride
(B) sodium azide
(C) sodium trinitride
(D) sodium(IX) nitride
(E) trisodium nitride
2. The net ionic equation for formation of an aqueous solution of $\text{Al}(\text{NO}_3)_3$ via mixing solid $\text{Al}(\text{OH})_3$ and aqueous nitric acid is _____.
- (A) $\text{Al}(\text{OH})_3 (\text{s}) + 3\text{HNO}_3 (\text{aq}) \rightarrow 3\text{H}_2\text{O} (\text{l}) + \text{Al}(\text{NO}_3)_3 (\text{aq})$
(B) $\text{Al}(\text{OH})_3 (\text{s}) + 3\text{NO}_3^- (\text{aq}) \rightarrow 3\text{OH}^- (\text{aq}) + \text{Al}(\text{NO}_3)_3 (\text{aq})$
(C) $\text{Al}(\text{OH})_3 (\text{s}) + 3\text{NO}_3^- (\text{aq}) \rightarrow 3\text{OH}^- (\text{aq}) + \text{Al}(\text{NO}_3)_3 (\text{s})$
(D) $\text{Al}(\text{OH})_3 (\text{s}) + 3\text{H}^+ (\text{aq}) \rightarrow 3\text{H}_2\text{O} (\text{l}) + \text{Al}^{3+} (\text{aq})$
(E) $\text{Al}(\text{OH})_3 (\text{s}) + 3\text{HNO}_3 (\text{aq}) \rightarrow 3\text{H}_2\text{O} (\text{l}) + \text{Al}^{3+} (\text{aq}) + \text{NO}_3^- (\text{aq})$
3. Which of the following correctly represents the second ionization of aluminum?
- (A) $\text{Al}^+ (\text{g}) + \text{e}^- \rightarrow \text{Al} (\text{g})$
(B) $\text{Al} (\text{g}) \rightarrow \text{Al}^+ (\text{g}) + \text{e}^-$
(C) $\text{Al}^- (\text{g}) + \text{e}^- \rightarrow \text{Al}^{2-} (\text{g})$
(D) $\text{Al}^+ (\text{g}) + \text{e}^- \rightarrow \text{Al}^{2+} (\text{g})$
(E) $\text{Al}^+ (\text{g}) \rightarrow \text{Al}^{2+} (\text{g}) + \text{e}^-$

4. The molecular geometry of the BCl_3 molecule is _____, and this molecule is _____.
- (A) trigonal pyramidal, polar
 - (B) trigonal pyramidal, nonpolar
 - (C) trigonal planar, polar
 - (D) trigonal planar, nonpolar
 - (E) trigonal bipyramidal, polar
5. Superconductivity means that _____.
- (A) electrons move faster
 - (B) electrons move through a shorter path
 - (C) super expensive materials were used
 - (D) electrons move without resistance
 - (E) diamagnetic atoms become elongated
6. Hydrophobic colloids _____.
- (A) are those that contain water
 - (B) can be stabilized by adsorption of ions
 - (C) are those that do not contain water
 - (D) can be stabilized by coagulation
 - (E) will separate into two phases if they are stabilized
7. Which one of the following is true concerning the Haber process?
- (A) It is a process used for shifting equilibrium positions to the right for more economical chemical synthesis of a variety of substances.
 - (B) It is a process used for the synthesis of ammonia.
 - (C) It is another way of stating LeChatelier's principle.
 - (D) It is an industrial synthesis of sodium chloride that was discovered by Karl Haber.
 - (E) It is a process for the synthesis of elemental chlorine.

8. In the gas phase reaction below, NH_3 is acting as a(n) _____ base but not as a(n) _____ base.



- (A) Arrhenius, Brønsted-Lowry
- (B) Brønsted-Lowry, Lewis
- (C) Lewis, Arrhenius
- (D) Lewis, Brønsted-Lowry
- (E) Arrhenius, Lewis

9. As one gains altitude in the atmosphere, based on the ionization energies shown below, which sequence of mole fractions is the correct one?

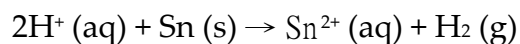
<u>Process</u>	<u>Ionization Energy (kJ/mol)</u>
$\text{N}_2 + h\nu \rightarrow \text{N}_2^+ + e^-$	1495
$\text{O}_2 + h\nu \rightarrow \text{O}_2^+ + e^-$	1205
$\text{O} + h\nu \rightarrow \text{O}^+ + e^-$	1313
$\text{NO} + h\nu \rightarrow \text{NO}^+ + e^-$	890

- (A) $\text{N}_2 > \text{N} > \text{NO} > \text{O}_2$
- (B) $\text{N}_2 > \text{O} > \text{O}_2 > \text{NO}$
- (C) $\text{N}_2 > \text{O}_2 > \text{O} > \text{NO}$
- (D) $\text{NO} > \text{O}_2 > \text{O} > \text{N}_2$
- (E) All will be equal.

10. When a system is at equilibrium, _____.

- (A) the reverse process is spontaneous but the forward process is not
- (B) the forward and the reverse processes are both spontaneous
- (C) the forward process is spontaneous but the reverse process is not
- (D) the process is not spontaneous in either direction
- (E) both forward and reverse processes have stopped

11. Consider an electrochemical cell based on the reaction:



Which of the following actions would change the measured cell potential?

- (A) increasing the pH in the cathode compartment
- (B) lowering the pH in the cathode compartment
- (C) increasing the $[\text{Sn}^{2+}]$ in the anode compartment
- (D) increasing the pressure of hydrogen gas in the cathode compartment
- (E) Any of the above will change the measure cell potential.

12. Which statement below is true?

- (A) New mining techniques and relatively untapped ore fields mean that the environmental impacts of mineral extraction will decrease significantly in the future.
- (B) There exists little correlation between the abundance of an element in the lithosphere and its commercial extraction and use.
- (C) Most metallic elements are found in the lithosphere in oxidation state zero.
- (D) The most important commercial class of minerals is the silicates.
- (E) The United States has plentiful ore fields of all strategic metals.

13. Which statement about hydrocarbons is false?

- (A) The smallest alkane to have structural (constitutional) isomers has 4 carbon atoms.
- (B) Cyclic alkanes are structural isomers of alkenes.
- (C) Alkanes are more reactive than alkenes.
- (D) Alkanes can be produced by hydrogenating alkenes.
- (E) Alkenes can be polymerized.

14. An isotope, X, of a particular element has an atomic number of 7 and a mass number of

15. Therefore,

- (A) X is an isotope of nitrogen.
- (B) X has 8 neutrons per atom.
- (C) X has an atomic mass of 14.0067.
- (D) a and b
- (E) a, b, and c

15. Which pair of ions would *not* be expected to form a precipitate when dilute solutions of each are mixed?
- (A) Al^{3+} , S^{2-}
 (B) Pb^{2+} , Cl^-
 (C) Ba^{2+} , PO_4^{3-}
 (D) Pb^{2+} , OH^-
 (E) Mg^{2+} , SO_4^{2-}
16. Given a cylinder of fixed volume filled with 1 mol of argon gas, which of the following is correct? (Assume all gases obey the ideal gas law.)
- (A) If the temperature of the cylinder is changed from 25°C to 50°C , the pressure inside the cylinder will double.
 (B) If a second mole of argon is added to the cylinder, the ratio T/P would remain constant.
 (C) A cylinder of identical volume filled with the same *pressure* of helium must contain more atoms of gas because He has a smaller atomic radius than argon.
 (D) Two of the above.
 (E) None of the above.
17. Choose the correct equation for the standard enthalpy of formation of $\text{CO}(\text{g})$, where ΔH_f° for $\text{CO} = -110.5 \text{ kJ mol}$ (gr indicates graphite).
- (A) $2\text{C}(\text{gr}) + \text{O}_2(\text{g}) \rightarrow 2\text{CO}(\text{g}), \quad \Delta H^\circ = -110.5 \text{ kJ}$
 (B) $\text{C}(\text{gr}) + \text{O}(\text{g}) \rightarrow \text{CO}(\text{g}), \quad \Delta H^\circ = -110.5 \text{ kJ}$
 (C) $\text{C}(\text{gr}) + (1/2)\text{O}_2(\text{g}) \rightarrow \text{CO}(\text{g}), \quad \Delta H^\circ = -110.5 \text{ kJ}$
 (D) $\text{C}(\text{gr}) + \text{CO}_2(\text{g}) \rightarrow 2\text{CO}(\text{g}), \quad \Delta H^\circ = -110.5 \text{ kJ}$
 (E) $\text{CO}(\text{g}) \rightarrow \text{C}(\text{gr}) + \text{O}(\text{g}), \quad \Delta H^\circ = -110.5 \text{ kJ}$
18. As the number of bonds between two carbon atoms increases, which one of the following decreases?
- (A) number of electrons between the carbon atoms
 (B) bond energy
 (C) bond length
 (D) all of these
 (E) none of these

19. Which of the following chemical or physical changes is an endothermic process?
- (A) the evaporation of water
 - (B) the combustion of gasoline
 - (C) the mixing of sulfuric acid and water
 - (D) the freezing of water
 - (E) none of these
20. The pH at the equivalence point of a titration of a weak acid with a strong base will be
- (A) less than 7.00.
 - (B) equal to 7.00.
 - (C) greater than 7.00.
 - (D) More data is needed to answer this question.

二、計算題（每題 10 分，共 20 分）

1. Consider the reaction $\text{H}_2 + \text{I}_2 \rightleftharpoons 2\text{HI}$ whose $K = 54.8$ at a high temperature. If an equimolar mixture of reactants gives the concentration of the product to be 0.50 M at equilibrium, determine the concentration of the hydrogen.
2. The rate constant for the beta decay of thorium-234 is 2.88×10^{-2} / day. What is the half-life of this nuclide?