

# 大同工學院 86 學年度轉學入學考試試題

第 1/2 頁

考試科目 化學 系別 生物工程

註：本次考試  不可 參考自己的書籍及筆記  不可 查字典  不可 使用計算器 \* 試題必須繳回！

答案每五題一組，寫在答案紙上，答錯不倒扣。

是非題每題 2 分，「是」畫○，「非」畫×。 選擇題每題 3 分。

是非題

1. The correct name for the  $\text{CrO}_4^{2-}$  ion is perchromate.
2. A covalent bond is formed when two atoms position themselves so that maximum overlap of the atomic orbitals occurs with an increase in the potential energy of the system.
3. The molecular formula for a substance can never contain fewer atoms than the empirical formula for the same substance.
4. A 0.540 molar aqueous solution of sodium tetrafluoroborate ( $M = 109.79$  g/mole) contains 14.82 grams of solute in 250 ml of solution.
5. Heat energy can always be quantitatively converted into various other forms of energy.
6. One driving force toward formation of homogeneous gas mixtures is the spontaneity of random mixing through random motion of small molecules.
7. The uncertainty principle was proposed to explain the fact that certain atoms, for instance silver, have different electronic configurations in their ground states than predicted by the Aufbau method.
8. The conductivity of some metalloids can be modified. The modified materials derive their conductivity from impurities that affect the population of the valence band (which would be ordinarily be filled if the material were pure and thus be considerably lower in conductivity).
9. The reaction,  
$$\text{AgNO}_3(\text{aq}) + \text{NH}_4\text{Br}(\text{aq}) \longrightarrow \text{AgCl}(\text{s}) + \text{NH}_4\text{NO}_3(\text{aq}),$$
involves changes in oxidation number and is therefore classified as a redox reaction.
10. Even though the average speed of a carbon monoxide molecule at 27.5 °C is greater than that of a sulfur dioxide molecule at the same temperature, the average kinetic energy of the molecules in a sample of carbon monoxide at 27.5 °C is the same as the average kinetic energy of the molecules in a sample of sulfur dioxide gas at the same temperature.
11. A cylinder contains a liquid which is in equilibrium with its vapor at 45.0 °C. If the piston is moved down to constrict the volume of the cylinder without changing the temperature, the vapor pressure of the liquid will increase.
12. The threat posed by a certain mercury species,  $\text{CH}_3\text{Hg}^+$ , is due to its ability to selectively concentrate in the food chain to a far greater extent than its general concentration in the aquatic environment.
13. Diamond coatings for devices used in high tech industries are made by crushing the diamonds to a very fine powder at high pressures to prevent them from reverting back to graphite, the using special adhesives to make to coatings secure under rough usage.
14. A positive catalyst that lowers the activation of the forward reaction in a system to one-half its uncatalyzed value will also lower the activation energy of the reverse reaction in the system to one-half its uncatalyzed value.
15. In a chemical reaction system which has reached equilibrium, the concentrations of the various species are constantly changing even though the total number of molecules is unchanging.
16. A capped, unopened carbonated beverage under a high  $\text{CO}_2(\text{g})$  pressure has a higher  $\text{H}^+$  ion concentration than a bottle of the same beverage which has been standing open for some time.
17. Coordination complexes of a particular metal ion in which water is the ligand usually contain fewer ligands than coordination complexes of the same metal with ethylenediamine as the ligand.
18. A reactive group, called a functional group, which is attached to the hydrocarbon portion of the molecule, influences or determines the kind of reactions a molecule undergoes.

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第 2/2 頁

考試科目 化 學 系別 生物工程

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選擇題

19. Even though atomic radii tend to show a regular increase within a group or family as the atomic number increases, post lanthanide elements do not appear to follow this pattern closely.
20. To dry a precipitate separated by filtration at room temperature in a desiccator a chemist might use  $P_4O_{10}$ . When this substance reacts with the water vapor distilling off the precipitate to saturate the air space in the desiccator, the product is  $H_4P_2O_7$ .
1. Which one of the following techniques or chemical substances is not commonly used to reduce metal oxides to metals?  
a. carbon    b. carbon monoxide    c. electrolysis    d.  $H_2$  gas    e. S
2. Large amounts of sulfuric acid are produced in the United States. The principal use of the sulfuric acid is in the manufacture of -  
a. nitric acid    b. plastics    c. fertilizers  
d. paper in the paper and pulp industry    e. steel
3. The electronic configuration of the hydride ion is the same as that of- a. hydrogen    b. helium    c. lithium    d. deuterium    e. tritium
4. The name for the compound,  $CH_3-CH=CH-CH_3$ , is ----  
a. butene-2    b. butene-3    c. 2-butene    d. 2-butyne    e. 2-butyl
5. Which one of the following nuclides has the maximum binding energy per nucleon, that is, it lies at or near the maximum in the binding energy per nucleon curve?  
a.  $^{251}Cf$     b.  $^{197}Au$     c.  $^{56}Fe$     d.  $^1H$     e.  $^4He$
6. The coordination number of the nickel ion in the complex ion,  $[Ni(en)_3]^{2+}$  is --- a. 1    b. 2    c. 3    d. 4    e. 6
7. Which one of the following metals is the only one which can be prepared by electrolysis of an aqueous solution of one of its salts?  
a. aluminum    b. copper    c. magnesium    d. potassium    e. sodium
8. The solubility product of  $Ag_2CrO_4$  is  $1.2 \times 10^{-12}$ . How many parts per million (ppm) of silver are there in a saturated solution of silver chromate in pure water?  
a. 0.012    b. 0.24    c. 7.2    d. 14    e. 1.6
9. If the dissociation constant,  $K_a$ , for malic acid is  $5.0 \times 10^{-5}$ , what is the  $pK_a$  of this acid?  
a.  $2 \times 10^4$     b. 4.3    c. 5.7    d.  $1.75 \times 10^{-1}$     e. 10.7
10. All of the following are needed for the Haber-Bosch reaction except  
a. carbon monoxide    b. methane    c. doped iron    d. water    e. air
11. In a diamond, the structure is that of a network covalent solid. The hybridization of the carbon in this diamond structure is  
a. sp    b.  $sp^2$     c.  $sp^3$     d.  $sp^4$     e.  $sp^3d$
12. How many grams of  $NaC_2H_3O_2$  ( $M = 82.034$  g/mole) should be dissolved in 400.0 g of water to make a solution which is 1.550 molal? -a. 3.146 g    b. 7.558 g    c. 21.17 g    d. 50.86 g    e. 127.15 g
13. How many lattice points does it require to fully define a body centered cubic unit cell? --- a. 2    b. 4    c. 8    d. 9    e. 14
14. A gas mixture is 50.00% helium and 50.00% methane, by volume. What is the percent, by weight, of methane in the mixture?  
a. 19.97 %    b. 20.05 %    c. 50.00 %    d. 75.00 %    e. 80.03 %
15. The strongest conjugate base among the following listed species is  
a.  $NO_3^-(aq)$     b.  $F^-(aq)$     c.  $Cl^-(aq)$     d.  $B^-(aq)$     e.  $I^-(aq)$
16. Application of the concepts of VSEPR theory leads to the prediction that the shape of the  $PCl_3$  molecule is --- a. bent    b. linear
17. An element, whose chemical symbol is illegible, had 6 electrons surrounding it in the Lewis structure. Which element among the following could it possibly be?  
a. Cr    b. Ni    c. Ba    d. Se    e. As
18. The wave functions which are solutions to the wave functions which describe the behavior of the electron in the hydrogen atom are described by how many quantum numbers? a. 1    b. 2    c. 3    d. 4    e. 5
19. Which one of the following compounds produces 3 ions per formula unit by dissociation when dissolved in water?  
a. sodium nitrate    b. nickel sulfate    c. calcium perchlorate  
d. aluminum sulfate    e. ammonium bromate
20. When  $BaCl_2$  reacts with  $Na_3PO_4$ ,  $Ba_3(PO_4)_2$  and  $NaCl$  are formed. How many moles of  $Ba_3(PO_4)_2$  are formed for each mole of  $BaCl_2$  that is consumed? --- a. 3    b. 1    c. 0.3333    d. 2.3333    e. 1.5