國立屏東大學104學年度研究所碩士班入學考試

化學 試題

（應用化學系碩士班）

※請注意：1.本試題共六頁。
2.答案須寫在答案卷上，否則不予計分。

一、選擇題 (每題 3 分，共 75 分)

1. The coordination numbers of cobalt(III) and of chromium(III) in their complexes are always _____.
（A）4
（B）5
（C）2
（D）3
（E）6
2. A substance with unpaired electrons will be
（A）slightly attracted to a magnet.
（B）slightly repelled by a magnet.
（C）permanently magnetic.
（D）brightly colored.
（E）nonmetallic.
3. Hydrogen can combine with _____ to form a metallic hydride.
（A）an element from group 5A
（B）an element from group 7A
（C）an element from group 8A
（D）an element from group 1B
（E）an element from group 6A
4. The gain of electrons by an element is called _____.
（A）reduction
（B）oxidation
（C）disproportionation
（D）fractionation
（E）sublimation
5. 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

6. The conjugate acid of HSO_4^- is _____.

（A）SO_4^{2-}

（B）H_2SO_4

（C）HSO_4^+

（D）H^+

（E）HSO_3^+

7. At equilibrium, _____.

（A）all chemical reactions have ceased

（B）the rates of the forward and reverse reactions are equal

（C）the rate constants of the forward and reverse reactions are equal

（D）the value of the equilibrium constant is 1

（E）the limiting reagent has been consumed

8. Under constant conditions, the half-life of a first-order reaction _____.

（A）is the time necessary for the reactant concentration to drop to half its original value

（B）is constant

（C）can be calculated from the reaction rate constant

（D）does not depend on the initial reactant concentration

（E）All of the above are correct.

9. The process of solute particles being surrounded by solvent particles is known as _____.

（A）salutation

（B）agglomeration

（C）solvation

（D）agglutination

（E）dehydration

10. Blue LEDs are usually made of _____.

（A）GaAs

（B）GaP

（C）GaO

（D）GaS

（E）GaN

11. According to VSEPR theory, if there are five electron domains in the valence shell of an atom, they will be arranged in a(n) _____ geometry.

（A）octahedral

（B）linear

（C）tetrahedral

（D）trigonal planar

（E）trigonal bipyramidal

12. There are _____ unpaired electrons in the Lewis symbol for an oxygen atom.

（A）0

（B）1

（C）2

（D）4

（E）3

13. Elements in the modern version of the periodic table are arranged in order of increasing _____.

（A）oxidation number

（B）atomic mass

（C）average atomic mass

（D）atomic number

（E）number of isotopes

14. Of the following, _____ radiation has the shortest wavelength.

（A）X-ray

（B）radio

（C）microwave

（D）ultraviolet

（E）infrared

15. Which one of the following is an endothermic process?

（A）ice melting

（B）water freezing

（C）boiling soup

（D）Hydrochloric acid and barium hydroxide are mixed at 25 °C:　the temperature increases.

（E）Both A and C

16. A tenfold dilution of a sample solution can be obtained by taking _____.

（A）1 part sample and 9 parts solvent

（B）1 part sample and 10 parts solvent

（C）9 parts sample and 1 part solvent

（D）10 parts sample and 1 part solvent

（E）99 parts sample and 1 part solvent

17. Which of the following is a statement of the first law of thermodynamics?

（A）$E_k = \frac{1}{2}mv^2$

（B）A negative ΔH corresponds to an exothermic process.

（C） $\Delta E = E_{final} - E_{initial}$

（D）Energy lost by the system must be gained by the surroundings.

（E）1 cal = 4.184 J (exactly)

18. Which of the following is a statement of Hess's law?

（A）If a reaction is carried out in a series of steps, the ΔH for the reaction will equal the sum of the enthalpy changes for the individual steps.

（B）If a reaction is carried out in a series of steps, the ΔH for the reaction will equal the product of the enthalpy changes for the individual steps.

（C）The ΔH for a process in the forward direction is equal in magnitude and opposite in sign to the ΔH for the process in the reverse direction.

（D）The ΔH for a process in the forward direction is equal to the ΔH for the process in the reverse direction.

（E）The ΔH of a reaction depends on the physical states of the reactants and products.

19. Which one of the quantum numbers does <u>not</u> result from the solution of the Schrodinger equation?

（A）principal

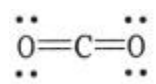
（B）azimuthal

（C）magnetic

（D）spin

（E）angular momentum

20. The formal charge on carbon in the molecule below is _____.



（A）0

（B）+1

（C）+2

（D）+3

（E）-1

21. The more effectively two atomic orbitals overlap, _____.

（A）the more bonding MOs will be produced by the combination

（B）the higher will be the energy of the resulting bonding MO and the lower will be the energy of the resulting antibonding MO

（C）the higher will be the energies of both bonding and antibonding MOs that result

（D）the fewer antibonding MOs will be produced by the combination

（E）the lower will be the energy of the resulting bonding MO and the higher will be the energy of the resulting antibonding MO

22. The kinetic-molecular theory predicts that pressure rises as the temperature of a gas increases because _____.

（A）the average kinetic energy of the gas molecules decreases

（B）the gas molecules collide more frequently with the wall

（C）the gas molecules collide less frequently with the wall

（D）the gas molecules collide more energetically with the wall

（E）both the gas molecules collide more frequently with the wall and the gas molecules collide more energetically with the wall

23. Which of the following statements is false?

（A）The absolute value of the heat of sublimation is equal to the absolute value of the heat of deposition.

（B）The heat of sublimation is equal to the sum of the heat of vaporization and the heat of melting.

（C）The heat of sublimation is equal to the sum of the heat of vaporization and the heat of freezing.

（D）The absolute value of the heat of sublimation is equal to the absolute value of the sum of the heat of condensation and the heat of freezing.

（E）The absolute value of the heat of deposition is equal to sum of the absolute value of the heat of vaporization and the absolute value of the heat of freezing.

24. A biomaterial intended for use as a long-term replacement of a blood vessel _____.

（A）must be rigid and have rough surfaces

（B）must be rigid and chemically inert

（C）must be rigid and must not degrade over time

（D）must be flexible and have an open porous structure

（E）should be designed such that it encourages coagulation of blood

25. One difference between first- and second-order reactions is that _____.

（A）the half-life of a first-order reaction does not depend on $[A]_0$; the half-life of a second-order reaction does depend on $[A]_0$

（B）the rate of both first-order and second-order reactions do not depend on reactant concentrations

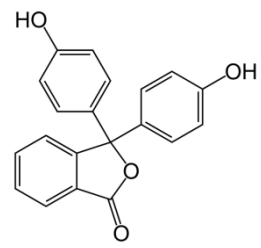
（C）the rate of a first-order reaction depends on reactant concentrations; the rate of a second-order reaction does not depend on reactant concentrations

（D）a first-order reaction can be catalyzed; a second-order reaction cannot be catalyzed

（E）None of the above are true.

二、問答題 (每題 5 分，共 25 分)

（一）試說明無色的酚酞指示劑在鹼性條件下，變為粉紅色的可能原因。



（二）說明為何液相層析串聯式質譜儀會被稱為打擊黑心食品的利器。其有別於其他光譜分析儀器的重要優點為何？

（三）試述真溶液與膠體溶液之差異。

（四）試說明影響溶解度之因素有哪些？

（五）試說明共同離子效應(Common-ion Effect)。