

科目：普通化學 適用：應化系二

編號：341

考生注意：1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分。
3. 試題隨卷繳回。

本試題
共 3 頁
第 / 頁

I. 是非題 (每題 2 分，共 12 分)：

- Transition metals show great similarities both within a given period and within a given vertical group.
- In exothermic reaction, potential energy stored in chemical bonds is being converted to thermal energy via heat.
- Paramagnetism is associated with paired electrons.
- Reduction is the gain of electrons.
- Adding salt to water decreases the freezing point of the water since it lowers the vapor pressure of the ice.
- The size in a series of isoelectronic ions increases as the nuclear charge increases.

II. 單選題，請選出一個最合適的答案 (每題 3 分，共 72 分)：

- What is the compound whose carbon skeleton (minus any hydrogen atoms) appears below?
 [A] 5-ethyl-3,6-trimethyloctane
 [B] 2,4-diethyl-3,6-dimethylheptane
 [C] 1,4-diethyl-3,6-dimethyl-tridecane
 [D] 2,5-dimethyl-4,6-diethylheptane
 [E] 4-ethyl-2,5,6-trimethyloctane

$$\begin{array}{ccccccc} & & \text{C} & & \text{C} & & \\ & & | & & | & & \\ \text{C} & - & \text{C} \\ & & | & & | & & & & & & & & \\ & & \text{C} & - & \text{C} & & \text{C} & - & \text{C} & & & & \end{array}$$
- Ethylenediamine (en) is a bidentate ligand. What is the coordination number of cobalt in $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$?
 [A] five [B] six [C] seven [D] eight [E] four
- Using the rules of significant figures, calculate the following: $4.0021 - 0.004$
 [A] 4.0 [B] 4 [C] 3.998 [D] 4.00 [E] 3.9981
- Which of the following is not a state function?
 [A] q [B] P [C] E [D] G [E] H
- You heat 3.970 g of a mixture of Fe_3O_4 and FeO to form 4.195 g Fe_2O_3 . The mass of oxygen reacted is
 [A] 0.475 g. [B] 0.225 g. [C] cannot be determined [D] 1.00 g. [E] none of these
- Which metals form cations with varying positive charges?
 [A] Group 1 metals [B] Group 3 metals [C] Group 2 metals
 [D] metalloids [E] transition metals
- Which of the following statements is true?
 [A] An electron in a 2s orbital can have the same n , l , and m_l quantum numbers as an electron in a 3s orbital.
 [B] Ni has 2 unpaired electrons in its 3d orbitals.
 [C] The exact location of an electron can be determined if we know its energy.
 [D] In the buildup of atoms, electrons occupy the 4f orbitals before the 6s orbitals.
 [E] Only three quantum numbers are needed to uniquely describe an electron.
- Give (in order) the correct coefficients to balance the following reaction:
 $\text{H}_2\text{SnCl}_6 + \text{H}_2\text{S} \rightarrow \text{SnS}_2 + \text{HCl}$
 [A] 2, 4, 2, 6 [B] 6, 2, 1, 1 [C] 1, 2, 1, 6 [D] 1, 1, 1, 6 [E] 1, 2, 2, 2
- Which of the following is not an assumption of the kinetic molecular theory for a gas?
 [A] Gas particles are very small compared to the average distance between the particles.
 [B] The average velocity of the gas particles is directly proportional to the absolute temperature.
 [C] Gas particles collide with the walls of their container in elastic collisions.
 [D] Gases are made up of tiny particles in constant chaotic motion.
 [E] All of these are correct.
- Given reaction $2\text{NH}_3(\text{g}) + 3\text{Cl}_2(\text{g}) \rightarrow \text{N}_2(\text{g}) + 6\text{HCl}(\text{g})$, you react 5.0 L of NH_3 with 5.0 L of Cl_2 measured at the same

科目：普通化學 適用：應化系二

編號：341

考生注意：1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分。
3. 試題隨卷繳回。

本試題
共 3 頁
第 2 頁

conditions in a closed container. Calculate the ratio of pressures in the container ($P_{\text{final}}/P_{\text{initial}}$).

- [A] 1.33 [B] 1.00 [C] 1.50 [D] 0.75 [E] none of these

11. When electrons in a molecule are not found between a pair of atoms but move throughout the molecule, this is called

- [A] ionic bonding. [B] polar covalent bonding. [C] covalent bonding.
[D] a dipole moment. [E] delocalization of the electrons.

12. Which of the following electron distributions among the molecular orbitals best describes the NO molecule?

	σ_{2s}	σ_{2s}^*	$\pi_{2py} = \pi_{2px}$	σ_{2pz}	$\pi_{2py}^* = \pi_{2px}^*$	σ_{2pz}^*
[A] Option E						
[B] Option D						
[C] Option A						
[D] Option B						
[E] Option C						
Option A	2	2	4	2	4	2
Option B	2	2	4	2	4	1
Option C	2	2	4	1	3	0
Option D	2	2	4	2	2	0
Option E	2	2	4	2	1	0

13. Which statement regarding water is true?

- [A] Energy must be given off in order to break down the crystal lattice of ice to a liquid.
[B] Only covalent bonds are broken when ice melts.
[C] Hydrogen bonds are stronger than covalent bonds.
[D] Liquid water is less dense than solid water.
[E] All of the statements (a-d) are false.

14. The compound SiO_2 does not exist as a discrete molecule while CO_2 does. This can be explained because

- [A] the SiO_2 is a solid while CO_2 is a gas. [B] the Si—O bond is unstable.
[C] the Lewis structure of SiO_2 has an even number of electrons.
[D] the 3p orbital of the Si has little overlap with the 2p of the O. [E] none of these

15. When a nonvolatile solute is added to a volatile solvent, the solution vapor pressure _____, the boiling point _____, the freezing point _____, and the osmotic pressure across a semipermeable membrane _____.

- [A] increases, increases, decreases, increases [B] decreases, increases, decreases, decreases
[C] decreases, increases, decreases, increases [D] decreases, decreases, increases, decreases
[E] increases, decreases, increases, decreases

16. In which of the following groups of substances would dispersion forces be the only significant factors in determining boiling points? I. Cl_2 II. HF III. Ne IV. KNO_3 V. CCl_4

- [A] II, V [B] I, II, III [C] III, IV, V [D] I, III, V [E] II, IV

17. Which of the following statements is typically true for a catalyst?

- [A] The catalyst speeds up the reaction. [B] The concentration of the catalyst will go down as a reaction proceeds.
[C] The catalyst provides a new pathway in the reaction mechanism. [D] Two of these.
[E] None of these.

18. A chemical reaction is most likely to be spontaneous if it is accompanied by

- [A] increasing energy and decreasing entropy. [B] lowering energy and decreasing entropy.
[C] increasing energy and increasing entropy. [D] lowering energy and increasing entropy.
[E] none of these (a-d)

19. The triple point of iodine is at 90 torr and 115°C . This means that liquid I_2

- [A] cannot exist at 1 atmosphere pressure. [B] can exist at pressure of 10 torr.
[C] cannot have a vapor pressure less than 90 torr. [D] cannot exist above 115°C .
[E] is more dense than $\text{I}_2(\text{s})$.

