

一、選擇題(15 題，每題 4 分，共 60 分)

1. What does "X" represent in the following symbol? ${}_{92}^{235}\text{X}$
 - (A) tin
 - (B) copper
 - (C) palladium
 - (D) niobium
 - (E) uranium

2. Which of the following statements is FALSE?
 - (A) Halogens are very reactive elements.
 - (B) The alkali metals are fairly unreactive.
 - (C) Sulfur is a main group element.
 - (D) Noble gases do not usually form ions.
 - (E) Zn is a transition metal.

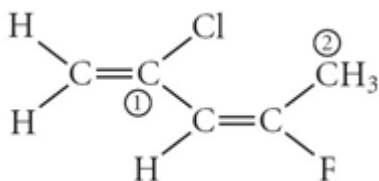
3. An ionic bond is best described as
 - (A) the sharing of electrons
 - (B) the transfer of electrons from one atom to another
 - (C) the attraction that holds the atoms together in a polyatomic ion
 - (D) the attraction between 2 nonmetal atoms
 - (E) the attraction between 2 metal atoms

4. Identify the compound with covalent bonds.
 - (A) CH_4
 - (B) Ne
 - (C) KBr
 - (D) Mg
 - (E) NaCl

5. Two samples of calcium fluoride are decomposed into their constituent elements. The first sample produced 0.154 g of calcium and 0.146 g of fluorine. If the second sample produced 294 mg of fluorine, how many g of calcium were formed?
 - (A) 0.280 g
 - (B) 3.09×10^2 g
 - (C) 3.13 g
 - (D) 0.309 g
 - (E) 2.80×10^2 g

6. HCl, HI, H₂SO₄, LiCl, and KI are all classified as
- (A) acids
 - (B) nonelectrolytes
 - (C) strong electrolytes
 - (D) weak electrolytes
7. Which of the following is TRUE if $\Delta E_{\text{sys}} = -95 \text{ J}$?
- (A) The system is gaining 95 J, while the surroundings are losing 95 J.
 - (B) The system is losing 95 J, while the surroundings are gaining 95 J.
 - (C) Both the system and the surroundings are gaining 95 J.
 - (D) Both the system and the surroundings are losing 95 J.
 - (E) None of the above are true.
8. When 0.455 g of anthracene, C₁₄H₁₀, is combusted in a bomb calorimeter that has a water jacket containing 500.0 g of water, the temperature of the water increases by 8.63°C. Assuming that the specific heat of water is 4.18 J/(g·°C), and that the heat absorption by the calorimeter is negligible, estimate the enthalpy of combustion per mole of anthracene.
- (A) +39.7 kJ/mol
 - (B) -39.7 kJ/mol
 - (C) -7060 kJ/mol
 - (D) -8120 kJ/mol
9. Identify the color that has a wavelength of 460 nm.
- (A) blue
 - (B) green
 - (C) red
 - (D) yellow
10. Give the set of four quantum numbers that represent the last electron added (using the Aufbau principle) to the Zn atom.
- (A) $n = 4, l = 3, m_l = 3, m_s = -$
 - (B) $n = 3, l = 2, m_l = 2, m_s = -$
 - (C) $n = 3, l = 1, m_l = 1, m_s = +$
 - (D) $n = 3, l = 3, m_l = 2, m_s = -$
 - (E) $n = 4, l = 2, m_l = 0, m_s = +$
11. Choose the compound below that should have the highest melting point according to the ionic bonding model.
- (A) AlN
 - (B) MgO
 - (C) NaF
 - (D) CaS
 - (E) RbI

12. Consider the molecule below. Determine the molecular geometry at each of the 2 labeled carbons.



- (A) C1 = tetrahedral, C2 = linear
 (B) C1 = trigonal planar, C2 = bent
 (C) C1 = bent, C2 = trigonal planar
 (D) C1 = trigonal planar, C2 = tetrahedral
 (E) C1 = trigonal pyramidal, C2 = see-saw
13. Place the following in order of **decreasing** X-A-X bond angle, where A represents the central atom and X represents the outer atoms in each molecule.



- (A) $\text{NCl}_3 > \text{NO}_2^- > \text{N}_2\text{O}$
 (B) $\text{NO}_2^- > \text{N}_2\text{O} > \text{NCl}_3$
 (C) $\text{N}_2\text{O} > \text{NO}_2^- > \text{NCl}_3$
 (D) $\text{NCl}_3 > \text{N}_2\text{O} > \text{NO}_2^-$
 (E) $\text{N}_2\text{O} > \text{NCl}_3 > \text{NO}_2^-$
14. Place the following compounds in order of **increasing** strength of intermolecular forces.



- (A) $\text{NH}_2\text{CH}_3 < \text{CO}_2 < \text{F}_2$
 (B) $\text{F}_2 < \text{NH}_2\text{CH}_3 < \text{CO}_2$
 (C) $\text{NH}_2\text{CH}_3 < \text{F}_2 < \text{CO}_2$
 (D) $\text{F}_2 < \text{CO}_2 < \text{NH}_2\text{CH}_3$
 (E) $\text{CO}_2 < \text{NH}_2\text{CH}_3 < \text{F}_2$
15. Name the following: $[\text{Pt}(\text{H}_2\text{O})_4\text{F}_2]\text{Br}_2$
- (A) tetraaquadifluoroplatinum(IV) bromide
 (B) tetraaquadibromodifluoroplatinate
 (C) platinum(II)bromide
 (D) platinum(III)tetraaquadifluorobromide
 (E) platinum (II) dibromodifluorotetrahydride

二、簡答題(4 題，每題 10 分，共 40 分)

1. Use the VSEPR theory to calculate the bond angle of A-X-A for the following molecules if all electrons on A are forming bonds with X atoms and there is no lone pair:
(A) A_2X
(B) A_3X
(C) A_4X
2. How many $2p$ electrons are in an atom of each element?
(A) C
(B) F
(C) P
3. Determine whether each redox reaction occurs spontaneously in the forward direction.
(A) $Fe(s) + Cu^{2+}(aq) \rightarrow Fe^{2+}(aq) + Cu(s)$ (5%)
(B) $Pb(s) + Mg^{2+}(aq) \rightarrow Pb^{2+}(aq) + Mg(s)$ (5%)
4. Classify each process as exothermic or endothermic?
(A) ice melting
(B) a sparkler burning
(C) acetone evaporating from skin