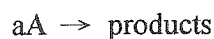


注意事項 (請務必閱讀):

- 題目均是單一選擇題，計 20 題，每題答對得 5 分，未答不計分。答錯不倒扣

1. What is the reaction order of the following reaction if the half-life of reactant A is independent on its initial concentration? (5%)

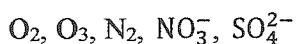


(A) zero order, (B) first order, (C) second order, (D) both zero and first orders, (E) both zero and second orders.

2. Which of the following acids and its sodium salt are the best combination for buffering a solution at pH 4.30? (5%)

(A) chloroacetic acid ($K_a = 1.35 \times 10^{-3}$), (B) propanoic acid ($K_a = 1.3 \times 10^{-5}$), (C) benzoic acid ($K_a = 6.4 \times 10^{-5}$), (D) hypochlorous acid ($K_a = 3.5 \times 10^{-8}$), (E) none of the above is acceptable.

3. How many molecules below have resonance structures? (5%)



(A) 1, (B) 2, (C) 3, (D) 4, (E) 5.

4. Which of the following solutions exhibits the greatest osmotic pressure, assuming all the solutions have the same molarity? (5%)

(A) NaCl, (B) $MgCl_2$, (C) $MgSO_4$, (D) HCl, (E) Glucose.

5. What is the bond order of diatomic molecules C_2 ? (5%)

(A) 0, (B) 1, (C) 2, (D) 3, (E) 4.

6. If an atom has 23 electrons, how many electron shells will be occupied? (5%)

(A) 1, (B) 2, (C) 3, (D) 4, (E) 5.

注意:背面有試題

7. What is the formal charge for oxygen atoms in a sulfate ion with the most stable Lewis structure? (5%)

(A) -2, (B) -1, (C) 0, (D) 1, (E) 2.

8. Which of the following statements about a catalyst is true? (5%)

(A) It changes the equilibrium constant, (B) It speeds up only the rate of the forward reaction, (C) It is consumed in the course of the reaction, (D) It lowers the activation energy for a reaction, (E) none of the above.

9. Arrange the following ions in order of decreasing size. (5%)

(A) $O^{2-} > Na^+ > Al^{3+}$, (B) $O^{2-} > Al^{3+} > Na^+$, (C) $Na^+ > Al^{3+} > O^{2-}$, (D) $Al^{3+} > O^{2-} > Na^+$, (E) $Al^{3+} > Na^+ > O^{2-}$.

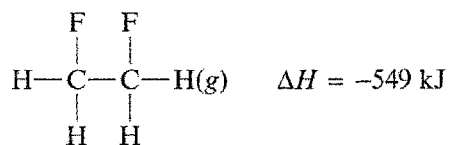
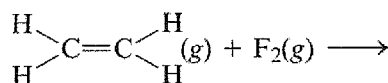
10. What is the definition of Lewis acid? (5%)

(A) electron-pair donor, (B) electron-pair acceptor, (C) H^+ donor, (D) H^+ acceptor, (E) H^+ producer.

11. What percentage of the tetrahedral holes are occupied in a zinc sulfide crystal? (5%)

(A) 0%, (B) 25%, (C) 50%, (D) 75%, (E) 100%.

12. Consider the following reaction:



Estimate the carbon-fluorine bond energy given that the C-C bond energy is 347 kJ/mol, the C=C bond energy is 614 kJ/mol, and the F-F bond energy is 154 kJ/mol. (5%)

(A) 64 kJ/mol, (B) 128 kJ/mol, (C) 421 kJ/mol, (D) 485 kJ/mol, (E) 970 kJ/mol.

13. How is the central atom in XeF_4 hybridized? (5%)

(A) sp , (B) sp^2 , (C) sp^3 , (D) dsp^3 , (E) d^2sp^3 .

14. What is the cathode reaction for a typical iron corrosion process? (5%)

- (A) $2\text{Fe} + \text{O}_2 + 2\text{H}_2\text{O} \rightarrow 2\text{Fe}^{2+} + 4\text{OH}^-$, (B) $\text{Fe} \rightarrow \text{Fe}^{2+} + 2\text{e}^-$, (C) $\text{Fe}^{2+} + 2\text{e}^- \rightarrow \text{Fe}$,
(D) $4\text{OH}^- \rightarrow \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^-$, (E) $\text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^- \rightarrow 4\text{OH}^-$.

15. Determine the pH at the first equivalent point for the titration of a H_3PO_4 solution with NaOH. (5%)

- (A) $\text{pH} = \text{p}K_{\text{a}1}$, (B) $\text{pH} = \text{p}K_{\text{a}2}$, (C) $\text{pH} = \text{p}K_{\text{a}3}$, (D) $\text{pH} = (\text{p}K_{\text{a}1} + \text{p}K_{\text{a}2})/2$, (E) $\text{pH} = (\text{p}K_{\text{a}2} + \text{p}K_{\text{a}3})/2$.

16. Order the relative energies of the orbitals in the $n = 3$ shell for polyelectronic atoms. (5%)

- (A) $E_{3s} < E_{3p} < E_{3d}$, (B) $E_{3s} = E_{3p} = E_{3d}$, (C) $E_{3s} > E_{3p} > E_{3d}$, (D) $E_{3s} = E_{3p} > E_{3d}$, (E) $E_{3s} > E_{3p} = E_{3d}$.

17. Which molecule has the smallest bond angle? (5%)

- (A) CH_4 , (B) NH_3 , (C) PH_3 , (D) H_2O , (E) all the same.

18. At constant pressure, the change in which property of a system is equal to the energy flow as heat? (5%)

- (A) internal energy, (B) work, (C) entropy, (D) Gibbs free energy, (E) enthalpy.

19. Under what conditions does a real gas exhibit nearly ideal behavior? (5%)

- (A) high temperature and high pressure, (B) high temperature and low pressure, (C) low temperature and high pressure, (D) low temperature and low pressure, (E) it is independent on temperature and pressure.

20. Chromatography is used to separate a mixture into individual components based on the differences in which properties of the components? (5%)

- (A) particle size, (B) boiling point, (C) ionic conductivity, (D) polarity, (E) density.