

類組：化學類 科目：綜合化學(1001)

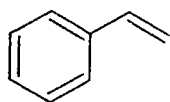
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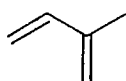
單選題，每題 2.5 分

- Mr. Krabs dissolved 6.299 g of sodium fluoride (41.99 g/mol) in water and diluted to 1.5 L. Then 10.0 mL of the diluted solution was pipetted. The quantity of fluoride ion Mr. Krabs pipetted should be recorded as
(A) 0.001 mol; (B) 0.0010 mol; (C) 1.00×10^{-3} mol; (D) 1.00 mmol.
- Which of the following techniques/instruments can used to measure the mass of an organic molecule?
(A) MS; (B) AFM; (C) XRD; (D) ESPN
- The chemical formula of allene is H_2CCCH_2 . Now, substitute one Cl atom and one Br atom for two of the H atoms of allene. How many possible isomers will the new compound have? Are there optical isomers?
(A) Two isomers, and no optical isomer. (B) Three isomers, and no optical isomer. (C) Three isomers, including two optical isomers. (D) Four isomers, including two optical isomers.
- The product of the hydrogenation of *cis*-2-butene is
(A) 2-butyne; (B) *trans*-2-butene; (C) butane; (D) ethane.
- EDTA titration is widely used for determining the concentration of calcium ion in water samples. If 30.0 mL of 0.010 M EDTA were used to reach the equivalence point, how many moles of Ca^{2+} are there in the water sample?
(A) 1.5×10^{-5} mol; (B) 1.5×10^{-4} mol; (C) 3.0×10^{-4} mol; (D) 6.0×10^{-4} mol
- The Nernst equation is an equation relates
(A) the total black body radiation energy and the temperature. (B) the change of the melting point of a solid, the pressure, and the enthalpy of melting. (C) the current a electrochemical reaction can provide, the concentrations of reactants and products, and the temperature. (D) the potential of an electrochemical reaction, the concentrations of reactants and products, and the temperature.
- Polystyrene (PS) is a synthetic polymer and has the recycling number 6. The monomer of PS is

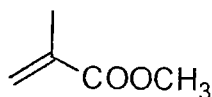
(A)



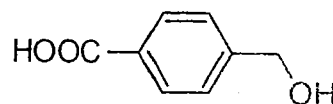
(B)



(C)



(D)



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8. The chemical formula of phenyl group is
(A) $\text{HO-C}_6\text{H}_4-$; (B) $\text{C}_6\text{H}_5-\text{CH}_2-$; (C) $\text{C}_6\text{H}_5-\text{O}-$; (D) C_6H_5- .
9. Which of the following solutions would be an acidic buffer solution?
(A) $\text{K}_2\text{HPO}_4(\text{aq})$; (B) $\text{KH}_2\text{PO}_4(\text{aq})$; (C) $\text{CH}_3\text{COOH}(\text{aq})$; (D) $\text{NaHCO}_3(\text{aq})$
10. The laboratory glassware "separatory funnel" is used in/for
(A) centrifugation; (B) suction filtration; (C) liquid-liquid extraction;
(D) transfer and adding fluids slowly.
11. Which of the following amines would not appear in a RNA molecule of a living cell?
(A) Adenine; (B) cytosine; (C) thymine; (D) uracil
12. The products of the acidic hydrolysis of ethyl propanoate are
(A) ethanal and propene; (B) ethanal and propanone; (C) propanol and ethanoic acid; (D) ethanol and propanoic acid.
13. The standard potential for the redox couples $(\text{Ce}^{3+}/\text{Ce})$ and $(\text{Ce}^{4+}/\text{Ce}^{3+})$ are -2.48 V and +1.61V, respectively. So we know the standard potential for the redox couple $(\text{Ce}^{4+}/\text{Ce})$ is
(A) -1.46 V; (B) -0.87 V; (C) +0.59 V; (D) +0.87 V.
14. Finish the radioactive decay equation: $^{86}\text{Rb} \rightarrow \text{X} + \beta^-$, X =
(A) ^{86}Kr ; (B) ^{85}Rb ; (C) ^{86}Rh ; (D) ^{86}Sr
15. The solubility of a salt $\text{Ca}(\text{IO}_3)_2 \cdot 6\text{H}_2\text{O}$ is 5.00×10^{-3} M, then it's $K_{\text{sp}} =$
(A) 3.13×10^{-8} ; (B) 1.25×10^{-7} ; (C) 5.00×10^{-7} ; (D) none of above is correct
16. How many following compounds are amphoteric? $\text{Al}(\text{OH})_3$, $\text{Be}(\text{OH})_2$, $\text{Mg}(\text{OH})_2$, ZnO , SnO , PbO
(A) 5; (B) 4; (C) 3; (D) 2
17. A 10.0g sample of a hydrocarbon polymer dissolved in 1.0 L of organic solvent at 300 K gave rise to an osmotic pressure of 0.010 atm. What is the average molar mass of the polymer?
(A) $2.5 \times 10^4 \text{ g} \cdot \text{mol}^{-1}$; (B) $4.9 \times 10^4 \text{ g} \cdot \text{mol}^{-1}$; (C) $1.2 \times 10^5 \text{ g} \cdot \text{mol}^{-1}$; (D) not enough information to determine
18. The systematic name of $(\text{CH}_3\text{CH}_2)_2\text{CHC}\equiv\text{CCH}_3$ is
(A) 1,1-diethyl-3-butyne; (B) 3-ethyl-4-hexyne; (C) 4,4-diethyl-2-butyne;
(D) 4-ethyl-2-hexyne.

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19. If you wish to dissolve silver chloride precipitate in water, you would add
 (A) nitric acid; (B) lead sulfide; (C) sodium cyanide; (D) magnesium hydroxide.
20. Nickel–metal hydride battery is an important secondary cell. Its cell notation is written as: $M_{(s)}|MH_{(s)}|KOH_{(aq)}|NiOOH_{(s)}|Ni(OH)_{2(s)}|Ni_{(s)}$.
 Which of the following statements is false?
 (A) The NiMH battery is not rechargeable.
 (B) There is no salt bridge in the cell notation.
 (C) The anode reaction is $MH_{(s)} + OH^{-}_{(aq)} \rightarrow M_{(s)} + H_2O_{(l)} + e^{-}$
 (D) There is no decrease in OH^{-} concentration after using.
21. Phosphorus trichloride reacts with water to give
 (A) phosphoric acid and chlorine; (B) phosphoric acid and hydrogen chloride
 (C) phosphine and hydrogen chloride; (D) phosphorus acid and hydrogen chloride
22. Which of the followings is the strongest reductant?
 (A) O_3 ; (B) Au^{3+} ; (C) ClO^{-} ; (D) $NaBH_4$
23. What compound is used in air bags in automobiles?
 (A) MgO ; (B) PbO ; (C) NaN_3 ; (D) Ether
24. If the mass of the particle in a one dimensional box is doubled, the ground state energy will
 (A) decrease by a factor of 4; (B) decrease by a factor of 2; (C) increase by a factor of 4; (D) increase by a factor of 2.
25. The energy of the lowest degenerate states of a particle in a cubic box is
 (A) 2; (B) 3; (C) 3.5; (D) 4 times that of the ground state.
26. What are the four quantum numbers, $\{n, l, m, m_s\}$, for ground state Li^{2+} ion?
 (A) 1, 0, 0, 1/2; (B) 2, 0, 0, 1/2; (C) 2, 0, 0, -1/2; (D) 2, 1, 0, 1
27. The HOMO for $C_4H_6^{-}$, negative ion of 1,3-butadiene, is a
 (A) π ; (B) π^* ; (C) $\sigma(C-C)$; (D) $\sigma^*(C-C)$
28. For ozone (O_3) molecule, there are four π electrons:
 (A) in two π bonding orbitals; (B) 2 in π bonding orbital and 2 in π^* antibonding orbital; (C) 2 in π bonding orbital and 2 in π nonbonding orbital; (D) in two π^* bonding orbitals.

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29. Which of the following technique can be used to determine the crystal structure?
(A) Laser Induced Fluorescence; (B) SEM; (C) STM; (D) X-ray diffraction
30. For a spontaneous process,
(A) it is endothermic; (B) it is exothermic; (C) the entropy of the system increases
(D) the free energy of the system decreases.
31. According to the equipartition theorem the constant volume molar heat capacities (C_v) for H atom and H_2 molecule are
(A) $1.5R$ and $2.5R$; (B) $1.5R$ and $3.5R$; (C) $3R$ and $3.5R$; (D) $3R$, and $5R$, respectively.
32. When two identical gases at the same temperature and pressure are mixed,
(A) $\Delta S > 0$, $\Delta G > 0$; (B) $\Delta S = 0$, $\Delta G = 0$; (C) $\Delta S = 0$, $\Delta H = 0$; (D) $\Delta S > 0$, $\Delta G < 0$.
33. The shape of complex *trans*- $[CoCl_2(en)_2]^+$ is
(A) tetrahedral; (B) square-planar; (C) octahedral; (D) linear.
34. Which of the following is a light, strong, amphoteric, reactive metallic element with a surface that becomes passivated when exposed to air?
(A) chromium; (B) aluminum; (C) iron; (D) lead
35. The ground-state configuration and magnetic property for $[Fe(CN)_6]^{4-}$ complex are (A) t_{2g}^4 , paramagnetic; (B) t_{2g}^4 , diamagnetic; (C) t_{2g}^6 , diamagnetic; (D) t_{2g}^6 , paramagnetic.
36. The half-life of radioactive carbon-15 is 2.4 s. What is the decay constant?
(A) 0.29 s^{-1} ; (B) 0.29 yr^{-1} ; (C) 0.42 min^{-1} ; (D) 0.42 yr^{-1}
37. Perovskite solar cells employ absorber materials with ABX_3 crystal structure, where A is CH_3NH_3 , X is a halogen atom, and B is
(A) Cu; (B) Co; (C) Ag; (D) Pb.
38. The relationship between the frequency of light and the energy of the light was postured by (A) Max Planck; (B) De Broglie; (C) Werner Heisenberg; (D) Erwin Schrodinger.
39. Define heterogeneous catalysis.
(A) The catalyst is in two different phases of matter. (B) The reactants and products are different phases of matter in a catalyzed reaction. (C) The catalyst is presented in a different phase of matter than are the reactants and products. (D) The catalyst changes phases during the reaction

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40. For the reaction $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{SO}_3(\text{g})$, $K_c = 2.8 \times 10^2$ at 1000K. If a vessel is filled with these gases such that the initial concentrations are $[\text{SO}_2] = 0.025$, $[\text{O}_2] = 0.035$, and $[\text{SO}_3] = 0.046$, in which direction will a reaction occur and why?
(A) it is at equilibrium; (B) toward reactants because $Q = 2.8 \times 10^3$; (C) toward reactants because $Q = 0.019$; (D) toward products because $Q = 96$