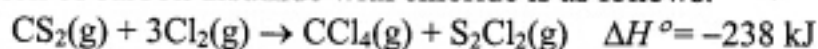


選擇題（單選題），請在電腦卡作答（每題二分）

- In an experiment, it has been found that 2.18 g of zinc metal combines with oxygen to yield 2.71 g of zinc oxide. How many grams of oxygen reacted with zinc metal?
(A) 0.40 g (B) 0.27 g (C) 0.53 g (D) 1.07 g (E) 0.62 g
- Which of the nomenclature of the following compounds is false?
(A) HNO_2 , nitric acid (B) H_2SO_4 , sulfuric acid (C) H_3PO_4 , phosphoric acid (D) CH_3COOH , acetic acid (E) none of the above
- Which of the following compound is a weak electrolyte?
(A) CaCl_2 (B) CH_3COOH (C) HCl (D) NaCl (E) none of the above
- Hydrogen bonding between DNA strands occurs between pairs of nitrogen bases. Which of the following is a pair of nitrogen bases where hydrogen bonding in DNA is important?
(A) guanine-adenine (B) cytosine-adenine (C) cytosine-thymine (D) guanine-cytosine (E) none of the above
- For which type of titration will be acidic at the equivalence point?
(A) weak acid vs. strong base (B) strong acid vs. strong base (C) strong acid vs. weak base (D) none of the above
- Consider the reaction, $\text{MnO}_2(\text{s}) + \text{Al}(\text{s}) \rightarrow \text{Mn}(\text{s}) + \text{Al}_2\text{O}_3(\text{s})$. Which of the following is the change in the oxidation number of manganese?
(A) $+2 \rightarrow 0$ (B) $+4 \rightarrow 0$ (C) $+2 \rightarrow -2$ (D) $+4 \rightarrow +2$ (E) none of the above
- Identify the oxidizing agent in the following reaction:
 $\text{Fe}_2\text{O}_3(\text{s}) + 6\text{H}_2\text{C}_2\text{O}_4(\text{aq}) \rightarrow 2\text{Fe}(\text{C}_2\text{O}_4)_3^{3-}(\text{aq}) + 3\text{H}_2\text{O}(\text{l}) + 6\text{H}^+(\text{aq})$.
(A) Fe_2O_3 (B) $\text{H}_2\text{C}_2\text{O}_4$ (C) $\text{Fe}(\text{C}_2\text{O}_4)_3^{3-}$ (D) H^+ (E) none of the above
- A sample of solid potassium chlorate (KClO_3) was heated in a test tube and decomposed according to the following reaction:
$$2\text{KClO}_3(\text{s}) \rightarrow 2\text{KCl}(\text{s}) + 3\text{O}_2(\text{g})$$

The oxygen produced was collected by displacement of water at 22 °C at total pressure of 754 torr. The volume of the gas collected was 0.650 L, and the vapor pressure of water at 22 °C is 21 torr. What's the partial pressure of O_2 in the gas collected? (universal gas constant $R = 0.08206 \text{ L atm K}^{-1} \text{ mol}^{-1}$)
(A) $2.66 \times 10^{-2} \text{ mol}$ (B) $1.73 \times 10^{-2} \text{ mol}$ (C) $3.89 \times 10^{-2} \text{ mol}$ (D) $2.59 \times 10^{-2} \text{ mol}$ (E) $5.18 \times 10^{-2} \text{ mol}$

9. The reaction of carbon disulfide with chloride is as follows:



Predict the effect of the following changes to the system on the direction of equilibrium:

- The pressure on the system is doubled by halving the volume.
- CCl_4 is removed as it is generated.
- Heat is added to the system.

The reaction shifts to the

(A) right, left, right (B) left, right, right (C) left, left, right (D) right, left, left (E) right, right, left

10. Which of the following is the strongest acid in water?

(A) HClO_4 (B) H_3PO_4 (C) HNO_2 (D) HOCl (E) $\text{C}_6\text{H}_5\text{COOH}$

11. Which of the following is the strongest Lewis base?

(A) NH_3 (B) PH_3 (C) AsH_3 (D) SbH_3 (E) BiH_3

12. What's the $[\text{H}^+]$ in a 0.500 L solution that contains 0.15 M HCOOH ($K_a = 1.8 \times 10^{-4}$) and 0.20 M NaCOOH

(A) 5.2×10^{-3} M (B) 1.4×10^{-4} M (C) 2.8×10^{-4} M (D) 2.6×10^{-3} M
(E) 7.0×10^{-4} M

13. The solubility of Ag_2S is 3.4×10^{-17} M at 25°C . What is the K_{sp} of Ag_2S ?

(A) 3.9×10^{-50} (B) 9.8×10^{-51} (C) 1.6×10^{-33} (D) 1.6×10^{-49} (E) 3.2×10^{-49}

14. The positive sign for ΔH indicates that at constant pressure.

(A) the reaction is exothermic (B) the reaction is endothermic (C) the reaction is fast (D) the reaction is spontaneous (E) none of the above

15. Under which condition is a reaction always in equilibrium?

(A) $\Delta H = 0$ (B) $\Delta G = 0$ (C) $\Delta S = 0$ (D) $\Delta H = +$ (E) $\Delta G = +$

16. The entropy change (ΔS_{vap}) on evaporating a beaker of ethanol at room temperature is

(A) always positive (B) always negative (C) zero (D) can be positive or negative (E) none of the above

17. In a galvanic cell, which of the following is false?

(A) cathode-reduction occurs here (B) anode-oxidation occurs here (C) salt bridge-allows exchange of ions to keep electric neutrality while electroactive solutions remain separated (D) the direction of electron flow is from the anode to the cathode (E) none of the above

18. According to the VSEPR theory, the shape of the NO_3^- is

(A) linear (B) triangular pyramidal (C) trigonal planar (D) tetrahedral (E) trigonal

bipyramidal

19. How many unpaired electrons does an atom of phosphorus have?
(A) 0 (B) 1 (C) 2 (D) 3 (E) 4
20. Which one of the following is a polar molecule?
(A) AlCl_3 (B) CCl_4 (C) N_2O (D) CO_2 (E) BF_3
21. What is the bond order and expected magnetism of carbon monoxide?
(A) 3, diamagnetic (B) 3, paramagnetic (C) 2, diamagnetic (D) 2, paramagnetic (E) none of the above
22. For a chemical reaction $\text{A} \rightarrow \text{B}$, a plot of $[\text{A}]$ versus time was found to give a straight line with a negative slope. What is the order of reaction?
(A) zero (B) first (C) second (D) none of the above
23. Which of the following metal element is a noble metal?
(A) Si (B) Ca (C) Ag (D) Zn (E) Fe
24. Which one of the following bonds has the highest polarity?
(A) O-H (B) S-H (C) H-H (D) Cl-H (E) F-H
25. What is the chemical name of the hydrocarbon C_2H_4 ?
(A) ethane (B) ethylene (C) propane (D) butane (E) none of the above
26. Which element has the following electron configuration $1s^2 2s^2 2p^6$?
(A) O (B) N (C) Na (D) Ne (E) F
27. The functional group that has the structure, $-\text{C}(=\text{O})\text{OR}$, is
(A) an aldehyde (B) a ketone (C) an acid (D) an amide (E) an ester
28. Identify the reducing agent in the following reaction
$$2\text{MnO}_4^- (\text{aq}) + 16\text{H}^+ (\text{aq}) + \text{C}_2\text{O}_4^{2-} (\text{aq}) \rightarrow 2\text{Mn}^{2+} (\text{aq}) + 10\text{CO}_2 (\text{g}) + 8\text{H}_2\text{O} (\text{l})$$

(A) MnO_4^- (B) H^+ (C) $\text{C}_2\text{O}_4^{2-}$ (D) Mn^{2+} (E) H_2O
29. Which of the following solvent has the highest boiling point?
(A) methanol (B) ethanol (C) H_2O (D) diethyl ether (E) acetone
30. Which of the following is true?
Beta particles
(A) have a mass of 4 and a charge of +2
(B) are more penetrating than X rays
(C) are repelled by a positively charged plate

- (D) are high-speed electrons
(E) none of the above

31. Which of the following ions has an electronic structure like that of a noble gas?
(A) La^{3+} (B) Bi^{3+} (C) V^{3+} (D) Fe^{3+} (E) Ti^{3+}
32. The Ideal Gas Law equation cannot be written
(A) $PV=nRT$ (B) $T=PV/nR$ (C) $R=PV/nT$ (D) $n=RT/PV$ (E) none of the above
33. The molar volume of butane, C_4H_{10} , at 500 °C and 760 mm of pressure is
(A) 22.4 liters (B) 44.8 liters (C) 63.4 liters (D) 112 liters (E) 5.1 liters
34. Two assumptions of the Kinetic Theory are that
(A) molecules are close together but do not attract each other
(B) molecules are large particles and are widely separated
(C) molecules have virtually no volume and do not attract each other
(D) molecules have the same average kinetic energy and undergo elastic collisions because of their attraction for each other
(E) none of the above
35. Exactly 100 mL of 1.00 M NaOH contains
(A) 4.00 g of NaOH = 100 mL water
(B) 40.0 g of NaOH diluted to 100 mL of solution
(C) 4.00 g of NaOH diluted to 100 mL of solution
(D) 1.00 mole of 1.00 M NaOH diluted to 100 mL of solution
(E) none of the above
36. Which of the following is not a Brønster-Lowry acid?
(A) CH_3NH_2 (B) $[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$ (C) CH_3COOH (D) H_2O (E) none of the above
37. For a reaction of the type $\text{A} + \text{B} \rightarrow 2\text{C}$, it is found that doubling the amount of A causes the reaction rate to be four times as great but that doubling the amount of B has no apparent on the rate. The rate equation that is most correct is
(A) $R = k[\text{A}]^2$ (B) $R = k[\text{A}][\text{B}]$ (C) $R = k[\text{A}]$ (D) $R = [\text{C}]^2/[\text{A}][\text{B}]$ (E) $R = k[2\text{A}]^2$
38. In aqueous solution containing only a strong acid H_2A , if the concentration of the acid solution is z moles per liter, then the pH is

- (A) $-\log z$ (B) $-\log [2z]$ (C) $-\log [2z]^2$ (D) $-\log z^2$ (E) $-\log [z]^{1/2}$
39. The K_{sp} for Ag_2SO_4 is
 (A) $[Ag^+][SO_4^{2-}]^2$ (B) $[Ag^+]^2[SO_4^{2-}]$ (C) $[Ag^+][SO_4^{2-}]$ (D) $[2Ag^+][SO_4^{2-}]$
 (E) $[2Ag^+]^2[SO_4^{2-}]$
40. Which salt is the least soluble?
 (A) $BaCO_3$ ($K_{sp} = 8.1 \times 10^{-9}$)
 (B) $CaCO_3$ ($K_{sp} = 4.8 \times 10^{-9}$)
 (C) $CoCO_3$ ($K_{sp} = 1.0 \times 10^{-12}$)
 (D) $CuCO_3$ ($K_{sp} = 1.4 \times 10^{-10}$)
41. As the lead storage battery is charged
 (A) the amount of sulfuric acid decreases
 (B) the lead electrode becomes coated with lead sulfate
 (C) sulfuric acid is regenerated
 (D) lead dioxide dissolves
 (E) none of the above
42. π bonds are formed by the overlap of
 (A) unhybridized p orbitals
 (B) sp^2 hybridized orbitals
 (C) sp hybridized orbitals
 (D) unhybridized s orbitals
 (E) none of the above
43. A peptide bond is
 (A) H_2N-CH_2- (B) $-CO-NH-$ (C) $H_2N-CHR-$ (D) $-CO-OR$
 (E) none of the above
44. The mass number for the 7_3Li atom is
 (A) 3 (B) 7 (C) 7.0146 (D) 6.939 (E) none of the above
45. The loss of an alpha particle causes
 (A) no change in the atomic number
 (B) the atomic number to decrease by one

- (C) the atomic number to decrease by two
(D) the atomic number to decrease by four
(E) none of the above
46. Each of the following particles can be accelerated by means of strong magnetic and electrostatic fields except
(A) alpha particles (B) electrons (C) protons (D) neutrons
(E) none of the above
47. The electronic configuration for the ion Fe^{3+} (atomic number of Fe= 26) is
(A) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$
(B) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3 4s^2$
(C) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$
(D) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2 4p^3$
(E) none of the above
48. The coordination number of Cr^{3+} in $[\text{Cr}(\text{en})(\text{NH}_3)_2\text{Cl}_2]^+$ is
(A) 2 (B) 3 (C) 4 (D) 5 (E) 6
49. Which of the following bases is not the construction unit of a DNA?
(A) adenine (B) guanine (C) uracil (D) thymine (E) none of the above
50. What is the scope of the nanomaterial?
(A) 10–50 nm (B) 1–100 nm (C) 10–200 nm (D) 50–200 nm (E) 1–100 μm