

選擇題，五選一

1. When a 5.0 g sample of ethane, C_2H_6 , is burned in excess oxygen, 8.2 g of water is collected. What is the percentage yield for this reaction?
(A) 91%
(B) 84%
(C) 56%
(D) 95%
(E) none of the above
2. A photon of electromagnetic radiation has a frequency of 3.0×10^{14} Hz. What is the energy of the photon? The Planck constant is 6.626×10^{-34} J s.
(A) 5×10^{10} J
(B) 2.0×10^{-11} J
(C) 1.5×10^{33} J
(D) 3.0×10^8 J
(E) none of the above
3. The explanation of the photoelectric effect in terms of the photon model was first advanced by
(A) Max Planck
(B) Niels Bohr
(C) Isaac Newton
(D) Albert Einstein
(E) none of the above
4. Niels Bohr was able to show that the energy of a hydrogen atom could be calculated from the equation $E = -2.18 \times 10^{-18}(1/n^2)$ J. What is the energy of one mole of hydrogen atoms in the ground state?

八十八學年度轉學生入學考試

科目 普通化學(化工、原料) 共 10 頁第 2 頁 *請在試卷【答案卷】內作答

- (A) $-1.3 \times 10^6 \text{ kJ}$
- (B) $-1.3 \times 10^9 \text{ kJ}$
- (C) -1313 kJ
- (D) $-3.2 \times 10^5 \text{ J}$
- (E) none of the above

5. What is the value of n when the hydrogen atom is ionized?

- (A) 1
- (B) 2
- (C) 3
- (D) 4
- (E) none of the above

6. Consider the reaction, $\text{CaC}_2 + \text{water} \rightarrow \text{products}$. Which of the following is a product?

- (A) Ca
- (B) CH_4
- (C) Ca(OH)_2
- (D) H_2
- (E) none of the above

7. Which of the following is a typical catalyst in a biological system?

- (A) HNO_3
- (B) Sn
- (C) C_4H_{10}
- (D) H_2SO_4
- (E) none of the above

8. Consider the reaction, $\text{C}_5\text{H}_{12} + \text{O}_2(\text{excess}) \rightarrow \text{products}$. What is the coefficient of oxygen in the balanced chemical equation?

- (A) 2
- (B) 4
- (C) 6
- (D) 8
- (E) none of the above

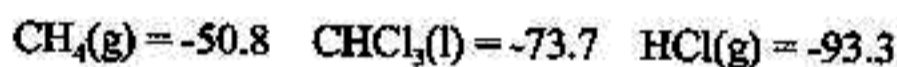
9. Consider a reaction where the ΔS is negative and the ΔH is positive. Under which set of conditions will the reaction be spontaneous?

- (A) The temperature is low and the ΔH is large.
- (B) The temperature is high and the ΔH is small.
- (C) The temperature is low and the ΔH is small.
- (D) The temperature is high and the ΔH is large.
- (E) none of the above

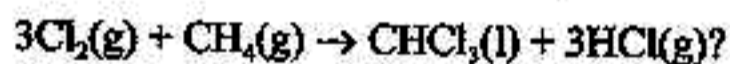
10. Under which condition is a reaction always in equilibrium?

- (A) $\Delta H = 0$
- (B) $\Delta S = 0$
- (C) $\Delta H = -$
- (D) $\Delta H = +$
- (E) none of the above

11. Given the following values of the ΔG_f° in kJ mol^{-1} :



What is the ΔG° for the reaction,



- (A) -227 kJ mol^{-1}
- (B) -303 kJ mol^{-1}
- (C) -415 kJ mol^{-1}
- (D) -427 kJ mol^{-1}
- (E) none of the above

12. Which of the lists of substances is in the order of increasing nitrogen-nitrogen bond strength?

- (A) N_2, HNNH
- (B) $\text{HNNH}, \text{H}_2\text{NNH}_2$
- (C) HNNH, N_2

- (D) N_2, H_2NNH_2
 (E) none of the above

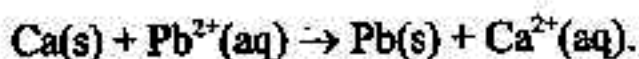
13. The value of ΔG for a gas phase reaction is 22 kJ. Which of the following is true?

- (A) Q is smaller than the K_p .
 (B) The reaction is spontaneous.
 (C) Q is equal to K_p .
 (D) Q is larger than K_p .
 (E) none of the above

14. Consider the equilibrium, $A(g) + B(g) \leftrightarrow C(l)$. What will be the effect on the equilibrium position of adding more "C" to the reaction mixture?

- (A) There will be a shift in the position of equilibrium to the left.
 (B) There will be a shift in the position of equilibrium to the right.
 (C) The concentration of "C" will increase.
 (D) There will be no effect on the equilibrium position.
 (E) none of the above

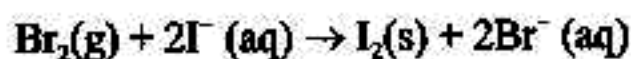
15. Consider the reaction,



The concentration of the Pb^{2+} is 0.5 M and that of Ca^{2+} is 1.5 M. If E° for the reaction is 2.74 V, what is E (volts) for the reaction?

- (A) 2.52 V
 (B) 2.75 V
 (C) 3.28 V
 (D) 2.73 V
 (E) none of the above

16. Consider the following oxidation-reduction reaction.



If ΔG° for the reaction is -106 kJ , what is the value of E° ?

- (A) 1.10 V
- (B) 0.275 V
- (C) 0.550 V
- (D) 2.55 V
- (E) none of the above

17. Which of the following statements best describes the difference in a primary cell and a seco

- (A) Only secondary cells can be placed in a series.
- (B) Secondary cells produce small voltages.
- (C) Primary cells are made of more expensive materials than secondary cells.
- (D) Secondary cells are rechargeable, and primary cells are not. ndary cell?
- (E) none of the above

18. How many grams of Cu^{2+} can be deposited as copper metal by a charge of $2.50 \times 10^4 \text{ C}$?

- (A) 16.5 g
- (B) 8.25 g
- (C) 33.0 g
- (D) 5.5 g
- (E) none of the above

19. Molten KF is placed in an electrolytic cell. Fluorine gas, F_2 , is produced at electrode A. Which of the following is true?

- (A) Oxidation occurs at electrode B.
- (B) Electrons flow away from electrode A.
- (C) Electrode B is the anode.
- (D) Electrode A is the cathode.
- (E) none of the above

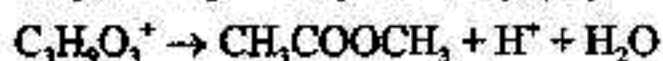
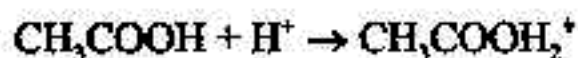
20. What is the name for the molecule, $\text{CH}_3\text{CH}_2\text{CH}_2\text{SH}$?

- (A) propanol
- (B) 1-propanethiol
- (C) propane

八十八學年度轉學生入學考試

科目 普通化學(化工、原料) 共 10 頁第 6 頁 *請在試卷【答案卷】內作答

- (D) sulfopropane
(E) none of the above
21. Which of the following is readily oxidized to produce a ketone?
(A) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
(B) $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{OH}$
(C) $(\text{CH}_3)_3\text{COH}$
(D) $(\text{CH}_3)_2\text{CHOH}$
(E) none of the above
22. Which of the following alcohols cannot be made by the reduction of an aldehyde?
(A) 2-propanol
(B) methanol
(C) 1-butanol
(D) ethyl alcohol
(E) none of the above
23. Which of the following is true?
(A) A catalyst will improve the yield from a given reaction by shifting the equilibrium position.
(B) A heterogeneous catalyst is in the same phase as the reaction medium.
(C) A catalytic converter in an automobile is an example of heterogeneous catalysis.
(D) An enzyme in solution behaves as a heterogeneous catalyst.
(E) none of the above
24. Consider the following steps for the formation of an ester from an alcohol and a carboxylic acid.



Which of the following is the reaction catalyst?

- (A) H^+
 (B) CH_3COOH
 (C) CH_3OH
 (D) $\text{CH}_3\text{COOCH}_3$
 (E) none of the above
25. Which of the following would represent a termination step in a free radical reaction that had a chain mechanism?
 (A) $2\text{Cl}^{\bullet} \rightarrow \text{Cl}_2$
 (B) $\text{CH}_3^{\bullet} + \text{Cl}_2 \rightarrow \text{CH}_4 + \text{Cl}^{\bullet}$
 (C) $\text{Cl}^{\bullet} + \text{CH}_4 \rightarrow \text{CH}_3^{\bullet} + \text{HCl}$
 (D) $\text{Cl}_2 + \text{H}^{\bullet} \rightarrow \text{HCl} + \text{Cl}^{\bullet}$
 (E) none of the above
26. Identify the reducing agent in the following reaction
 $\text{Cd} + \text{NiO}_2 + 2\text{H}_2\text{O} \rightarrow \text{Cd}(\text{OH})_2 + \text{Ni}(\text{OH})_2$
 (A) Cd (B) NiO_2 (C) H_2O (D) $\text{Cd}(\text{OH})_2$ (E) $\text{Ni}(\text{OH})_2$
27. 1.018 g of Freon-113 gas is trapped in a 145 mL container at 760 mmHg and 50.0 °C. What is the molar mass of Freon-113?
 (A) 21.7 g/mol (B) 28.8 g/mol (C) 46.1 g/mol (D) 186 g/mol (E) 245 g/mol
28. For the reaction $\text{C}(\text{graphite}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g})$ $\Delta H_f^\circ = -393 \text{ kJ}$. How many grams of graphite must be burned to released 275 kJ of heat?
 (A) 22.3 g (B) 0.70 g (C) 12.0 g (D) 17.1 g (E) 8.4 g
29. Calculate the work done in joules when 2.5 mole of H_2O vaporizes at 1.0 atm and 25 °C. Assume the volume of liquid H_2O is negligible compared to that of vapor.
 (A) 6190 kJ (B) 6.19 kJ (C) 61.1 kJ (D) 5.66 kJ (E) 518 J
30. Which element has the following electron configuration? $1s^2 2s^2 2p^6 3s^2$
 (A) Na (B) Mg (C) Al (D) Si (E) Ne
31. Which of the following is the electron configuration for the Cl^- ion?
 (A) $[\text{Ne}]3s^2 3p^4$ (B) $[\text{Ne}]3s^2 3p^7$ (C) $[\text{Ar}]$ (D) $[\text{Ar}]4s^1$ (E) $[\text{Ne}]3s^2 3p^5$

八十八學年度轉學生入學考試

科目 普通化學(化工、原料) 共 10 頁第 8 頁 *請在試卷【答案卷】內作答

32. Use VSEPR theory to predict the shape of the PCl_3 molecule
 (A) linear (B) bent (C) trigonal planar (D) trigonal pyramid (E) tetrahedral
33. Each of the following substances is a gas at 25°C and 1 atm pressure. Which one will liquefy most easily when compressed at a constant temperature?
 (A) F_2 (B) H_2 (C) HF (D) SiH_4 (E) Ar
34. Which of the following aqueous solution has the highest boiling point?
 (A) 0.2 m KCl (B) 0.2 m Na_2SO_4 (C) 0.2 m $\text{Ca}(\text{NO}_3)_2$ (D) pure water
 (E) more than one of the above
35. What is the molar mass of toluene ($\text{C}_6\text{H}_5\text{CH}_3$) if 0.85 g of toluene depresses the freezing point of 100 g of benzene by 0.47°C ? $K_f(\text{benzene})=5.12^\circ\text{C}/\text{m}$
 (A) 92.6 g/mol (B) 78.0 g/mol (C) 10.7 g/mol (D) 81.8 g/mol (E) 927 g/mol
36. It takes 42 min for the concentration of a reactant in a first-order reaction to drop from 0.45 M to 0.32 M at 25°C . How long will it take for the reaction to be 90% complete?
 (A) 13 min (B) 86 min (C) 137 min (D) 222 min (E) 284 min
37. Which one of the following would alter the value of the rate constant (k) for the reaction $2\text{A} + \text{B} \rightarrow \text{products}$?
 (A) increase the concentration of A (B) increase the concentration of B
 (C) increase concentration of both A and B (D) increase the temperature
 (E) all of the above
38. Which statement is false? A catalyst
 (A) increase the rate of the forward reaction, but does not alter the reverse rate
 (B) alters the mechanism of reaction (C) alters the activation energy
 (D) is altered in the reaction, but is always regenerated (E) increase the rate of reaction, but is not consumed.

八十八學年度轉學生入學考試

科目 普通化學(化工、原料) 共 10 頁第 9 頁 *請在試卷【答案卷】內作答

39. Consider a weak acid CH_3COOH (acetic acid). Given that a 0.048 M CH_3COOH solution is 5.2% ionized, determine the $[\text{H}_3\text{O}^+]$ concentration at equilibrium.
 (A) 0.25 M (B) 9.2×10^{-3} M (C) 0.048 M (D) 0.052 M (E) 2.5×10^{-3} M
40. Calculate the pH of a 0.20 M NaHSO_3 solution. $K_a(\text{HSO}_3^-) = 6.3 \times 10^{-8}$.
 (A) 0.70 (B) 3.95 (C) 4.25 (D) 7.20 (E) 7.90
41. The molar solubility of tin iodide (SnI_2) is 1.28×10^{-2} mol/L. What is K_{sp} for this compound?
 (A) 8.4×10^{-6} (B) 1.28×10^{-2} (C) 4.2×10^{-6} (D) 1.6×10^{-4} (E) 2.1×10^{-6}
42. The entropy change on vaporization (ΔS_{vap}) of a compound or element is
 (A) always negative (B) always positive (C) zero (D) can be positive or negative
43. A certain electrochemical cell has for its cell reaction: $\text{Zn} + \text{HgO} \rightarrow \text{ZnO} + \text{Hg}$. Which is the half-reaction occurring at the anode?
 (A) $\text{HgO} + 2e^- \rightarrow \text{Hg} + \text{O}^{2-}$ (B) $\text{Zn}^{2+} + 2e^- \rightarrow \text{Zn}$ (C) $\text{Zn} \rightarrow \text{Zn}^{2+} + 2e^-$
 (D) $\text{ZnO} + 2e^- \rightarrow \text{Zn}$
44. Iron objects such as storage tanks and underground pipelines can be protected from corrosion by connecting them through a wire to a piece of
 (A) Pb (B) Ag (C) Sn (D) Mg (E) Cu
45. In order for a gas to be a "greenhouse gas" it must
 (A) transmit visible light and absorb infrared radiation
 (B) be radioactive (C) transmit infrared and absorb visible light
 (D) be combustible (E) absorb both visible and infrared
46. Co-60 is a beta emitter with a half-life of 5.3 years. Approximately what fraction of the Co-60 atoms in a particular sample will remain after 32 years?
 (A) 1/6 (B) 1/8 (C) 1/16 (D) 1/32 (E) 1/64
47. Which molecule represented below is unsaturated?
 (A) C_3H_8 (B) CH_3OH (C) C_5H_{10} (D) CH_4 (E) C_4H_{10}

八十八學年度轉學生入學考試

科目 普通化學(化工、原料) 共 10 頁第 10 頁 *請在試卷【答案卷】內作答

48. Octane (C_8H_{18}) undergoes combustion according to the following thermochemical equation: $2C_8H_{18}(l) + 25O_2(g) \rightarrow 16CO_2(g) + 18H_2O(l)$ $\Delta H_{rxn}^\circ = -11,020 \text{ kJ}$. Given that $\Delta H_f^\circ[CO_2(g)] = -393.5 \text{ kJ/mol}$ and $\Delta H_f^\circ[H_2O(l)] = -285.8 \text{ kJ/mol}$. Calculate the enthalpy of formation of 1 mole of octane.
 (A) -210 kJ (B) $-11,230 \text{ kJ}$ (C) $22,040 \text{ kJ}$ (D) -420 kJ (E) 420 kJ
49. Deviation from the ideal gas law are greater at
 (A) low temperatures and low pressures (B) low temperatures and high pressures
 (C) high temperatures and high pressures (D) high temperatures and low pressures
50. The formal charge on the bromine atom in BrO_3^- drawn with three single bonds is (A) -2 (B) -1 (C) 0 (D) $+1$ (E) $+2$

選擇題，五選一

1. Consider the reaction, $2\text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow 4\text{Fe} + 3\text{CO}_2$. How many moles of carbon are needed to produce 5 moles of Fe?

(A) 15.0 mol
 (B) 6.67 mol
 (C) 5.00 mol
 (D) 10.0 mol
 (E) none of the above
2. Aluminum reacts with sulfuric acid, H_2SO_4 , to produce aluminum sulfate, $\text{Al}_2(\text{SO}_4)_3$, and hydrogen gas. What is the amount of aluminum sulfate that can be produced by reacting 2.5 g of aluminum?

(A) 10.5 g
 (B) 15.8 g
 (C) 31.6 g
 (D) 0.250 g
 (E) none of the above
3. When a 5.0 g sample of ethane, C_2H_6 , is burned in excess oxygen, 8.2 g of water is collected. What is the percentage yield for this reaction?

(A) 91%
 (B) 84%
 (C) 56%
 (D) 95%
 (E) none of the above
4. Given:

$$\text{N}_2(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow 2\text{NO}_2(\text{g})$$

$$\Delta H^\circ = 3.6 \text{ kJ}$$

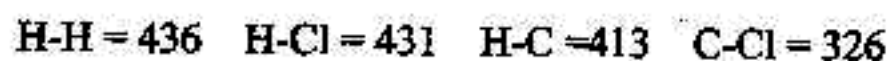
$$2\text{NO}(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{NO}_2(\text{g})$$

$$\Delta H^\circ = -6.7 \text{ kJ}$$

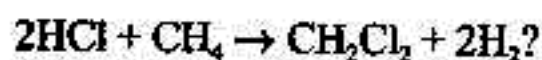
What is the standard enthalpy of formation for nitric oxide, NO?

- (A) 10.3 kJ
- (B) 10.3 kJ
- (C) 5.2 kJ
- (D) -20.6 kJ
- (E) none of the above

5. Given the following bond energies in kJ mol^{-1} :



What is the approximate reaction enthalpy for the reaction,



- (A) -164 kJ
- (B) 164 kJ
- (C) 82 kJ
- (D) -82 kJ
- (E) none of the above

6. Which of the lists of substances is in the order of increasing nitrogen-nitrogen bond strength?

- (A) N_2 , HNNH
- (B) HNNH, H_2NNH_2
- (C) HNNH, N_2
- (D) N_2 , H_2NNH_2
- (E) none of the above

7. Which of the following reactions has a negative change in entropy?

- (A) $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$
- (B) $2\text{HgO}(\text{s}) \rightarrow 2\text{Hg}(\text{l}) + \text{O}_2(\text{g})$
- (C) $5\text{H}_2(\text{g}) + 4\text{C}(\text{s}) \rightarrow \text{C}_4\text{H}_{10}(\text{g})$
- (D) $2\text{NH}_3(\text{g}) \rightarrow \text{N}_2(\text{g}) + 3\text{H}_2(\text{g})$
- (E) none of the above

國立清華大學命題紙

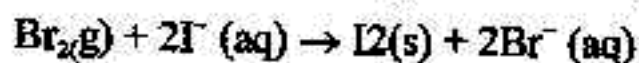
八十八學年度轉學生入學考試

科目 普通化學(化學、生科) 共 11 頁第 3 頁 *請在試卷【答案卷】內作答

8. The ΔG_f° for methane is $-50.8 \text{ kJ mole}^{-1}$, and the ΔH_f° is $-74.5 \text{ kJ mol}^{-1}$. What is the value of ΔS_f° for CH_4 ?

- (A) $-152 \text{ J mol}^{-1} \text{ K}^{-1}$
- (B) $-79.5 \text{ J mol}^{-1} \text{ K}^{-1}$
- (C) $-204 \text{ J mol}^{-1} \text{ K}^{-1}$
- (D) $-24.8 \text{ J mol}^{-1} \text{ K}^{-1}$
- (E) none of the above

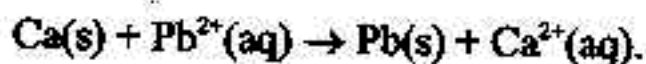
9. Consider the following oxidation-reduction reaction.



If ΔG° for the reaction is -106 kJ , what is the value of E° ?

- (A) 1.10 V
- (B) 0.275 V
- (C) 0.550 V
- (D) 2.55 V
- (E) none of the above

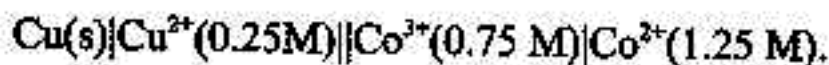
10. Consider the reaction,



The concentration of the Pb^{2+} is 0.5 M and that of Ca^{2+} is 1.5 M. If E° for the reaction is 2.74 V, what is E (volts) for the reaction?

- (A) 2.52 V
- (B) 2.75 V
- (C) 3.28 V
- (D) 2.73 V
- (E) none of the above

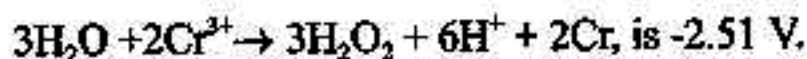
11. Consider the electrochemical cell,



If E° for the cell is 1.47 V, what is E (volts) for the cell?

- (A) 1.45 V
- (B) 1.57 V
- (C) 1.63 V
- (D) 1.31 V
- (E) none of the above

12. The E° for the reaction,



What is the value of K for the reaction?

- (A) 2.6×10^{23}
- (B) 3.6×10^{42}
- (C) 4.1×10^{-255}
- (D) 17
- (E) none of the above

13. Molten CaBr_2 is placed in an electrolytic cell. Electrons flow in electrode A and out electrode B. What happens at electrode A?

- (A) Reduction occurs.
- (B) Oxidation occurs.
- (C) Br_2 is formed.
- (D) Calcium ions are produced.
- (E) none of the above

14. How many grams of Ag^+ can be deposited as silver metal by $2.50 \times 10^4 \text{ C}$ of charge?

- (A) 28.0 g
- (B) 18.0 g
- (C) 56.0 g
- (D) 0.250 g
- (E) none of the above

15. Which of the following is not a nucleophile?
- (A) Na^+
 (B) CN^-
 (C) OH^-
 (D) NH_3
 (E) none of the above
16. Which of the following is ethylene glycol?
- (A) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
 (B) CH_3CHOH
 (C) $\text{CH}_2\text{OHCH}_2\text{OH}$
 (D) $\text{CH}_2\text{OHCH}_2\text{OHCH}_2\text{OH}$
 (E) none of the above
17. Which of the following is readily oxidized to produce a ketone?
- (A) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
 (B) $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{OH}$
 (C) $(\text{CH}_3)_2\text{COH}$
 (D) $(\text{CH}_3)_2\text{CHOH}$
 (E) none of the above
18. Consider the reaction rate data for the reaction, $\text{A} + 3\text{B} \rightarrow \text{products}$.

| Initial [A] | Initial [B] | $-\Delta[\text{A}]/\Delta t$ |
|-------------|-------------|---|
| 0.015 M | 0.024 M | $2.3 \times 10^{-5} \text{ mol h}^{-1}$ |
| 0.030 M | 0.024 M | $4.6 \times 10^{-5} \text{ mol h}^{-1}$ |
| 0.015 M | 0.012 M | $1.7 \times 10^{-5} \text{ mol h}^{-1}$ |

What is the rate equation for this reaction?

- (A) $k[\text{A}]$
 (B) $k[\text{A}][\text{B}]$
 (C) $k[\text{A}][\text{B}]^2$
 (D) $k[\text{B}]$

- (E) none of the above
19. The rate equation for the reaction, $2A + 3B \rightarrow \text{products}$, is found to be $\text{rate} = k[A][B]$. What is the molecularity of the slow step for this reaction?
- (A) unimolecular
 (B) bimolecular
 (C) termolecular
 (D) tetramolecular
 (E) none of the above
20. Consider the reaction, $2A + B \rightarrow \text{products}$. If the reaction is first order in both A and B, what are appropriate units for the rate constant, k ?
- (A) mol L^{-1}
 (B) $\text{L mol}^{-1} \text{s}^{-1}$
 (C) $\text{mol}^2 \text{s}$
 (D) s mol^{-2}
 (E) none of the above
21. Consider the reaction, $A + B \rightarrow \text{products}$, which has the rate equation, $\text{rate} = k[A]$. The value of the rate constant is 0.15 h^{-1} . What will be the concentration of A after 2.0 hours if the initial concentration of A was 0.050 M?
- (A) 0.045 M
 (B) 0.040 M
 (C) 0.037 M
 (D) 0.032 M
 (E) none of the above
22. Consider the reaction, $A + B \rightarrow$, which has the rate equation, $\text{rate} = k[A]$. The half-life for the reaction is 2.8 days. What is the value of the rate constant, k , for the reaction?
- (A) 4 d^{-1}

- (B) 1.8 d^{-1}
 (C) 0.62 d^{-1}
 (D) 0.25 d^{-1}
 (E) none of the above

23. The equilibrium constant for the vapor phase reaction,



If the value for the rate constant for the forward reaction is $0.015 \text{ L mol}^{-1} \text{ s}^{-1}$,

what is the rate constant for the reverse reaction?

- (A) $33 \text{ mol L}^{-1} \text{ s}^{-1}$
 (B) 3300 s^{-1}
 (C) $3.1 \times 10^{-4} \text{ s}^{-1}$
 (D) 520 s^{-1}
 (E) none of the above
24. The rate constant for a chemical reaction is 0.031 at 25°C . If the temperature is increased to 40°C , the rate constant increases to 0.095. What is the activation energy for the reaction?
- (A) 37 kJ mol^{-1}
 (B) 28 kJ mol^{-1}
 (C) 16 kJ mol^{-1}
 (D) 0.84 kJ mol^{-1}
 (E) none of the above

25. Which of the following is a typical catalyst in a biological system?
- (A) HNO_3
 (B) Sn
 (C) C_4H_{10}
 (D) H_2SO_4
 (E) none of the above
26. Calculate the mass of excess reagent remaining at the end of the reaction $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$, in which 90.0 g of SO_2 are mixed with 100.0 g of O_2
- (A) 11.5 g (B) 22.5 g (C) 67.5 g (D) 77.5 g (E) 400 g
27. Identify the oxidizing agent in the following reaction
- $$2\text{MnO}_4^- + 5\text{H}_2\text{SO}_3 \rightarrow 2\text{Mn}^{2+} + 5\text{SO}_4^{2-} + 4\text{H}^+ + 3\text{H}_2\text{O}$$
- (A) MnO_4^- (B) H_2SO_3 (C) Mn^{2+} (D) SO_4^{2-} (E) H^+
28. 5.02 g of unknown gas is sealed in a 1.0 L flask at 37 °C and 3.75 atm. Which one of the following is most likely to be the unknown
- (A) H_2O (B) HBr (C) HCN (D) H_2S (E) C_2H_2
29. Calculate the work done against an atmospheric pressure of 1.0 atm when 7.65 mole of zinc dissolves in excess acid at 30.0 °C.
- $$\text{Zn(s)} + 2\text{H}^+(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{H}_2(\text{g})$$
- (A) 22.4 kJ (B) 24.9 kJ (C) 0 (D) -2.52 kJ (E) -19.3 kJ
30. Which one of the following sets of atomic quantum numbers (n, l, m_l, m_s) is unacceptable?
- (A) (4, 3, -1, 1/2) (B) (3, 0, 1, -1/2) (C) (3, 0, 0, 1/2) (D) (2, 1, 1, -1/2)
 (E) (2, 0, 0, 1/2)

國立清華大學 命題紙

八十八學年度轉學生入學考試

科目 普通化學(化學、生科) 共 11 頁第 9 頁 *請在試卷【答案卷】內作答

31. How many unpaired electrons does an atom of sulfur have?
(A) 0 (B) 1 (C) 2 (D) 3 (E) 4
32. Which of the following would be the electron configuration of an excited state of an oxygen atom?
(A) $1s^2 2s^2 2p^4$ (B) $1s^2 2s^2 2p^5$ (C) $1s^2 2s^2 2p^3 3s^1$ (D) $1s^2 2s^2 2p^6$ (E) $1s^2 2s^2 2p^3$
33. Which ion is isoelectronic with Ar?
(A) Fe^{2+} (B) F^- (C) Br^- (D) Ga^{3+} (E) Ca^{2+}
34. Which of the following solid would have the highest melting point?
(A) NaF (B) NaCl (C) NaBr (D) NaI
35. The formal charge on the sulfur atom in the resonance structure of SO_2 which has one single bond and one double bond is:
(A) 0 (B) +1 (C) -1 (D) +2 (E) -2
36. According to the VSEPR theory, the shape of the SO_3 molecule is
(A) pyramidal (B) tetrahedral (C) trigonal planar (D) distorted tetrahedron
(E) square planar
37. Which one of the following is a polar molecule?
(A) PBr_3 (B) CCl_4 (C) BrF_3 (D) XeF_2 (E) XeF_4
38. The number of atoms in a face-centered cubic unit cell is
(A) 1 (B) 2 (C) 3 (D) 4 (E) 8
39. Which of the following liquids would have the highest viscosity at the same temperature?
(A) CH_3OCH_3 (B) CH_2Cl_2 (C) C_2H_5OH (D) CH_3Br (E) $HOCH_2CH_2OH$

40. Which of the following solutions has the highest osmotic pressure at 25 °C?
 (A) 0.2 M KBr (B) 0.2 M ethanol (C) 0.2 M Na₂SO₄ (D) 0.2 M KCl
 (E) all the same
41. The vapor pressure of water at 20 °C is 17.5 mmHg. What is the vapor pressure of water over a solution prepared from 200.0 g of sucrose (C₁₂H₂₂O₁₁) and 350.0 g water?
 (A) 0.51 mmHg (B) 16.0 mmHg (C) 17.0 mmHg (D) 18.0 mmHg (E) 19.4 mmHg
42. The activation energy for the reaction $\text{Sn}^{2+} + 2\text{Co}^{3+} \rightarrow \text{Sn}^{4+} + 2\text{Co}^{2+}$ is 60 kJ/mol. By what factor will the rate constant increase when the temperature is raised from 10 °C to 28 °C?
 (A) 1.002 (B) 4.6 (C) 5.6 (D) 2.8 (E) 696
43. For a chemical reaction $\text{A} \rightarrow \text{C}$, a plot of $1/[\text{A}]$ versus time was found to give a straight line with a positive slope. What is the order of reaction?
 (A) zero (B) first (C) second (D) none of the above
44. A certain first-order reaction $\text{A} \rightarrow \text{B}$ is 25% complete in 42 min at 25 °C. What is the half-life of the reaction?
 (A) 21 min (B) 42 min (C) 84 min (D) 101 min (E) 120 min
45. A certain weak acid (HA) is 1.5% ionized in a 0.25 M solution of the acid. What is the value of K_a for this acid?
 (A) 7.1×10^{-4} (B) 1.4×10^{-5} (C) 1.8×10^{-5} (D) 5.6×10^{-5} (E) 1.5×10^{-2}
46. A solution is prepared by mixing 500 mL of 0.10 M NaOCl and 500 mL of 0.20 M HOCl. What is the pH of this solution? $K_a(\text{HOCl}) = 3.2 \times 10^{-8}$
 (A) 4.10 (B) 7.00 (C) 7.19 (D) 7.49 (E) 7.80

國立清華大學 命題紙

八十八學年度轉學生入學考試

科目 普通化學(化學、生科) 共 11 頁第 11 頁 *請在試卷【答案卷】內作答

47. For which type of titration will the pH be basic at the equivalence point?
(A) strong acid vs. strong base (B) strong acid vs. weak base
(C) weak acid vs. strong base (D) none of the above
48. Which of the following species has the highest entropy (S^0) at 25 °C?
(A) $\text{CH}_3\text{OH}(l)$ (B) $\text{CO}(g)$ (C) $\text{MgCO}_3(s)$ (D) $\text{H}_2\text{O}(l)$ (E) $\text{Ni}(s)$
49. How many coulombs of charge are required to cause reduction of 0.25 mole of Cu^{2+} to Cu ?
(A) 0.25 C (B) 0.50 C (C) 1.2×10^4 C (D) 2.4×10^4 C (E) 4.8×10^4 C
50. The overall reaction $2\text{Co}^{3+}(aq) + 2\text{Cl}^-(aq) \rightarrow 2\text{Co}^{2+}(aq) + \text{Cl}_2(g)$ has a standard cell voltage of $E_{\text{cell}}^0 = 0.46$ V. Given that $\text{Cl}_2(g) + 2e^- \rightarrow 2\text{Cl}^-(aq)$ $E^0 = 1.36$ V.
Calculate the standard reduction potential for the following half reaction: $\text{Co}^{3+}(aq) + e^- \rightarrow \text{Co}^{2+}(aq)$
(A) 1.82 V (B) -0.90 V (C) 0.90 V (D) -1.82 V (E) -1.36 V