※ 考生請注意：本試題 ☑可 ☐不可 使用計算機

選擇題：每題5分(共70分)

1. Select the precipitate that forms when aqueous ammonium sulfide reacts with aqueous copper(II) nitrate. A.CuS; B.Cu_2S; C. NH_4NO_3;D. $NH_4(NO_3)_2$; E.$CuSO_4$
2. Which one of the following is not a redox reaction?
   A. $2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$
   B. $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$
   C. $2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$
   D. $Fe_2O_3(s) + 3H_2SO_4(aq) \rightarrow Fe_2(SO_4)_3(aq) + 3H_2O(l)$
   E. $2KMnO_4(aq) + 10FeSO_4(aq) + 8H_2SO_4(aq) \rightarrow K_2SO_4(aq) + 2MnSO_4(aq) + 5Fe_2(SO_4)_3(aq) + 8H_2O(l)$
3. "The volume of an ideal gas is directly proportional to the number of moles of the gas at constant temperature and pressure" is a statement of _____ Law. A. Charles's; B.Boyle's; C.Amontons's; D. Avogadro's; E.Dalton's
4. A system receives 575 J of heat and delivers 425 J of work. Calculate the change in the internal energy, ΔE, of the system. A.-150 J; B.150 J; C.-1000 J; D.1000 J; E. 575 J
5. The dissolution of barium hydroxide in water is an exothermic process. Which of the following statements is correct?
   A. The enthalpy of solid barium hydroxide plus pure water is less than that of the solution, at the same temperature.
   B. The enthalpy of solid barium hydroxide plus pure water is greater than that of the solution, at the same temperature.
   C. The enthalpy of solid barium hydroxide plus pure water is the same as that of the solution, at the same temperature.
   D. The temperature of the solution is lower than of the barium hydroxide and water before mixing.
   E. When barium hydroxide dissolves in water, the system does work on the surroundings.
6. In the photoelectric effect, a photon with an energy of 5.3×10^{-19} J strikes an electron in a metal. Of this energy, 3.6×10^{-19} J is the minimum energy required for the electron to escape from the metal. The remaining energy appears as kinetic energy of the photoelectron. What is the velocity of the photoelectron, assuming it was initially at rest? A.3.7×10^{14} m/s; B.3.7×10^{11} m/s; C.1.9×10^{6} m/s; D.6.1×10^{5} m/s; E.1.7×10^{-19} m/s
7. According to the Rydberg equation, the line with the shortest wavelength in the emission spectrum of atomic hydrogen is predicted to lie at a wavelength (in nm) of: A.91.2 nm; B.1.10×10^{-2} nm; C.1.10×10^{2} nm; D.1.10×10^{16} nm; E. None of these choices is correct.

(背面仍有題目,請繼續作答)

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8. Using the bond energies provided below, calculate $\Delta H°$ for the reaction
$CH_4(g) + 4Cl_2(g) \rightarrow CCl_4(g) + 4HCl(g)$
Bond energies: C — H = 413 kJ/mol, Cl — Cl = 243 kJ/mol, C — Cl = 339 kJ/mol,H — Cl = 427 kJ/mol
A.1422 kJ; B.440 kJ; C.110 kJ; D.-110 kJ; E.-440 kJ

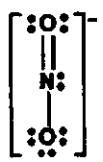
9. Which of the following period 3 chlorides would be expected to have the highest melting point? A. $MgCl_2$; B.$AlCl_3$; C. $SiCl_4$; D.PCl_3; E.SCl_2

10. Which one of the following Lewis structures is definitely incorrect?

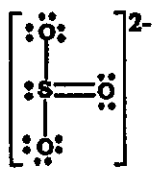
A. NO

B. HCN

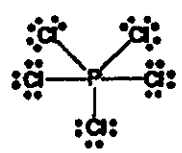
C. NO_2^-



D. SO_3^{2-}



E. PCl_5



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11. The best Lewis structure for sulfuric acid has zero formal charges, sulfur as the central atom, and no bonds between S and H. How many single and double bonds, respectively, are there in this Lewis structure?
    A. 2 single, 4 double; B. 4 single, 2 double; C. 4 single, no double; D. 6 single, no double; E. 5 single, 1 double
12. A voltaic cell prepared using zinc and iodine has the following cell notation.
    $Zn(s) \mid Zn^{2+}(aq) \parallel I^{-}(aq) \mid I_2(s) \mid C(\text{graphite})$
    Which of the following equations correctly represents the balanced, spontaneous cell reaction?
    A. $2I^{-}(aq) + Zn^{2+}(aq) \rightarrow I_2(s) + Zn(s)$
    B. $I_2(s) + Zn(s) \rightarrow 2I^{-}(aq) + Zn^{2+}(aq)$
    C. $2I^{-}(aq) + Zn(s) \rightarrow I_2(s) + Zn^{2+}(aq)$
    D. $I_2(s) + Zn^{2+}(aq) \rightarrow 2I^{-}(aq) + Zn(s)$
    E. None of these choices, since graphite must be in the equation.
13. The oxidation and coordination numbers of cobalt in the compound $[Co(NH_3)_5Cl]Cl_2$ are, respectively:
    A.2 and 6.; B. 2 and 8.; C.3 and 6.; D.3 and 8.; E.None of these choices is correct.
14. Which of the following ions could exist in only the high-spin state in an octahedral complex? A.Cr^{2+}; B.Mn^{4+}; C.Fe^{3+}; D.Co^{3+}; E.Ni^{2+}

簡答題I：每題9分(共18分)

15. Name the three different classes (types) of hydride, and list some of their important characteristics.
16. Give at least three different crystalline forms of carbon. Describe what kinds of chemical bonds are formed among these different forms.

簡答題II：每題6分(共12分)

17. Explain why the atomic radii of 3A family such as Ga (n=4) is unexpectedly smaller than that of Al (n=3).
18. What are the definition of entropy and the second law of thermodynamics ? Please provide the related equations.