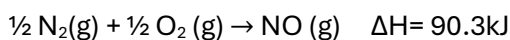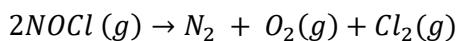**CHM 2045 Exam 2 Review**

Academic Resources

Spring 2025

1. In a bomb calorimeter compartment surrounded by 2.45 kg of water, the combustion of 1.608 g of benzene, C_6H_6 (l), raised the temperature of the water from 25.720°C to 34.852°C. The heat capacity of the calorimeter is 0.923 kJ/°C. What is ΔE for the reaction in kJ/mol of C_6H_6 (l), the specific heat of water is 4.184 J/g°C.

   a. 93.6 kJ/mol
   b. -102.04 kJ/mol
   c. -4953.4 kJ/mol
   d. 4544.6 kJ/mol

2. If 130. grams of iron (0.450 J/g°C) at 120°C is combined with 120. grams of water (4.184J/g°C) at 22°C in an insulated container, what will be the final temperature of the water?

   a. 71.0 °C
   b. 32.2 °C
   c. 52.0 °C
   d. -9.08 °C

3. Calculate ΔH for the following reaction given the reactions below

$$2NOCl\ (g) \rightarrow N_2\ +\ O_2(g) + Cl_2(g)$$

$$½ N_2(g) + ½ O_2\ (g) \rightarrow NO\ (g) \quad ΔH= 90.3kJ$$

$$NO(g) + ½ Cl_2(g) \rightarrow NOCl\ (g) \quad ΔH= -38.6kJ$$

   a. 103.4kJ
   b. 51.7 kJ
   c. -252.8 kJ
   d. -108.4kJ

4. Calculate the standard enthalpy of reaction for the following reaction. The standard heat of formations are as follows. H_2S =-20.2kJ/mol, $SO_2(g)$=-296.8kJ/mol, H_2O (g) =-241.8kJ/mol H_2O (l)= -285.8kJ/mol

$$2H_2S\ (g) + 3O_2(g) \rightarrow 2SO_2(g) + 2H_2O\ (g)$$
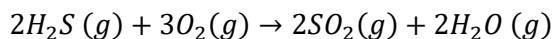
   a. -1036.8 kJ/mol
   b. 498.2 kJ/mol
   c. -1084.4 kJ/mol
   d. -518.4 kJ/mol

5. Which of the following statements is true about energy?
   a. The total change in energy is $q + w$
   b. A temperature increase of the surroundings indicates that the reaction is endothermic
   c. Work=$V\Delta P$
   d. The volume in a coffee cup calorimeter is always constant

6. Find the total work done by the combustion of methane at 1atm.
   a. -1 J
   b. 0 J
   c. 50.7 J
   d. -101.3 J

7. Which of the following sets of quantum numbers is possible
   a. $n=2$, $l=2$, $m_l=1$ $m_s=1/2$
   b. $n=3$ $l=2$ $m_l=3$ $m_s = -1/2$
   c. $n=3$ $l=1$ $m_l = -1$ $m_s =1/2$
   d. $n=1$ $l=0$ $m_l=0$ $m_s=1$

8. A portion of soup is 155 grams of water that is heated from 30 to 90 degrees C by a microwave with radiation of wavelength 0.22m. How many photons are absorbed by the water in the soup?
   a. 6.46×10^{20} photons
   b. 4.31×10^{28} photons
   c. 9.04×10^{25} photons
   d. 6.02×10^{23} photons

9. How many orbitals are in the 5f electron shell?
   a. 5
   b. 14
   c. 4
   d. 7

10. Which of the following is the electron configuration for copper?
    a. $[Ar]4s^23d^9$
    b. $[Ar]5s^24d^9$
    c. $[Ar]4s^13d^{10}$
    d. $[Ar]4s^13d^5$

11. Which of the following electron configurations is paramagnetic?
    a. Kr
    b. Ni
    c. Mg
    d. Zn

12. Which of the following pairs are isoelectronic?
   a. V^{3+}, Ca
   b. S^{2-}, Ca^{2+}
   c. Zn^{2+}, Ni
   d. Ne, Ar

13. Rank the following atoms and ions in order of increasing size
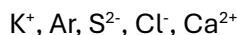
$$K^+, Ar, S^{2-}, Cl^-, Ca^{2+}$$

   a. $K^+ < Ar < S^{2-} < Cl^- < Ca^{2+}$
   b. $Ca^{2+} < K^+ < Ar < Cl^- < S^{2-}$
   c. $S^{2-} < Cl^- < Ar < K^+ < Ca^{2+}$
   d. $Ar < K^+ < Ca^{2+} < Cl^- < S^{2-}$

14. Which of the following values could represent the ionization energy for a calcium ion?
   a. IE1=5000 IE2=9000 IE3= 25000
   b. IE1=10,000 IE2= 15,000 IE3 = 20,000
   c. IE1=11,000 IE2=20,000 IE3= 22,000
   d. IE1= 1,000 IE2= 1,000 IE3=20,000

15. Which of the following reactions represents electron affinity?
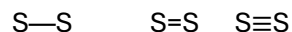   a. P (g) + e⁻ → P⁻ (g)
   b. Na (s) + e⁻ → Na⁻ (g)
   c. K (g) → K⁺ (g) + e⁻
   d. S (g) → S⁻(g) + e⁻

16. Calculate the standard enthalpy of formation for the following reaction. The bond enthalpies are as follows. C—H= 413kJ/mol, Cl—Cl= 243kJ/mol, C—Cl = -339 kJ/mol, H—Cl= -427kJ/mol
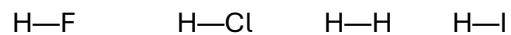
$$CH_4 + 3\,Cl_2 \rightarrow CHCl_3 + 3HCl$$
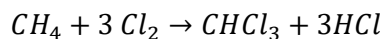
   a. -4401 kJ/mol
   b. 936 kJ/mol
   c. 4401 kJ/mol
   d. -936 kJ/mol

17. Place the following bonds in order of increasing bond length
   S—S   S=S   S≡S

   a. S—S < S=S < S≡S
   b. S≡S < S=S < S—S
   c. S=S < S—S < S≡S
   d. S—S< S≡S < S=S

18. Place the following bonds in order of increasing bond length

        H—F   H—Cl   H—H   H—I

        a. H—F<H—Cl<H—I< H—H

        b. H—H < H—I < H—Cl < H—F

        c. H—H < H—F < H—Cl < H—I

        d. H—I < H—Cl < H—F < H—H

19. Order the following salts in order of increasing lattice energy: Calcium chloride, sodium chloride, potassium chloride, barium chloride

    a. Calcium chloride < sodium chloride < potassium chloride < barium chloride

    b. Sodium chloride < potassium chloride < barium chloride < calcium chloride

    c. Potassium chloride < sodium chloride < calcium chloride < barium chloride

    d. Potassium chloride < sodium chloride < barium chloride < calcium chloride