

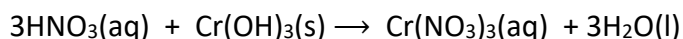
Choose the correct answer for each question and write the letter of the correct answer in the table provided on page one.

Chapter. 4 reaction in aqueous solution

Q1. What is the oxidation number of phosphorous in the compound FrH_2PO_4 ?

- A) -2 B) -5 C) +5 D) +7

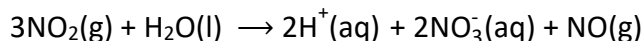
Q2. In the following reaction:



Which of the following is/are the spectator ion(s)?

- A) Cr^{3+} and NO_3^- B) NO_3^- C) Cr^{3+} D) NO_3^- and OH^-

Q3. The type of the following reaction is ..



- A) Disproportionation B) Neutralization C) Precipitation D) Combination

Q4. The concentration of NaCl in a typical blood serum is about 0.14 M. What volume (in milliliters) of blood contains 0.1 g of NaCl?

- A) 818.3 B) 714.3 C) 122.2 D) 12.2

Q5. A flask contains a solution with an unknown amount of HCl. This solution is titrated with 0.195 M NaOH. It takes 4.75 mL NaOH to complete the reaction. What is the mass (in grams) of the HCl?

- A) 0.034 B) 0.068 C) 0.195 D) 4.75

Chapter. 5 Gases

Q6. How many moles of He gas atoms are present in a 450 mL container at 35°C and 740 mmHg?

- A) 0.152 B) 1.144 C) 0.017 D) 1.505

Q7. What is the density of argon (Ar) at STP?

- A) 0.016 B) 0.018 C) 1.634 D) 1.784

Q8. A 0.271 g sample of an unknown vapor occupies 294 mL at 140°C and 847 mmHg. The empirical formula of the compound is CH_2 . What is the molecular formula of the compound?

- A) CH_2 B) C_3H_6 C) C_2H_4 D) C_4H_8

Q9. A sample of hydrogen gas was collected over water at 21°C and 685 mmHg. The volume of the container was 7.80 L. Calculate the mass (in grams) of H₂ gas collected. The vapor pressure of water at 21°C is 18.6 mmHg.

- A) 0.286 B) 0.571 C) 217 D) 434

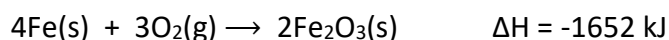
Chapter. 6 thermodynamic

Q10. How many liters of chlorine gas at 25°C and 0.950 atm can be produced by the reaction of 12.0 g of MnO₂ with excess HCl(aq) according to the following chemical equation?



- A) 0.138 B) 0.282 C) 3.09 D) 3.55

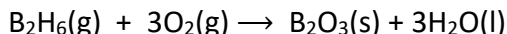
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How much heat (in kJ) is released when 63.83 g iron are reacted with excess O₂?

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If the change in internal energy (ΔE) for this reaction at 25°C is -2143.2 kJ, what is the change in enthalpy (in kJ) at the same temperature?

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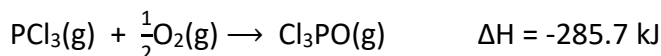
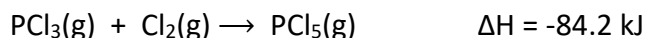
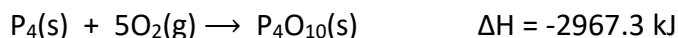
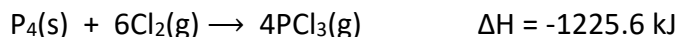
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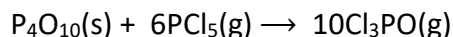
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Calculate ΔH (in kJ) for the reaction:



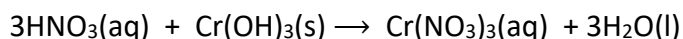
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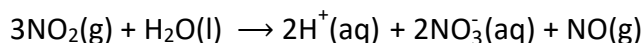
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Ch. 5 - Gases

Q6 # of moles = n ? P $V = 450 \text{ ml}$

$$T = 35 + 273 = 308 \text{ K}$$

$$P = \frac{740 \text{ mmHg}}{760 \text{ mmHg}} = 0.97 \text{ atm}$$

$$PV = nRT \Rightarrow n = \frac{0.450 \text{ L} \times 0.97 \text{ atm}}{0.082 \times 308 \text{ K}}$$

$$n = 0.017 \text{ mol}$$

Q7 $d = \text{Ar}$? at STP

$$d = \frac{PM_{wt}}{RT} = \frac{1 \text{ atm} \times 39.95 \text{ g/mol}}{0.0821 \times 273.15 \text{ K}}$$

$$= 1.78 \text{ g/L}$$

Q8 m (mass of unknown vapor) = 0.271 g

$$V = 294 \text{ ml} \xrightarrow{\div 1000} 0.294 \text{ L}$$

$$T = 140^\circ \text{C} \xrightarrow{+273} 413 \text{ K}$$

$$P = 847 \text{ mmHg} \xrightarrow{\div 760} 1.11 \text{ atm}$$

Empirical formula = $\text{CH}_2 = 14 \text{ g/mol}$

Molecular formula = ?

$$M_w = \frac{dRT}{P}$$

$$d = \frac{m(g)}{V(L)} = \frac{0.271}{0.294} = 0.921 \text{ g/L}$$

$$M_w = \frac{0.921 \times 0.0821 \times 413 \text{ K}}{1.11 \text{ atm}}$$

$$M_w = \text{Molecular formula} = 28 \text{ g/mol}$$

$$x = \frac{\text{Molecular}}{\text{Empirical}} = \frac{28}{14} = 2$$

$$2 \times \text{CH}_2 = \text{C}_2\text{H}_4 = \text{Molecular formula}$$

Q9

$$T = 21^\circ \text{C} \rightarrow 294 \text{ K}$$

$$P = \frac{685 \text{ mmHg}}{760} = 0.9 \text{ atm}$$

$$m_{\text{H}_2} = ? \quad V = 7.8 \text{ L}$$

$$P_{\text{water}} = \frac{18.6 \text{ mmHg}}{760} = 0.027 \text{ atm}$$

$$PV = nRT \Rightarrow PV = \frac{m}{M_w} RT$$

$$\Rightarrow m_{\text{H}_2} = \frac{P V M_w}{RT}$$

$$P_{\text{tot}} = P_{\text{H}_2} + P_{\text{H}_2\text{O}}$$

$$P_{\text{H}_2} = P_{\text{tot}} - P_{\text{H}_2\text{O}}$$

$$P_{\text{H}_2} = 0.9 - 0.027$$

$$P_{\text{H}_2} = 0.87 \text{ atm}$$

$$\text{now, } m = \frac{0.87 \text{ atm} \times 7.8 \text{ L} \times 2 \text{ g/mol}}{0.082 \times 294 \text{ K}}$$

$$m_{\text{H}_2} = 0.57 \text{ g}$$

Q10

$$V_{\text{CH}_2} = ? \quad T = 25^\circ \text{C} \rightarrow 298 \text{ K}$$

$$P = 0.950 \text{ atm}$$

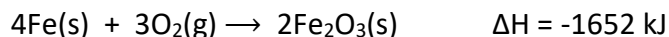
$$m_{\text{MnO}_2} = 12 \text{ g} \rightarrow \text{limiting Reagent and HCl excess}$$

$$V = \frac{nRT}{P}$$

$$n = \frac{12}{86.94} = 0.13 \text{ mol}$$

$$V = \frac{0.13 \times 0.082 \times 298}{0.95} = 3.35 \text{ L}$$

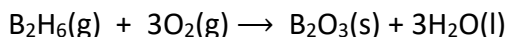
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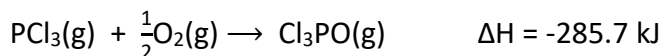
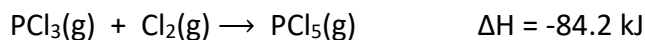
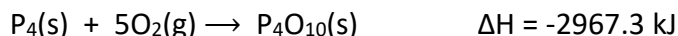
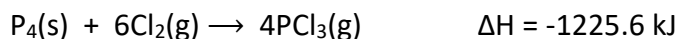
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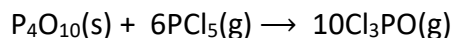
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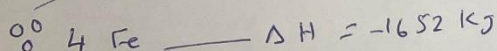
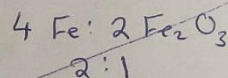
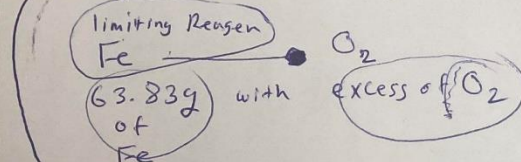
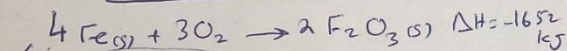


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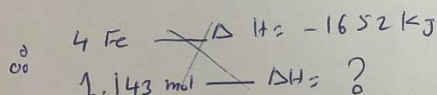
Ch. 6 - Thermodynamics

Q11

$$\Delta H = KJ ? = \ominus \text{ release?}$$



$$n = \frac{m}{M_{\text{wt}}} = \frac{63.83}{55.84} = 1.143 \text{ mol of Fe}$$

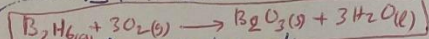


$$\Delta H = 472 \text{ kJ}$$

Q12 $\Delta H = ? \quad \Delta E = -2143.2 \text{ kJ}$

$$\Delta H = \Delta E + P \Delta V$$

$$\Delta H = \Delta E + RT \Delta n$$



$$\Delta n = 0 - 4 = -4$$

of reactant gases

of products gases

$$\Delta H = -2143.2 + 8.314(298)(-4) \quad \frac{1 \text{ kJ}}{1000 \text{ J}}$$

$$\Delta H = -2153.1 \text{ kJ/mol}$$

Q13

$$\Delta T = T_f - T_i \quad q = m \times s \times \Delta T$$

$$q = m \times s \times \Delta T$$

$$-9700 \text{ J} = 335 \text{ g} \times 4.184 \text{ J/g} \cdot ^\circ\text{C} \times \Delta T$$

$$\Delta T = -6.92^\circ\text{C} \Rightarrow \Delta T = T_f - T_i$$

$$T_f = \Delta T + T_i \Rightarrow T_f = -6.9 + 67.5 = 60.6^\circ\text{C}$$

Q14

$$\text{heat gained by water: } \Delta T = 62.64 - 22.07$$

$$q = m s \Delta T$$

$$m_{\text{H}_2\text{O}} = 107 \text{ ml} \rightarrow 0.107 \text{ L}$$

$$s = 4.184 \text{ J/g} \cdot ^\circ\text{C}$$

$$\Delta T = 22.07 - 21.3 = 0.77^\circ\text{C}$$

$$q_{\text{H}_2\text{O}} = 107 \times 4.184 \times 0.77$$

$$\approx 374 \text{ J}$$

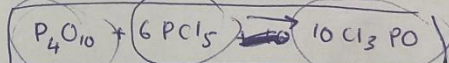
$$q_{\text{H}_2\text{O}} \text{ gained} \approx \text{metal lose}$$

$$\text{so } q = -374 \text{ J}$$

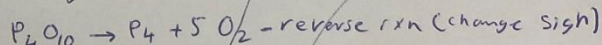
$$n = s_{\text{metal}} \times \frac{q}{m \Delta T}$$

Q15

to Calculate ΔH for the next reaction:



we use given rxns to do so.



$$\Delta H = (+) 2967.3 \text{ kJ}$$

- multiply by 6 and change sign

$$\Delta H = (+) \times 6(84.2) \text{ kJ}$$

- multiply by 10

$$\Delta H = -10(285.7) = -2857 \text{ kJ}$$

- add up the first rxn

$$\Delta H = -1225.6 \text{ kJ}$$

$$\text{so, } \Delta H = +2967.3 + 505.2 - 2857 - 1225.6$$

$$\Delta H = -610.1 \text{ kJ}$$