Part I. Multiple choice

Page 2:
1. D
2. D
3. B
4. C
5. C

Page 3:
6. A
7. D
8. D
9. C
10. D
11. B

Page 4:
12. A
13. A
14. C
15. A
16. C

Page 5:
17. C
18. B
19. E

Part II. Problems

1. worth 10 pts
Either use Hess’s law in the form of
\[
\Delta H_{\text{rxn}}^o = \sum_{\text{products}} (\text{stoich coeff}) \Delta H_f^o - \sum_{\text{reactants}} (\text{stoich coeff}) \Delta H_f^o
\]

\[
\Delta H_{\text{rxn}}^o = \left[\Delta H_f^o (\text{O}_3\text{(g)}) + 3\Delta H_f^o (\text{H}_2\text{(g)})\right] - 3\Delta H_f^o (\text{H}_2\text{O}(l))
\]

\[
= \left[\left(\frac{+271\text{kJ}}{2}\right) + 3(0)\right] - 3(-286\text{kJ})
\]

\[= +994\text{kJ}\]

or arrange the reactions so that they sum to the overall rxn

\((-3) \times \{\text{H}_2\text{(g)} + \frac{1}{2} \text{O}_2\text{(g)} \rightarrow \text{H}_2\text{O}\text{(l)}\} \Delta H^o = (-3) \times \{-286\text{kJ}\}\]

\(\frac{1}{2} \times \{3\text{O}_2\text{(g)} \rightarrow 2\text{O}_3\text{(g)}\} \Delta H^o = \frac{1}{2} \times \{+271\text{kJ}\}\)

sums to:

\(3\text{H}_2\text{(g)} + \text{O}_3\text{(g)} \rightarrow 3\text{H}_2\text{O}\text{(l)}\) with sum of \(\Delta H^o = +994\text{kJ}\)

2. worth 20 pts, each part worth 5 pts

a) \(\text{AgNO}_3\) available = \((0.1300\text{L})(0.110\text{M}) = 0.0143\text{mol}\)

\(\text{CaCl}_2\) available = \((0.0900\text{L})(0.095\text{M}) = 0.0086\text{mol}\)

need 2:1 mole ratio, so \(\text{AgNO}_3\) is limiting moles of \(\text{AgCl}\) that form:

\[= 0.0143\text{mol AgNO}_3 \times \frac{2\text{mol AgCl}}{2\text{mol AgNO}_3} = 0.0143\text{mol AgCl}\]

b) temperature change \(\Delta T = 27.00 - 25.00 = 2.00\text{°C}\)

mass of solution = \(220.0\text{mL} \times 1.000\text{g/mL} = 220.0\text{g}\)

heat,

\[q = mc\Delta T = (220.0\text{g}) \left(4.184 \frac{\text{J}}{\text{g}\cdot\text{°C}} \right) \left(2.00\text{°C}\right) = 1841\text{J} = 1.84\text{kJ}\]

c) reaction shown is exothermic because water temperature increased (indicating that reaction system gave off heat energy)

d) \(\Delta H_{\text{rxn}}\) in \(\frac{kJ}{\text{mol AgCl}} = \frac{1.84\text{kJ}}{0.0143\text{mol AgCl}} = 129\text{kJ/mol}\)

so \(\Delta H_{\text{rxn}} = -129\text{kJ/mol}\)