

Show all the work for the calculations and give the answers in the correct significant figures.

- 1) Calculate the heat capacity of a piece of iron if a temperature rise from 18 to 69 °C requires 672 J of heat. (Ans: 13 J/°C)

$$\Delta T = 69 - 18 = 51^\circ\text{C}$$

$$q = c \Delta T$$

$$c = \frac{q}{\Delta T} = \frac{672}{51} = \boxed{13 \text{ J/}^\circ\text{C}}$$

- 2) How much heat in KJ is required to raise the temperature of

- a) A 320.0 g of water from 15.0 to 96.0 °C? (Ans: 108 KJ)

$$q = 320 \text{ g} \times \frac{4.18 \text{ J}}{\text{g}^\circ\text{C}} \times (96 - 15)^\circ\text{C}$$

$$= \boxed{108 \text{ KJ}}$$

$$q = ms \Delta T$$

- b) And 74.3 g of ethanol from -36.4 to 44.5 °C? (Ans: 14.8 KJ)

$$q = 74.3 \text{ g} \times \frac{2.46 \text{ J}}{\text{g}^\circ\text{C}} \times (44.5 - (-36.4))^\circ\text{C}$$

$$= \boxed{14.8 \text{ KJ}}$$

- 3) A 638 g block of lead initially at 27.0 °C absorbs 2044 J of heat. What is the final temperature of the lead block? (Ans: 52.0 °C)

$$q = ms \Delta T$$

$$\Delta T = \frac{q}{ms} = \frac{2044 \text{ J}}{638 \text{ g} \times \frac{0.128 \text{ J}}{\text{g}^\circ\text{C}}} = 25^\circ\text{C}$$

$$25^\circ\text{C} = T_f - 27.0^\circ\text{C}$$

$$\boxed{T_f = 52^\circ\text{C}}$$

- 4) A 500.0 mL sample of 0.500 M NaOH at 20.00 °C is mixed with an equal volume of 0.500 M HCl at the same temperature in a foam cup calorimeter. The temperature rises to 23.21 °C. What is the ΔH of the reaction? (Ans: -53.5 KJ/mol)

total vol = 500 + 500 = 1000 mL \approx 1000 g.

$$① q_{cal} = MS\Delta T = 1000g \text{ soln} \times \frac{4.18J}{g^{\circ}C} \times (23.21 - 20)^{\circ}C = 13.42 kJ$$

$$q_{rxn} = -q_{cal} = -13.42 kJ$$

$$② \text{ Calculate mols } 0.5L \times \frac{0.5 \text{ mol}}{L} = 0.25 \text{ mol NaOH} \times \frac{1 \text{ mol H}_2\text{O}}{1 \text{ mol NaOH}} = 0.25 \text{ mol}$$

$$③ \text{ molar } \Delta H = \frac{-13.42 kJ}{0.25 \text{ mol}} = \boxed{-53.7 kJ}$$

- 5) A 1.50 g sample of NH_4NO_3 (s) is added to 35.0 g of water in a foam cup calorimeter and stirred until dissolved. The temperature of the solution drops from 22.7 to 19.4 °C. What is the heat of solution of the NH_4NO_3 ? (Ans: +27 KJ/mol)

$$① q_{cal} = MS\Delta T = 35g \text{ H}_2\text{O} \times \frac{4.18J}{g^{\circ}C} \times (19.4 - 22.7)^{\circ}C = -483J$$

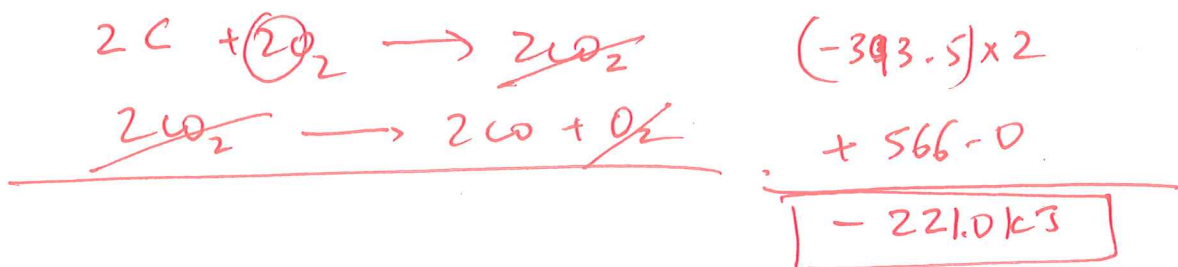
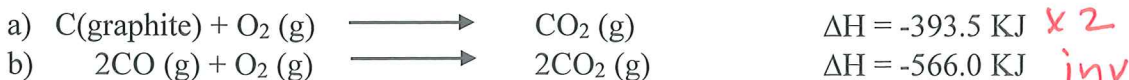
$$② q_{rxn} = -q_{cal} = +483J \text{ (endo)}$$

$$\text{NH}_4\text{NO}_3 = 80.05g/\text{mol}$$

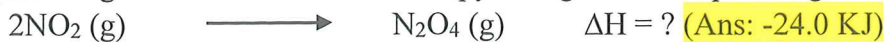
$$③ \frac{483J}{1.5g \text{ NH}_4\text{NO}_3} \times \frac{80.05g \text{ NH}_4\text{NO}_3}{1 \text{ mol}} = \boxed{26 kJ/\text{mol}}$$

- 6) Use the equations given to calculate the enthalpy change for the equation given below.
 $2C(\text{graphite}) + O_2(g) \longrightarrow 2CO(g) \quad \Delta H = ?$ (Ans: -221.0 KJ)

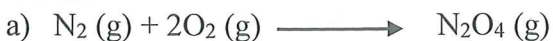
Given:



7) Use the equations given to calculate the enthalpy change for the equation given below.



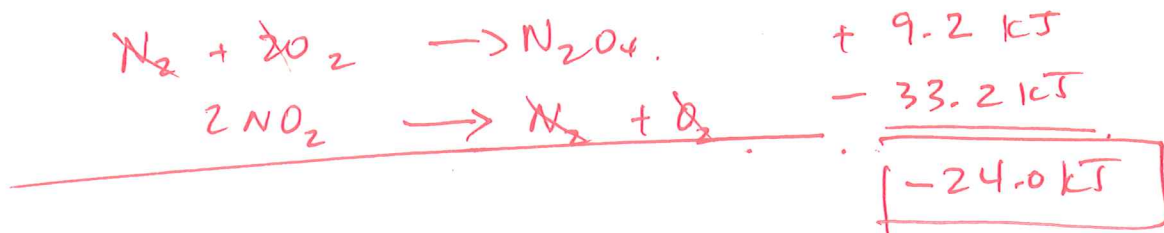
Given:



$\Delta H = +9.2 \text{ KJ}$ - as is



$\Delta H = +33.2 \text{ KJ}$ inv



8) Use the standard enthalpies of formation from the Appendix to calculate the standard enthalpy change for the following reactions.



$(\text{Ans: } -19 \text{ KJ})$ 7698



$(\text{Ans: } -1095.9 \text{ KJ})$

