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Answer key
10/13/25

Extra Chapter 5 Problems

A gas absorbs 62 kJ of heat and does 48 kJ of work on the system. Calculate ΔE.

$q = +62\,kJ$

$w = +48\,kJ$

$\Delta E = q + w$

$= (62\,kJ) + (48\,kJ)$

$= \boxed{110\,kJ}$

Calculate the change in internal energy of the system if it releases 415 kJ of heat and does 562 kJ of work on the surroundings.

$\Delta E = q + w$

$\Delta E = ?$

$q = -415\,kJ$

$w = -562\,kJ$

$= (-415\,kJ) + (-562\,kJ)$

$= \boxed{-977\,kJ}$

How much heat does it take to increase the temperature of a 540.6g sample of Fe from 20.0 °C to 84.3 °C? The specific heat of iron = 0.450 J/g °C.

$q = mc\Delta T$

$q = ?$

$m = 540.6\,g$

$c = 0.450\,J/g^\circ C$

$\Delta T = 84.3^\circ C - 20.0^\circ C = 64.3^\circ C$

$= (540.6\,g)(0.450\,J/g^\circ C)(64.3^\circ C)$

$= \boxed{1.56 \times 10^4\,J}$

Calculate the specific heat capacity of a metal if a 17.0 g sample requires 481 J to change the temperature of the metal from 25.0 °C to 67.0 °C?

$q = 481\,J$

$m = 17.0\,g$

$c = ?$

$\Delta T = 67.0^\circ C - 25.0^\circ C = 42.0^\circ C$

$\frac{q}{m\Delta T} = \frac{mc\Delta T}{m\Delta T}$

$c = \frac{q}{m\Delta T}$

$= \frac{(481\,J)}{(17.0\,g)(42.0^\circ C)}$

$= \boxed{0.674\,J/g^\circ C}$

The enthalpy change for the reaction is given below:

$$2CH_3OH\ (l) + 3O_2\ (g) \rightarrow 4H_2O\ (l) + 2CO_2\ (g) \qquad \Delta H = -1452.8\ \text{kJ}$$

What quantity of heat is released (in Joules) for each mole of water formed? Go to 2 sig figs.

$$\frac{4\ \text{mol}\ H_2O}{} \left| \frac{-1452.8\ \text{kJ}}{1\ \text{mol}\ H_2O} \right. = -5811.2\ \text{kJ}$$

$$\frac{-5811.2\ \text{kJ}}{} \left| \frac{1000\ \text{J}}{1\ \text{kJ}} \right. = \boxed{-5.8 \times 10^6\ \text{J}}$$

How much heat will be released (in J) if 44.8 g of SO_2 is reacted with an excess of oxygen according to the following chemical equation? (MW SO_2=64.064g). [redacted].

$$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g) \qquad \Delta H = -198\ \text{kJ}$$

$$\frac{44.8\ \text{g}\ SO_2}{} \left| \frac{1\ \text{mol}\ SO_2}{64.064\ \text{g}\ SO_2} \right| \frac{-198\ \text{kJ}}{2\ \text{mol}\ SO_2} = -69.2\ \text{kJ}$$

$$\frac{-69.2\ \text{kJ}}{} \left| \frac{1000\ \text{J}}{1\ \text{kJ}} \right. = \boxed{-6.92 \times 10^4\ \text{J}}$$

Calculate ΔH for this reaction:

$$CH_4(g) + NH_3(g) \text{ ---> } HCN(g) + 3H_2(g)$$

given:

flip $\div 2$ $\left(N_2(g) + 3H_2(g) \text{ ---> } 2NH_3(g) \right)$ $\Delta H = -91.8$ kJ

flip $C(s) + 2H_2(g) \text{ ---> } CH_4(g)$ $\Delta H = -74.9$ kJ

$\div 2$ $\left(H_2(g) + 2C(s) + N_2(g) \text{ ---> } 2HCN(g) \right)$ $\Delta H = +270.3$ kJ

$NH_3(g) \rightarrow 0.5 N_2(g) + 1.5 H_2(g)$ $\Delta H = +45.9$ kJ

$CH_4(g) \rightarrow \cancel{C(s)} + 2 H_2(g)$ $\Delta H = +74.9$ kJ

$0.5 H_2(g) + \cancel{C(s)} + 0.5 N_2(g) \rightarrow HCN(g)$ $\Delta H = +135.15$ kJ

$0.5 H_2 + \cancel{0.5 N_2} \rightarrow \cancel{0.5 N_2} + 1.5 H_2 + 2 H_2$

$3.5 H_2 - 0.5 H_2 = 3 H_2$

$NH_3(g) + CH_4(g) \rightarrow HCN(g) + 3 H_2(g)$ $\boxed{\Delta H = +256.0 \text{ kJ}}$

Determine if it's endothermic or exothermic:

$6CO_2 + 6H_2O + \Delta \rightarrow C_6H_{12}O_6 + 6O_2$

Photosynthesis

Endothermic

Cooking an egg - Egg absorb Δ

Endothermic

Hand warmers - release Δ

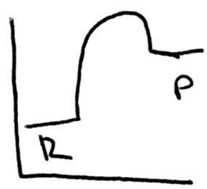
Exothermic

Campfire with logs burning - Logs release Δ

- combustion of wood

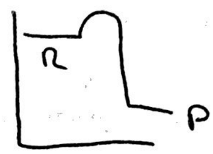
Exothermic

ΔH_f° = products - reactants



Endothermic

- Bonds breaking



Exothermic

- Bonds forming