PROBLEM \(\PageIndex{1}\))

How much heat is produced by burning 4.00 moles of acetylene under standard state conditions?

**Answer**

5204.4 kJ

PROBLEM \(\PageIndex{2}\))

How much heat is produced by combustion of 125 g of methanol (CH\(_3\)OH) under standard state conditions?

**Answer**

2836.3 kJ

Click here to see a video of the solution

*The section number changed after this video was made*

PROBLEM \(\PageIndex{3}\))

How many moles of isooctane must be burned to produce 100 kJ of heat under standard state conditions?

**Answer**

1.83 × 10^-2 mol
PROBLEM \(\PageIndex{4}\)

What mass of carbon monoxide must be burned to produce 175 kJ of heat under standard state conditions?

Answer

17.3 g

Click here to see a video of the solution

*The section number changed after this video was made*

PROBLEM \(\PageIndex{5}\)

When 2.50 g of methane burns in oxygen, 125 kJ of heat is produced. What is the enthalpy of combustion per mole of methane under these conditions?

Answer

802 kJ mol\(^{-1}\)

PROBLEM \(\PageIndex{6}\)

a. How much heat is produced when 100 mL of 0.250 M HCl (density, 1.00 g/mL) and 200 mL of 0.150 M NaOH (density, 1.00 g/mL) are mixed? (Refer to Example 8.2.1 for how the heat of this reaction was derived)

\(\ce{HCl(aq)+NaOH(aq)?NaCl(aq)+H2O(l)}\hspace{20px}\Delta H^{\circ}_{298}=-58\text{kJ/mol}\)
b. If both solutions are at the same temperature and the heat capacity of the products is 4.19 J/g °C, how much will the temperature increase? What assumption did you make in your calculation?

Answer a

-1.45 kJ

Answer b

-1.15 °C, assuming the products have the same density as the reactants (1.00 g/mL)

Click here to see a video of the solution

*The section number changed after this video was made*

PROBLEM \((\text{PageIndex}(7))\)

A sample of 0.562 g of carbon is burned in oxygen in a bomb calorimeter, producing carbon dioxide. Assume both the reactants and products are under standard state conditions, and that the heat released is directly proportional to the enthalpy of combustion of graphite. The temperature of the calorimeter increases from 26.74 °C to 27.93 °C. What is the heat capacity of the calorimeter and its contents?

Answer

15.5 kJ/°C

PROBLEM \((\text{PageIndex}(8))\)
Homes may be heated by pumping hot water through radiators. What mass of water will provide the same amount of heat when cooled from 95.0 to 35.0 °C, as the heat provided when 100 g of steam is cooled from 110 °C to 100 °C.

**Answer**

7.43 g

**PROBLEM**

The following sequence of reactions occurs in the commercial production of aqueous nitric acid:

\[
\ce{4NH3(g)+5O2(g)?4NO(g)+6H2O(l)\hspace{20px}ΔH=−907\:kJ}\\
\ce{2NO(g)+O2(g)?2NO2(g)\hspace{20px}ΔH=−113\:kJ}\\
\ce{3NO2+H2O(l)?2HNO2(aq)+NO(g)\hspace{20px}ΔH=−139\:kJ}\\
\]

Determine the total energy change for the production of one mole of aqueous nitric acid by this process.

**Answer**

495 kJ/mol

**PROBLEM**

Both graphite and diamond burn.

\[
\ce{C(s,\:diamond)+O2(g)?CO2(g)}\\
\]

For the conversion of graphite to diamond:

\[
\ce{C(s,\:graphite)?C(s,\:diamond)\hspace{20px}ΔH^\circ_{298}=1.90\:kJ}\\
\]

Which produces more heat, the combustion of graphite or the combustion of diamond? (Hint: The heats of formation for all these compounds can be found in Table T1).

**Answer**

Diamond

**PROBLEM**

Calculate \(ΔH\) for the process

\[
\ce{Hg2Cl2(s)?2Hg(l)+Cl2(g)}\\
\]

from the following information:

\[
\ce{Hg(l)+Cl2(g)?HgCl2(s)\hspace{20px}ΔH=−224\:kJ}\\
\ce{Hg(l)+HgCl2(s)?Hg2Cl2(s)\hspace{20px}ΔH=−41.2\:kJ}\\
\]

4
PROBLEM \(\PageIndex{12}\)

Using the data in Table T1, calculate the standard enthalpy change for each of the following reactions:

a. \(\ce{N2}(g)+\ce{O2}(g)?\ce{2NO}(g)\)

b. \(\ce{Si}(s)+\ce{2Cl2}(g)?\ce{SiCl4}(g)\)

c. \(\ce{Fe2O3}(s)+\ce{3H2}(g)?\ce{2Fe}(s)+\ce{3H2O}(l)\)

d. \(\ce{2LiOH}(s)+\ce{CO2}(g)?\ce{Li2CO3}(s)+\ce{H2O}(g)\) (Hint: For \(\ce{LiOH}(s)\), \(\Delta H_f = -487.5\) kJ/mol; For \(\ce{Li2CO3}(s)\), \(\Delta H_f = -1216.04\) kJ/mol)

\begin{align*}
\text{Answer} & \quad 182.6\text{ kJ} \\
\text{Answer} & \quad -657.0\text{ kJ mol}^{-1} \\
\text{Answer} & \quad -33.2\text{ kJ} \\
\text{Answer} & \quad -89.34\text{ kJ}
\end{align*}
PROBLEM \(\PageIndex{13}\)

Using the data in Table T1, calculate the standard enthalpy change for each of the following reactions:

a. \(\ce{Si(s) + 2F2(g) \rightarrow SiF4(g)}\) (Hint: For \(\ce{SiF4(g)}\), \(\Delta H_f = -1615.0 \text{ kJ/mol}\))

b. \(\ce{2C(s) + 2H2(g) + O2(g) \rightarrow CH3CO2H(l)}\) (Hint: For \(\ce{CH3CO2H(l)}\), \(\Delta H_f = -484.3 \text{ kJ/mol}\))

c. \(\ce{CH4(g) + N2(g) \rightarrow HCN(g) + NH3(g)}\)

d. \(\ce{CS2(g) + 3Cl2(g) \rightarrow CCl4(g) + S2Cl2(g)}\) (Hint: For \(\ce{S2Cl2(g)}\), \(\Delta H_f = -19.5 \text{ kJ/mol}\))

**Answer a**

\(-1615.0 \text{ kJ mol}^{-1}\)

**Answer b**

\(-484.3 \text{ kJ mol}^{-1}\)

**Answer c**

164.2 kJ
Answer d

\[-232.1 \text{ kJ}\]

---

**Have a video solution request?**

Let your professors know here.

***Please know that you are helping future students - videos will be made in time for next term's class.***

---

**Contributors**

- Paul Flowers (University of North Carolina - Pembroke), Klaus Theopold (University of Delaware) and Richard Langley (Stephen F. Austin State University) with contributing authors. Textbook content produced by OpenStax College is licensed under a [Creative Commons Attribution License 4.0](http://cnx.org/contents/85abf193-2bd...a7ac8df6@9.110) license. Download for free at [http://cnx.org/](http://cnx.org/)

- Adelaide Clark, Oregon Institute of Technology

---

**Feedback**

Think one of the answers above is wrong? Let us know here.