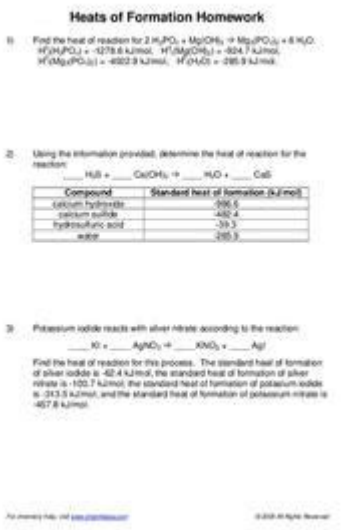
Heat Of Formation Worksheet With Answers



Heats of Formation Homework

1) Find the heat of reaction for $2\ H_3PO_4 + Mg(OH)_2 \rightarrow Mg_3(PO_4)_2 + 6\ H_2O$.
$H^\circ_f(H_3PO_4) = -1278.6$ kJ/mol, $H^\circ_f(Mg(OH)_2) = -924.7$ kJ/mol,
$H^\circ_f(Mg_3(PO_4)_2) = -4602.9$ kJ/mol, $H^\circ_f(H_2O) = -285.9$ kJ/mol.

2) Using the information provided, determine the heat of reaction for the reaction:
____ H_2S + ____ $Ca(OH)_2$ → ____ H_2O + ____ CaS

Compound	Standard heat of formation (kJ/mol)
calcium hydroxide	-986.6
calcium sulfide	-482.4
hydrosulfuric acid	-39.3
water	-285.8

3) Potassium iodide reacts with silver nitrate according to the reaction:
____ KI + ____ $AgNO_3$ → ____ KNO_3 + ____ AgI
Find the heat of reaction for this process. The standard heat of formation of silver iodide is -62.4 kJ/mol, the standard heat of formation of silver nitrate is -100.7 kJ/mol, the standard heat of formation of potassium iodide is -343.5 kJ/mol, and the standard heat of formation of potassium nitrate is -457.8 kJ/mol.

Heat of formation worksheet with answers is an essential tool for students and educators in the field of chemistry. Understanding the concept of heat of formation is crucial for anyone studying thermodynamics, as it lays the groundwork for comprehending how energy changes during chemical reactions. This article will delve into the definition of heat of formation, its significance, how to calculate it, and provide a worksheet with answers to solidify understanding.

Understanding Heat of Formation

Definition

The heat of formation, also known as standard enthalpy of formation, is defined as the change in enthalpy when one mole of a compound is formed from its elements in their standard states. The standard state of a substance is defined as its most stable form at 1 atm pressure and a specified temperature, typically 25°C (298 K).

Importance in Chemistry

The heat of formation is crucial for several reasons:

1. Predicting Reaction Feasibility: It helps in determining whether a reaction is exothermic (releases heat) or endothermic (absorbs heat).
2. Calculating Reaction Enthalpies: By using the heats of formation of reactants and products, one can

calculate the overall enthalpy change of a chemical reaction.
3. Understanding Stability: Compounds with lower heats of formation are generally more stable than those with higher heats of formation.

Calculating Heat of Formation

The Formula

The enthalpy change of a reaction can be calculated using Hess's Law, which states that the total enthalpy change in a chemical reaction is the sum of the enthalpy changes for each step of the reaction. The formula for calculating the heat of formation is:

$$
\Delta H_{reaction} = \sum (\Delta H_f^{products}) - \sum (\Delta H_f^{reactants})
$$

where:
- $\Delta H_{reaction}$ is the enthalpy change of the reaction.
- ΔH_f represents the standard heat of formation of the respective substances.

Standard Heat of Formation Values

The standard heat of formation values are typically found in tables, with the following points to note:

- The heat of formation for any element in its standard state is zero (e.g., $O_2(g)$, $N_2(g)$, $H_2(g)$).
- Values are usually expressed in kilojoules per mole (kJ/mol).

Heat of Formation Worksheet

This worksheet provides a variety of exercises to help students practice calculating the heat of formation for different chemical reactions. Below are several problems along with their answers.

Problem 1: Combustion of Methane

Calculate the enthalpy change for the combustion of methane:

\[

$$
\text{CH}_4(g) + 2\text{O}_2(g) \rightarrow \text{CO}_2(g) + 2\text{H}_2\text{O}(l)
$$

Given:
- ΔH_f° of $CH_4(g)$ = -74.8 kJ/mol
- ΔH_f° of $O_2(g)$ = 0 kJ/mol
- ΔH_f° of $CO_2(g)$ = -393.5 kJ/mol
- ΔH_f° of $H_2O(l)$ = -285.8 kJ/mol

Answer:
$$
\Delta H_{reaction} = [\Delta H_f^\circ(\text{CO}_2) + 2 \times \Delta H_f^\circ(\text{H}_2\text{O})] - [\Delta H_f^\circ(\text{CH}_4) + 2 \times \Delta H_f^\circ(\text{O}_2)]
$$
$$
\Delta H_{reaction} = [-393.5 + 2 \times (-285.8)] - [-74.8 + 2 \times 0]
$$
$$
\Delta H_{reaction} = [-393.5 - 571.6] - [-74.8]
$$
$$
\Delta H_{reaction} = -965.1 + 74.8 = -890.3 \text{ kJ/mol}
$$

Problem 2: Formation of Ammonia

Determine the enthalpy change for the formation of ammonia from its elements:

$$
\text{N}_2(g) + \frac{3}{2}\text{H}_2(g) \rightarrow 2\text{NH}_3(g)
$$

Given:
- ΔH_f° of $NH_3(g)$ = -45.9 kJ/mol
- ΔH_f° of $N_2(g)$ = 0 kJ/mol
- ΔH_f° of $H_2(g)$ = 0 kJ/mol

Answer:
$$
\Delta H_{reaction} = [2 \times \Delta H_f^\circ(\text{NH}_3)] - [\Delta H_f^\circ(\text{N}_2) + \frac{3}{2} \times \Delta H_f^\circ(\text{H}_2)]
$$
$$
\[

$$
\Delta H_{reaction} = [2 \times (-45.9)] - [0 + \frac{3}{2} \times 0]
$$
$$
\Delta H_{reaction} = -91.8 - 0 = -91.8 \text{ kJ/mol}
$$

Problem 3: Formation of Water

Calculate the heat of formation for the formation of water from hydrogen and oxygen:

$$
2\text{H}_2(g) + \text{O}_2(g) \rightarrow 2\text{H}_2\text{O}(l)
$$

Given the same values for water as in Problem 1.

Answer:
$$
\Delta H_{reaction} = [2 \times \Delta H_f^\circ(\text{H}_2\text{O})] - [2 \times \Delta H_f^\circ(\text{H}_2) + \Delta H_f^\circ(\text{O}_2)]
$$
$$
\Delta H_{reaction} = [2 \times (-285.8)] - [2 \times 0 + 0]
$$
$$
\Delta H_{reaction} = -571.6 - 0 = -571.6 \text{ kJ/mol}
$$

Conclusion

The heat of formation worksheet with answers serves as a valuable educational resource for students learning about thermodynamics and chemical reactions. Understanding how to calculate the heat of formation enables learners to grasp the energy changes that accompany chemical processes. Through practice problems like those provided, students can enhance their analytical skills and gain a deeper understanding of the principles governing chemical reactions. With continued practice, mastering the concept of heat of formation will become an attainable goal for any chemistry student.

Frequently Asked Questions

What is the heat of formation?

The heat of formation is the change in enthalpy when one mole of a compound is formed from its elements in their standard states.

How do you calculate the heat of formation using a worksheet?

You can calculate the heat of formation by using the formula $\Delta H_f = \Sigma(\Delta H_f \text{ products}) - \Sigma(\Delta H_f \text{ reactants})$, where ΔH_f represents the standard enthalpy of formation.

What information is typically included in a heat of formation worksheet?

A heat of formation worksheet typically includes a list of compounds, their chemical formulas, standard heats of formation values, and space for calculations.

What are standard conditions for heat of formation measurements?

Standard conditions are defined as a temperature of 25°C (298 K) and a pressure of 1 atmosphere (101.3 kPa).

Why are standard heats of formation important in thermodynamics?

Standard heats of formation are important because they allow chemists to predict the energy changes during chemical reactions and calculate reaction enthalpies.

Can the heat of formation be negative, and what does it indicate?

Yes, the heat of formation can be negative, which indicates that the formation of the compound from its elements releases energy (exothermic reaction).

What is the heat of formation for elements in their standard state?

The heat of formation for elements in their standard state is defined as zero.

How can a heat of formation worksheet help in balancing chemical equations?

A heat of formation worksheet can help in balancing chemical equations by providing the necessary enthalpy values to calculate the overall energy change and ensure conservation of energy.

Are there online resources available for heat of formation worksheets?

Yes, there are many online resources, including educational websites and chemistry databases, that provide downloadable heat of formation worksheets and calculators.

Heat Of Formation Worksheet With Answers

Decoding facebook's blob video url - Stack Overflow
Facebook downloads the audio and the video separately, so get the audio link from the google chrome inspector, by right click on the video and choosing inspect ,going to Inspector, Network …

How to resolve Facebook Login is currently unavailable for this ...
Jul 28, 2021 · In the facebook developers console for your app, go to App Review-> Permissions and Features. Set the public_profile and email to have advanced access. This will allow all …

What are all the custom URL schemes supported by the …
Note These URL's are likely not available. Facebook has been updated a number of times and did not officially support any of these. /Note I am trying to see what information is available about...

application_id needs to be Valid Facebook Ad - Stack Overflow
Dec 11, 2020 · application_id needs to be Valid Facebook Ad Asked 4 years, 7 months ago Modified 1 year, 2 months ago Viewed 46k times

Facebook share link - can you customize the message body text?
Feb 17, 2011 · Facebook will not allow developers pre-fill messages. Developers may customize the story by providing OG meta tags, but it's up to the user to fill the message. This is only …

Facebook share link without JavaScript - Stack Overflow
Learn how to create a Facebook share link without using JavaScript, including tips and solutions for effective sharing.

Where can I find my Facebook application id and secret key?
Jul 8, 2010 · In my Facebook account, where can I find these application IDs, secret key, all?

How to add facebook share button on my website? - Stack Overflow
May 9, 2013 · Note that with using the Facebook SDK your users are being tracked only by visiting your site; they don't even need to click any of your Share or Like buttons. The answers …

How do I remove my Paypal account from Facebook?
Now, i went into the payment settings on facebook and tried to remove my paypal account. It said i had to login to paypal.com and decline the facebook agreement in the settings.

Newest Questions - Stack Overflow
I have obtained advanced access to Facebook's Graph API user_link, which results in an app-scoped ID accessible only to the logged-in user. The user_link document clearly states: The …

Official Detroit Tigers Website | MLB.com
The official website of the Detroit Tigers with the most up-to-date information on news, tickets, schedule, stadium, roster, rumors, scores, and stats.

Detroit Tigers Scores, Stats and Highlights - ESPN
Visit ESPN for Detroit Tigers live scores, video highlights, and latest news. Find standings and the full 2025 season schedule.

Detroit Tigers: Breaking News, Rumors & Highlights | Yardbarker
2 days ago · Get the latest Detroit Tigers news, rumors, scores and highlights from Yardbarker, your source for the best Detroit Tigers content on the web.

Detroit Tigers trade deadline rumor tracker: Latest news, updates
1 day ago · Follow the latest rumors, news updates and analysis as the Detroit Tigers get active at the 2025 MLB trade deadline.

Detroit Tigers News, Scores, Status, Schedule - MLB
6 days ago · Get the latest news and information for the Detroit Tigers. 2025 season schedule, scores, stats, and highlights. Find out the latest on your favorite MLB teams on CBSSports.com.

Detroit Tigers News: Breaking News, Scores, Highlights & Stats ...
Tigers make trade with Phillies, send outfielder to Philadelphia Justin Backer • 9hr

Detroit Tigers, MLB, AL Central news and scores - Detroit News ...
Complete coverage of the Detroit Tigers, the AL Central and Major League Baseball, with news, scores and opinions from The Detroit News Sports team.

Tigers snap six-game losing streak with 10-4 win over Blue Jays
1 day ago · Jack Flaherty pitched six scoreless innings, Gleyer Torres hit a three-run homer and the Detroit Tigers ended a six-game losing streak with a 10-4 victory over the Toronto Blue Jays.

Detroit Tigers - News, Schedule, Scores, Roster, and Stats - The Athletic
Breaking Detroit Tigers news and in-depth analysis from the best newsroom in sports. Follow your favorite clubs. Get the latest injury updates, player news and more from around the league.

Detroit Tigers Baseball - MLB - mlive.com
Get the latest Detroit Tigers team and players news, blogs, rumors, schedule, roster, audio and more. Comment on the news and join Tigers fan forum at MLive.com.

Back to Home