

- For the reaction $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$ at 25 °C

$$\Delta H^\circ = -198.4 \text{ kJ mol}^{-1} \text{ and } \Delta S^\circ = -187.9 \text{ J K}^{-1} \text{ mol}^{-1}$$

Show that this reaction is spontaneous in the forward direction at 25 °C.

If the volume of the reaction system is increased at 25 °C, in which direction will the equilibrium move?

Calculate the value of the equilibrium constant, K_p , at 25 °C.

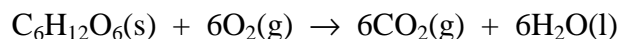
$K_p =$

Assuming ΔH° and ΔS° are independent of temperature, in which temperature range is the reaction non-spontaneous?

Answer:

Marks
5

- Glucose is a common food source. The net reaction for its metabolism in humans is:



Calculate ΔH° for this reaction given the following heats of formation.

$$\Delta H^\circ_f(\text{C}_6\text{H}_{12}\text{O}_6(\text{s})) = -1274 \text{ kJ mol}^{-1}, \quad \Delta H^\circ_f(\text{CO}_2(\text{g})) = -393 \text{ kJ mol}^{-1} \quad \text{and}$$
$$\Delta H^\circ_f(\text{H}_2\text{O}(\text{l})) = -285 \text{ kJ mol}^{-1}$$

Answer:

If the combustion of glucose is carried out in air, water is produced as a vapour. Calculate the ΔH° for the combustion of glucose in air given that

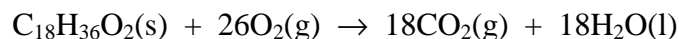


Answer:

Will ΔS be different for the two oxidation reactions? If so, how will it differ and why?

Marks
5

- Stearic acid, $C_{18}H_{36}O_2$, is a fatty acid common in animal fats and vegetable oils and is a valuable energy source for mammals. The net reaction for its metabolism in humans is:



Calculate ΔH° for this reaction given the following heats of formation.

$$\Delta H_f^\circ (C_{18}H_{36}O_2(s)) = -948 \text{ kJ mol}^{-1}, \quad \Delta H_f^\circ (CO_2(g)) = -393 \text{ kJ mol}^{-1} \text{ and}$$

$$\Delta H_f^\circ (H_2O(l)) = -285 \text{ kJ mol}^{-1}$$

Answer:

If the combustion of stearic acid is carried out in air, water is produced as a vapour. Calculate the ΔH° for the combustion of stearic acid in air given that



Answer:

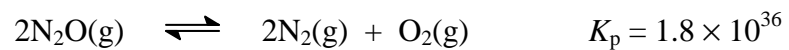
Will ΔS be different for the two oxidation reactions? If so, how will it differ and why?

Calculate the mass of carbon dioxide produced by the complete oxidation of 1.00 g of stearic acid.

Answer:

4

- Nitrous oxide decomposes at 25 °C according to the following equation.

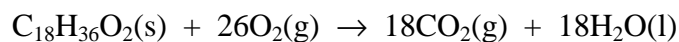


What is the value for K_p at 40 °C?

Answer:

Is the reaction endothermic or exothermic? Give a reason for your answer.

- Stearic acid, $C_{18}H_{36}O_2$, is a fatty acid common in animal fats and vegetable oils and is a valuable energy source for mammals. The net reaction for its metabolism in humans is:



Calculate ΔH° for this reaction given the following heats of formation.

Compound	$C_{18}H_{36}O_2(s)$	$CO_2(g)$	$H_2O(l)$
$\Delta_f H^\circ / \text{kJ mol}^{-1}$	-948	-393	-285

$\Delta H^\circ =$

If the combustion of stearic acid is carried out in air, water is produced as a vapour. Calculate the ΔH° for the combustion of stearic acid in air given that:



$\Delta H^\circ =$

Will ΔS be different for the two oxidation reactions? If so, how will it differ and why?

Calculate the mass of carbon dioxide produced by the complete oxidation of 1.00 g of stearic acid.

Answer:

Marks
5

- The autoionisation of water conforms to the following balanced equation:



Is this an exothermic or endothermic reaction?

What will happen to the equilibrium if the temperature is raised?

The equilibrium constant, K , for this reaction is 1.8×10^{-16} at 25°C . Calculate ΔG .

Answer:

Why is ΔG not equal to ΔH for this reaction?

The pH of pure water is 6.81 at 37°C . Is water acidic, basic or neutral at this temperature? Explain.