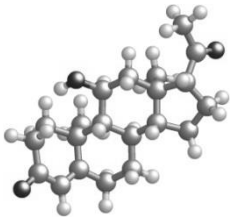


Chem!stry

Name: …… **( )**

Class: ……

Date: …… **/** …… **/** ……

Investigating Exothermic Reactions at the Molecular Level – Methane

Question 1:

a) Explain what is meant by the term *exothermic* chemical reaction:

……

……

b) For an *exothermic* chemical reaction, the energy change is: ☐ Positive ☐ Negative

Question 2:

a) Explain what is meant by the term *endothermic* chemical reaction:

……

……

b) For an *endothermic* chemical reaction, the energy change is: ☐ Positive ☐ Negative

Question 3:

During a chemical reaction, existing chemical bonds are *broken* and new chemical bonds are *formed*.

a) Bond breaking is: ☐ Exothermic ☐ Endothermic

b) Bond formation is: ☐ Exothermic ☐ Endothermic

Question 4:

The following word equation describes the combustion of methane forming carbon dioxide and water:

methane + oxygen $\rightarrow$ carbon dioxide + water

Write the balanced chemical equation for this reaction, including state symbols:

……

Question 5:

For the combustion of methane forming carbon dioxide and water, $\Delta H = -890$ kJ.

a) What is meant by the term ΔH?

……

b) What is the significance of the value −890 kJ?

……

Question 6:

Using the molecular modelling kits that have been provided, apply your knowledge bonding to construct molecular models of methane and oxygen. Now *react* the molecular models together to form carbon dioxide and water. In the space provided below, use words and diagrams to explain the process that you went through to convert the molecular models of methane and oxygen into the molecular models of carbon dioxide and water. Try to capture as many of your thoughts, ideas and questions as possible:

Question 7:

Refer to the energy level diagram given on the right. Use the following average bond energies to calculate values for ΔH_1, ΔH_2, ΔH_3 and ΔH_4 and hence the overall energy change for the reaction: ΔH_r. You may wish to refer to the molecular models and notes that you made in answer to **Question 6** to help you visualise exactly what ΔH_1, ΔH_2, ΔH_3 and ΔH_4 represent.

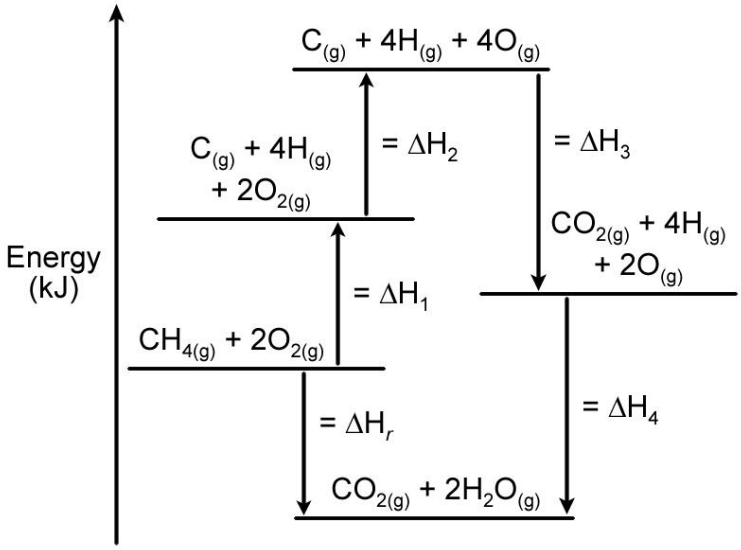
C–H = 412 kJ/mol

O=O = 496 kJ/mol

C=O = 743 kJ/mol

O–H = 463 kJ/mol

With reference to bond breaking and bond formation, rationalise why the combustion of methane to form carbon dioxide and water is an *exothermic* reaction.



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- Scan the QR Code below for the answers to this assignment.

http://www.chemist.sg/energy_changes/enthalpy_change_calcs/methane_ans.pdf