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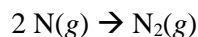
Directions: Show all work in a way that would earn you credit on the AP Test! This is always the rule! Grading rubrics posted in the Google Answer Key Drive. Check your work, correct in green pen after you try them yourself in an honest way! Don't peek at rubrics while you work! **USE BINDER PAPER, STAPLE TO YOUR WORKSHEET.** Clearly label work.

SET A 27 MINUTE TIMER AND SEE IF YOU FINISH ON TIME!

2003

7. Answer the following questions that relate to the chemistry of nitrogen.

(a) Two nitrogen atoms combine to form a nitrogen molecule, as represented by the following equation.



Using the table of average bond energies below, determine the enthalpy change, ΔH , for the reaction.

Bond	Average Bond Energy (kJ mol ⁻¹)
N – N	160
N = N	420
N ≡ N	950

2003B

3. In another experiment, liquid heptane, $\text{C}_7\text{H}_{16}(l)$, is completely combusted to produce $\text{CO}_2(g)$ and $\text{H}_2\text{O}(l)$, as represented by the following equation.



The heat of combustion $\Delta H^\circ_{\text{comb}}$, for one mole of $\text{C}_7\text{H}_{16}(l)$ is -4.85×10^3 kJ.

(c) Using the information in the table below, calculate the value of ΔH°_f for $\text{C}_7\text{H}_{16}(l)$ in kJ mol⁻¹

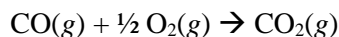
Compound	ΔH°_f (kJ mol ⁻¹)
$\text{CO}_2(g)$	-393.5
$\text{H}_2\text{O}(l)$	-285.8

(d) A 0.0108 mol sample of $\text{C}_7\text{H}_{16}(l)$ is combusted in a bomb calorimeter.

(i) Calculate the amount of heat released to the calorimeter.

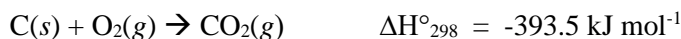
(ii) Given that the total heat capacity of the calorimeter is $9.273 \text{ kJ } ^\circ\text{C}^{-1}$, calculate the temperature change of the calorimeter.

2006



2. The combustion of carbon monoxide is represented by the equation above.

(a) Determine the value of the standard enthalpy change, $\Delta H^\circ_{\text{rxn}}$, for the combustion of $\text{CO}(g)$ at 298 K using the following information.



Dougherty Valley HS Chemistry - AP
Thermochemistry – FRQs

2005B

7. Answer the following questions about thermodynamics.

Substance	Combustion Reaction	Enthalpy of Combustion, ΔH°_{comb} , at 298 K (kJ mol ⁻¹)
H ₂ (g)	H ₂ (g) + ½ O ₂ (g) → H ₂ O(l)	-290
C(s)	C(s) + O ₂ (g) → CO ₂ (g)	-390
CH ₃ OH(l)		-730

- (a) In the empty box in the table above, write a balanced chemical equation for the complete combustion of one mole of CH₃OH(l). Assume products are in their standard states at 298 K. Coefficients do not need to be whole numbers.
- (b) On the basis of your answer to part (a) and the information in the table, determine the enthalpy change for the reaction C(s) + H₂(g) + H₂O(l) → CH₃OH(l)
- (c) Write the balanced chemical equation that shows the reaction that is used to determine the enthalpy of formation for one mole of CH₃OH(l)
- (d) Predict the sign of the standard entropy change, ΔS° for the combustion of H₂(g). Explain your reasoning.
NOTE *We haven't learned about entropy yet, you can skip this part.*
BUT I bet you could give it a try anyway! ☺
- (e) On the basis of bond energies, explain why the combustion of H₂(g) is exothermic.

Reflection: Use this area to jot down notes about the types of mistakes you made, things you need to restudy, things that tricked you, etc. One of the most important skills to develop in AP Chem is self reflection and not making the same mistakes. The joke is – you should always make NEW mistakes, not the SAME mistakes ☺