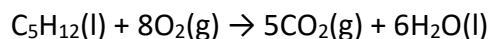


ENERGETICS Core (SL & HL)

1. An equation for the combustion of pentane is given below:



(a) Determine the standard enthalpy change, ΔH^\ominus , for this reaction using **section 11** of the data booklet. **Show your working.**

[3]

.....

(b) Calculate the standard enthalpy change, ΔH^\ominus , for this reaction using **section 12** of the data booklet. **Show your working.**

[3]

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(c) State and briefly explain whether the method in (a) or the method in (b) above is likely to be the most accurate determination of ΔH^\ominus , for this reaction.

[1]

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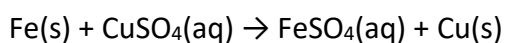
2. Copper has a relatively low specific heat capacity. A 50.0g sample of copper rises in temperature by 52.0°C when it absorbs 1000J of energy.

(a) Determine the specific heat capacity of copper in $\text{J g}^{-1} \text{K}^{-1}$ using section 1 of the data booklet. Give your answer to three significant figures.

[2]

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(b) 0.840g of iron powder was added to 40.0cm³ of copper sulphate solution in a calorimeter. The copper sulphate was in excess. The maximum temperature rise of the solution was 15.0°C.



(i) Assuming that the heat released was absorbed only by the solution, calculate the enthalpy change, ΔH , for this reaction. Use sections 1 and 2 of the data booklet.

[3]

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(ii) State another assumption that you made in (b)(i).

[1]

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3. (a) The reaction below is an endothermic reaction.



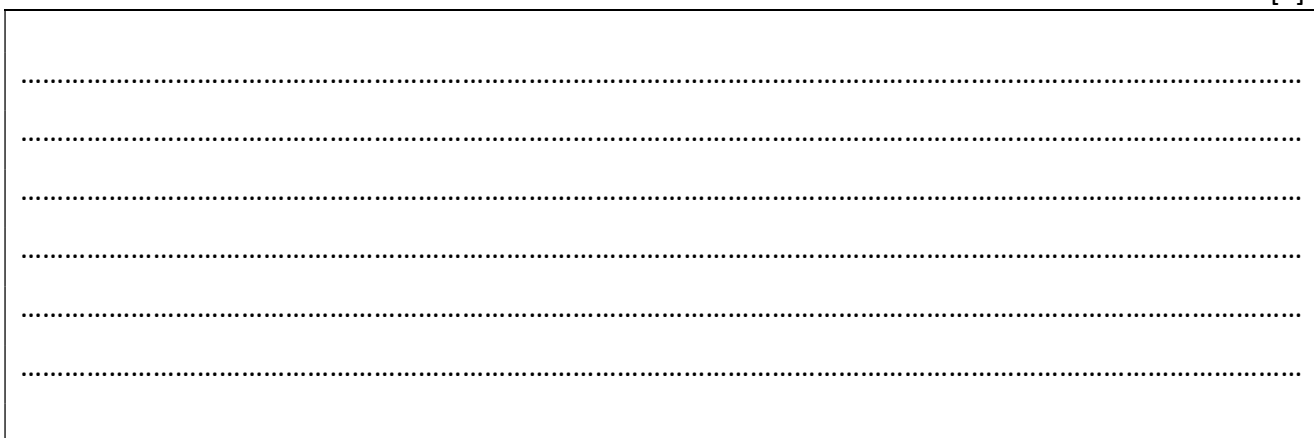
(i) Sketch a labelled potential energy profile for this reaction, label the enthalpy change, ΔH .

[2]



(ii) Given that the enthalpy change, ΔH , for the reaction as shown above in (a) is +181kJ, use section 11 of the data booklet to calculate the bond enthalpy of the bond in NO(g).

[2]

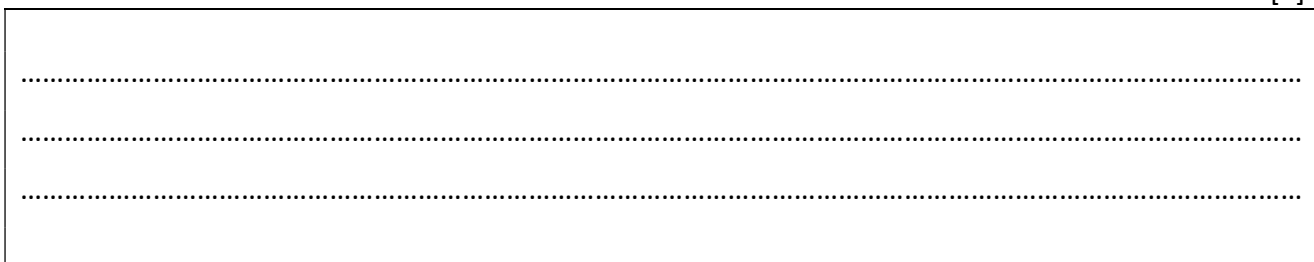


4. Sulfuric acid is produced in the Contact Process. The first two steps are the reactions:



(a) SO_3 is a solid at just below room temperature. If $\text{SO}_3(\text{s})$ was the product in reaction II, instead of $\text{SO}_3(\text{g})$, would the ΔH for reaction II be more or less negative? Explain your answer.

[2]



(b) Write the equation for the standard enthalpy of formation of $\text{SO}_3(\text{g})$.

[2]

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(c) Using the ΔH^\ominus values given for reactions I and II above, calculate the ΔH^\ominus for the standard enthalpy of formation of $\text{SO}_3(\text{g})$.

[2]

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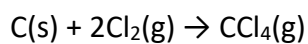
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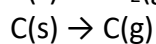
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5. Given the enthalpy changes below, and average bond enthalpy for Cl–Cl bond of $+242\text{kJ mol}^{-1}$, calculate the average bond enthalpy for the C–Cl bond. **Show your working.**



$$\Delta H^\ominus = -96\text{kJ mol}^{-1}$$



$$\Delta H^\ominus = +715\text{kJ mol}^{-1}$$

[3]

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Total Marks 26 (39 minutes)