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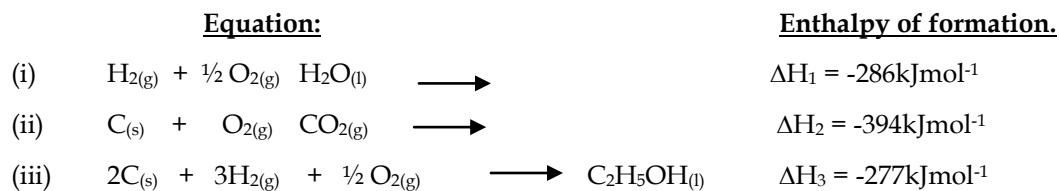
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ENERGY CHANGES IN CHEMICAL REACTIONS

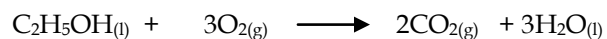
INSTRUCTIONS TO CANDIDATES

Answer **ALL** questions in this paper in the spaces provided.

1. Use the information below to answer the questions that follow:



Calculate the molar enthalpy of combustion of ethanol. Given that:



(3mks)

2. Study the information in the table below and answer the questions that follow

Bond	Bond energy (KJmol ⁻¹)
C - H	414
Cl - Cl	244
C - Cl	326
H - Cl	431

Calculate the enthalpy change of the reaction



(3mks)

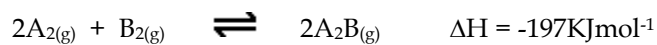
3. When 25 cm³ of 0.5M HCl is added to 25 cm³ of 0.5 M NaOH the temperature of the solution rose from 25°C to 26°C. Given that the density of the solution is 1g cm⁻³ and its specific heat capacity is 4.2 Jg⁻¹K⁻¹,

- (a) **Determine** the amount of heat evolved that caused the temperature rise.

(1mark)

- (b) **Work** out the molar enthalpy of neutralization for this reaction. (2marks)

4. Study the following equilibrium equation.



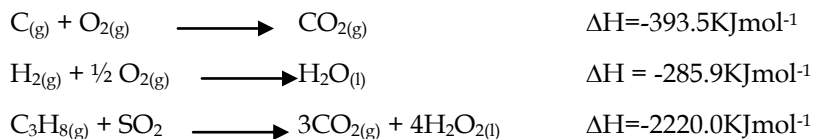
a) Suggest two ways of increasing the yield of A_2B . (2mks)

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b) Draw the energy level diagram for the forward reaction.

(1mk)

5. Use the data below to calculate the enthalpy of formation of propane. (3mks)



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6. Study bond energies shown below and answer the questions that follow.

Bond	Bond Energy KJmol ⁻¹
C - C	348
C - H	412
Cl - Cl	242
C - Cl	338
H - Cl	431

a) Calculate the enthalpy change (ΔH) for the reaction given below.



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b) State the condition necessary for the above reaction to occur. (1mk)

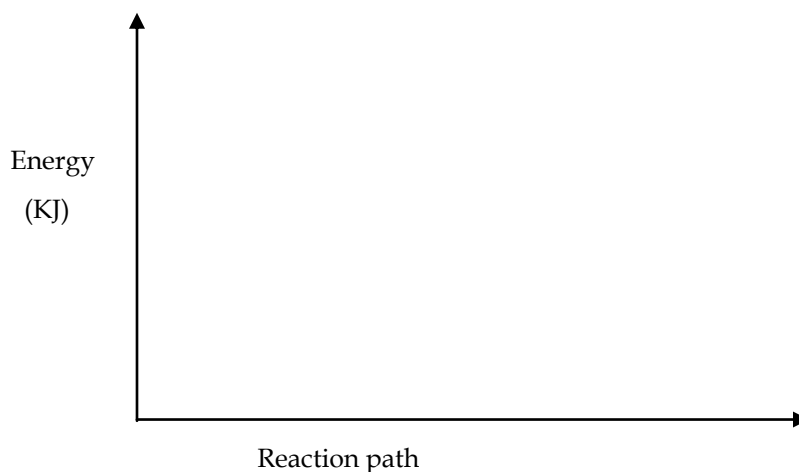
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7. 10.0g of ethanol ($\text{C}_2\text{H}_5\text{OH}$) were completely burnt in air. The heat evolved caused the temperature of 400cm^3 of water to rise from 22°C to 87°C . Calculate the molar heat of combustion of ethanol (H=1, C=12, O=16, specific heat capacity of water = $4.2 \text{ kJkg}^{-1}\text{k}^{-1}$; Density of water = 1gcm^{-3})

(3mks)

8. (a) Consider the following reaction: $A_{2(g)} + B_{2(g)} \rightleftharpoons 2AB_{(g)} \quad \Delta H = 75 \text{ KJ}$

Sketch an energy level diagram showing the relative activation energies for the catalysed and uncatalysed reactions using the axes below. (2 marks)



(b)

$$\text{Given } \Delta H_f(\text{Al}_2\text{O}_3) = -1590 \text{ KJ mol}^{-1}$$

$$\Delta H_f(\text{Cr}_2\text{O}_3) = -1134 \text{ KJ mol}^{-1}$$

Calculate the heat of reaction for



(c) The following data was obtained during an experiment

Mass of ethanol burnt	=	0.2g
Mass of water in the calorimeter	=	200g
Specific heat capacity of water	=	4.2 j g ⁻¹ k ⁻¹
Initial temperature of water	=	23.5 °C
Final temperature of water	=	28.0 °C

(i) **How** was the mass of ethanol that burnt determined? (1mark)

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(ii) **How** much heat was required to raise the temperature of water from 23.5 °C to 28.0°C? (2marks)

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(iii) Two assumptions were made in calculating the enthalpy of combustion for ethanol. **State them.** (1mark)

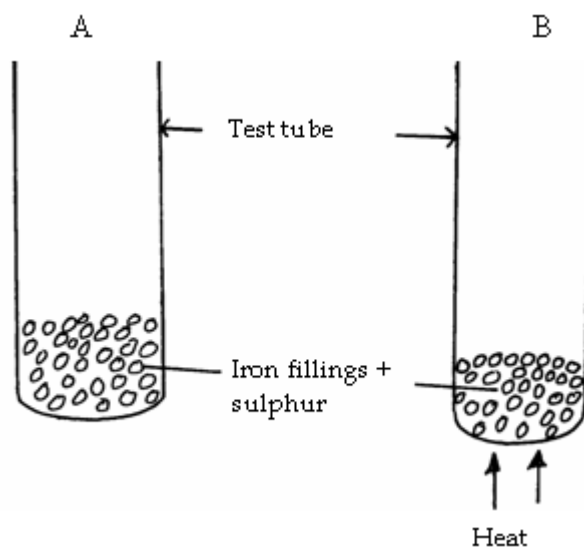
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(iv) **Determine** the molar enthalpy of combustion of ethanol (2marks)
(C= 12, H=1, O= 16)

(v) **Write** a thermochemical equation for the combustion of ethanol given the accurate value for enthalpy of combustion is -1368 Kj mol⁻¹.

(1mark)

9. Iron fillings were thoroughly mixed with sulphur then placed in two test tubes as shown below.



Both test tubes were cooled to room temperature then 3cm³ of 2M Hydrochloric acid was added.

a) What is the general name given to the substance in. (2mks)

(i) Test tube A

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(ii) Test tube B

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b) Identify the gas produced when 2M Hydrochloric acid was added to test tube A.

Explain your answer. (2mks)

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c) Write an equation for the reaction that takes place when 2M Hydrochloric acid is added to test tube B. (1mk)

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d) In another experiment excess iron powder was added to 25.0cm³ of 0.2M copper II sulphate solution in a plastic cup wrapped in tissue paper. The temperature of this solution rose from 21.5°C to 31.5°C.

(i) What was the main reason for using a plastic cup wrapped in tissue paper? (1mk)

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(ii) Give reason for using excess iron powder. (1mk)

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(iii) State two other observations made in the above experiment. (2mks)

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(iv) Calculate the molar enthalpy of displacement of copper II ions by iron powder. (3mks) (Density of solution =1.0gcm⁻³ heat capacity of soln 4.2J/g/k.)

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v) Write a Thermo chemical equation for the reaction that took place. (1mk)

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