

Name: _____ () Class: _____ Date: _____

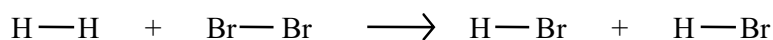
Section A: Multiple Choice Questions

1 Which of the following is an endothermic reaction?

- A the reaction of nitrogen with oxygen in a car engine
B the oxidation of carbon to carbon dioxide
C the combustion of ethanol in air
D the reaction of magnesium with dilute sulphuric acid

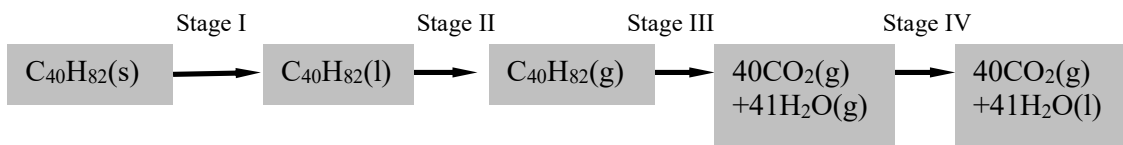
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2 The formation of hydrogen bromide from hydrogen and bromine is an exothermic reaction.



What may be deduced from this information?

- A The number of bonds broken is less than the number of bonds formed.
B Energy is given out in breaking $\text{H} - \text{H}$ and $\text{Br} - \text{Br}$ bonds.
C The $\text{H} - \text{Br}$ bonds are weaker than the $\text{H} - \text{H}$ and $\text{Br} - \text{Br}$ bonds.
D The total energy change in bond formation is greater than that in bond breaking.

☐3 The reaction scheme shows how paraffin wax ($\text{C}_{40}\text{H}_{82}$) is converted into carbon dioxide and water in four stages.

Which stages are exothermic?

- A I and II
B I, II and III
C III and IV
D I and IV

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4 When solid potassium iodide is added to water, the temperature of the liquid decreases. What deduction can be made from this observation?

- A The change is endothermic.
B New bonds are made in the change.
C The change is exothermic.
D The solid forms ions in water.

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Section B: Structured Questions

- 1 Samples of two compounds were dissolved in water at 28°C. The temperature of each solution was measured immediately after the solid had dissolved.

name of compound	formula of compound	temperature / °C		temperature change on dissolving solid
water	solution			
potassium carbonate		28	35	
ammonium chloride		28	16	

- (a) Complete the table. [4]
 (b) State the type of energy change which takes place when ammonium chloride dissolves in water. Give a reason for your answer.

type of energy change:

.....

reason:

.....

[2]

- 2 When liquid oxygen (O₂) is mixed with liquid ethanol (C₂H₅OH), a very fast exothermic reaction takes place, which has been used to propel rockets. The reaction products are steam and carbon dioxide gas.

- (a) (i) Construct the equation, with state symbols, for the reaction.

.....

- (ii) Is ΔH for this equation, positive or negative? Explain your answer.

.....

[2]

- (b) One of the bonds in ethanol can be represented as C-C. Show in a similar way

- (i) two other bonds which are broken in this reaction.

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- (ii) two bonds which are formed in this reaction.

.....

[4]

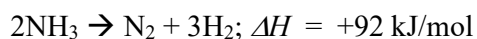
- (c) If the rocket is loaded with 23 kg of ethanol, calculate the mass of liquid oxygen needed to react with it.

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[3]

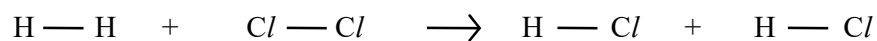
Section C: Essay Questions

1 Ammonia decomposes according to the equation:



- (a) What is the total number of bonds in two molecules of ammonia?
(b) Explain why this reaction is endothermic.
- [3]

2 Hydrogen chloride gas can be manufactured by reacting hydrogen and chlorine together, in an exothermic reaction. The equation for this reaction is shown below.



- (a) (i) What is meant by the term **exothermic**?
(ii) Explain in terms of the bonds being made and broken, why this reaction is exothermic.
- [3]
- (b) Calculate the mass of hydrogen chloride that can be made from 9600 dm³ of chlorine gas, measured at r.t.p.
- [2]