Oxford Cambridge and RSA

AS Level Chemistry A

H032/01 Breadth in chemistry

Question Set 12

1. This question is about alkenes.

(a) The combustion of ethene is shown in **equation 25.1** below.

$C_2H_4(g) + 3O_2(g) \rightarrow 2CO_2(g) + 2H_2O(g)$ $\Delta H = -1318$ kJ mol^{-1} **equation 25.1**

(i) Explain, in terms of bond breaking and bond forming, why a reaction can be exothermic. more energy is released during bond forming than is taken in during bond breaking. **[1]**

(ii) Average bond enthalpies are shown in the table.

Bond	Average bond enthalpy /kJ mol^{-1}
O–H	+464
O=O	+498
C–H	+413
C=O	+805

Calculate the average bond enthalpy, in kJ mol^{-1}, of the C=C bond.

Use the average bond enthalpies in the table and **equation 25.1**. **[3]**

1. a) ii) ΔH = bonds broken − bonds formed

$-1318 = [x + 4(413) + 3(498)] - [4(805) + 4(464)]$
$-1318 = x + 1652 + 1494 - 3220 - 1856$
$-1318 = x - 1930$
x (C=C) = + 612 kJ mol^{-1}

(b) An alkene **D** is a liquid at room temperature and pressure but can easily be vaporised.

When vaporised, 0.1881 g of **D** produces 82.5 cm^3 of gas at 101 kPa and 373 K.

Determine the molar mass and molecular formula of alkene **D**.

Show all your working.

[5]

b) $pV = nRT$
$n = \frac{pV}{RT}$

$n = \frac{101000 \times (82.5 \times 10^{-6})}{8.31 \times 373}$
$n = 2.6882 \times 10^{-3}$

$Mr = \frac{\text{mass}}{\text{moles}} = \frac{0.1881}{0.0026882} = 69.9$

$C_3H_6 = 42$
$C_4H_8 = 56$
$C_5H_{10} = 70$

hence the alkene is C_5H_{10}.

Total Marks for Question Set 12: 9

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