Question 23 (3 marks)

C_4H_9OH

(a) Write a balanced chemical equation for the complete combustion of 1-butanol. **1**

$C_4H_9OH_{(g)} + 6O_{2(g)} \longrightarrow 4CO_{2(g)} + 5H_2O_{(g)}$

(b) A student measured the heat of combustion of three different fuels. The results are shown in the table. **2**

Fuel	*Heat of combustion* (kJ g^{-1})
A	–48
B	–38
C	–28

The published value for the heat of combustion of 1-butanol is 2676 kJ mol-1.

Which fuel from the table is likely to be 1-butanol? Justify your answer.

$M = 4(12.01) + 10(1.008) + 16 =$ per mol $= 74.12$ g

$\Delta H = 2676$

$= m \times C \times \Delta T$

$\frac{kJ/mol}{kJ/g} = \frac{m}{m} \div M = \frac{1}{74.12}$

The fuel is most likely to be B. This is because the molar mass of 1-butanol is 74.12 (shown above). When the heat of combustion is divided by this value, you obtain $\frac{-2676}{74.12} = -36.1036...$ B (-38) is the most correct choice.