Question 23 (3 marks)

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

$C_4H_9OH + 6O_2 \rightarrow 4CO_2 + 5H_2O$

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

(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.

$n = \frac{m}{MM}$

$= \frac{1}{74.12}$

$= 0.0135 \text{ mols}$

$\therefore A \Rightarrow 0.0135 \text{ mol} \rightarrow 48 \text{ kJ}$

$1 \text{ mol} \rightarrow x$

$x = 3555.5 \text{ mol/kJ}$

$\therefore B \Rightarrow 0.0135 \text{ mol} \rightarrow 38 \text{ kJ}$

$1 \text{ mol} \rightarrow x$

$x = 2814.8 \text{ mkJ/mol}$

$\therefore C \Rightarrow 0.0135 \text{ mol} \rightarrow 28 \text{ kJ}$

$1 \text{ mol} \rightarrow x$

$x = 2074.1 \text{ kJ/mol}$

∴ Fuel B is most likely 1-butanol as its ΔH is closest to 2676 kJ mol^{-1}