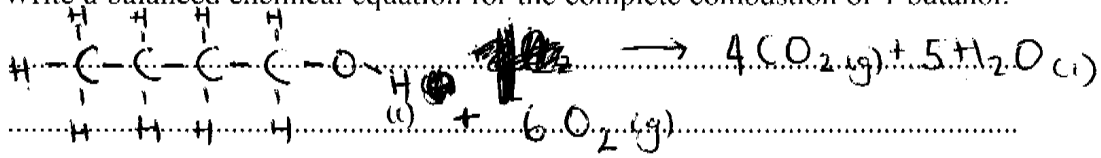
Question 23 (3 marks)

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



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

(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

$\Delta H = mc\Delta T$

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.

Heat of combustion of 1-butanol (kJg^{-1})

$n = \frac{m}{M}$ moles ~~ether~~ 1-butanol in 1g

$1 = n \times (4 \times 12.01 + 10 \times 1.008 + 16)$

$1 = 74.12n$

$n = \frac{1}{74.12}$

grams 1-butanol in 1mole

$1 = \frac{m}{74.12}$

$m = 74.12g$

74.12g produces 2676 kJ

1g produces $\frac{2676}{74.12} = 36.10$

B is likely to be 1-butanol as it is closest to the published value