Q5 Ethyl Alcohol C_2H_6O is used as a fuel in an internal combustion engine.
(a) Calculate the stoichiometric air/fuel ratio
(b) The engine runs with an air fuel ratio of 10/1. Determine the wet exhaust gas analysis.
(c) Suggest an environmental benefit from using this fuel.

(Note this is by mass but not stated as such in the exam)

$C_2H_6O + 3\ O_2 \rightarrow 2CO_2 + 3H_2O$
46 96 88 54

Mass of air required = (96/46) ÷ 0.233 = 8.957 stoichiometric ratio is 8.957/1

Actual air = 10 kg
Content are

Nitrogen	0.767 x 10 = 7.670	69.73%
Oxygen	1.063 x 0.233 = 0.248 kg	2.25%
Carbon Dioxide	88/46 = 1.913 kg	17.39%
Water Vapour	54/46 = 1.174 kg	10.67%
Totals	11 kg	100%

As the fuel contains no sulphur it is better than most and also contains some oxygen saving on the air required. The low carbon content and high hydrogen content is also beneficial reducing the CO_2 produced.