

Solutions

Original authored marking; accept equivalent evidence-based evaluations.

2.1 Hazard is potential to cause harm; risk concerns likelihood and severity during actual use. Smaller quantities reduce the possible scale of a fire; an appropriate electric heater instead of a naked flame reduces ignition risk. Accept a suitable less flammable solvent or other justified controls. Ventilation addresses vapour exposure but does not alone remove ignition risk.

2.2 $\text{C}_{12}\text{H}_{26} \rightarrow \text{C}_8\text{H}_{18} + \text{C}_4\text{H}_8$. In the stated cracking model, C_4H_8 is the alkene product; bonds change and new substances form, unlike physical separation. Its formula alone would not distinguish an unknown alkene from a cycloalkane.

2.3 Polymerisation; substitution; oxidation; reduction respectively. Adding hydrogen to ethene reduces the organic molecule.

3.1 CO is toxic because it binds strongly to haemoglobin and reduces oxygen transport. SO_2 and nitrogen oxides contribute acidity/acid deposition. Carbon particulates damage air quality and can harm respiratory health. Nitrogen oxides can form from atmospheric nitrogen and oxygen at high engine temperatures even if the fuel contains no sulfur.

3.2 Net $\text{CO}_2 = 0.45 + 0.10 + 1.60 - 1.60 = 0.55$ kg per litre. It is not carbon neutral within this boundary because net emissions are positive. Land-use change, soil carbon changes or machinery manufacture could change the full-life-cycle result. Crop uptake cancels the stated combustion emission only.

3.3 $\text{C}_6\text{H}_{14} \rightarrow \text{C}_6\text{H}_6 + 4\text{H}_2$. Reforming changes chemical bonds; fractional distillation separates existing substances by boiling range. Hydrogen forms water rather than CO_2 at its point of use, but this hydrogen originated from a fossil feedstock and processing consumes energy, so use-stage emissions alone do not show life-cycle carbon neutrality.