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SPECA

GCSE Combined Science (AQA Trilogy) · Chemistry

Organic Chemistry · Mark Scheme

For use with the Worksheet. Marking points are indicative, not exhaustive: award equivalent correct answers.

1) Crude oil is a mixture of a very large number of compounds, most of which are hydrocarbons (1); it is found in rocks, formed from an ancient buried biomass, mainly plankton, over millions of years (1) [2]

2) C_nH_{2n+2} (1) [1]

3) Methane (1); ethane (1); propane (1); butane (1) [4]

4) Propane (1); it has 3 carbon atoms and 8 hydrogen atoms, matching C_nH_{2n+2} when n = 3, since (2 × 3) + 2 = 8 (1) [2]

5) Separates crude oil into fractions, each containing molecules of a similar carbon-chain length/boiling point (1); crude oil is heated so its hydrocarbons evaporate (1); as vapours rise up the column and cool, they condense at different heights, according to their boiling points (1) [3]

6) Any two of, with a valid use: e.g. petrol, fuel for cars; diesel, fuel for engines; polymers, making plastics; solvents/lubricants/detergents, industrial/household use (1 mark each, max 2) [2]

7) Boiling point increases (1) [1]

8) Viscosity increases (1) [1]

9) Flammability decreases (1) [1]

10) Short-chain hydrocarbons are more flammable, so ignite more easily (1); they also have lower boiling points and lower viscosity, making them easier to vaporise and burn efficiently in an engine (1) [2]

11) Correct reactant/product formulae, $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$ (1); correctly balanced carbons and hydrogens, $3CO_2$ and $4H_2O$ (1); correctly balanced oxygens overall: $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$ (1) [3]

12) Complete combustion occurs when there is a plentiful/sufficient supply of oxygen (1); it produces only carbon dioxide and water (1) [2]

13) Cracking breaks larger, less useful hydrocarbon molecules into smaller, more useful ones (1); this helps meet the higher demand for small-molecule fuels than crude oil naturally provides (1) [2]

14) A mixture of smaller hydrocarbons (1); including both alkanes and alkenes (1) [2]

15) Sample X (1); alkenes decolourise bromine water because they are more reactive than alkanes, giving a positive colour-change result (1) [2]

16) Alkenes can be used as starting materials for making polymers (1); and as starting materials for producing many other chemicals (1) [2]

Total: 32 marks

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