Mark schemes

Q1.

(a) high temperatures

ignore pressure

1

(cause) nitrogen (from air) and oxygen (from air) to react

1

(b) less climate change

ignore references to water vapour

allow less global warming

allow an effect of climate change for climate change

1

(because) no carbon dioxide (produced)

1

(c) more oxides of nitrogen (produced)

1

(so) more acid rain

or

(so) more respiratory problems

allow an effect of acid rain for acid rain

allow a named respiratory problem for respiratory problems

MP2 cannot be linked to an incorrect gas from MP1 1

1

(d) (volume of oxygen = $3.50 \times \frac{1}{2} =$ 1.75 (dm^3)

1

(volume of air =) $1.75 \times \frac{100}{20}$

allow correct use of an incorrectly determined volume of oxygen

1

= 8.75 (dm^3)

1

(e) there is a temperature gradient in the (fractionating) column

allow the (fractionating) column gets cooler going up

1

(so) kerosene condenses

allow (so) the hydrocarbons / vapours condense

1

at the level (in the column) corresponding to kerosene's boiling point (range)

allow at the level (in the column) corresponding to the boiling point of the hydrocarbons / vapours

for the award of 2 marks for MP2 and MP3, a reference to kerosene must be made

1

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Q2.

(a) crude oil is heated to vaporise (the hydrocarbons)

1

there is a temperature gradient in the (fractionating) column

allow a (fractionating) column is cooler going up

1

(so) the gases condense at different levels
or
(so) lubricating oil condenses below naphtha (and petroleum gases do not condense)

1

(because of their) different boiling points

1

(b) detergents

1

solvents

1

(c) $C_9H_{20} + 14\ O_2 \rightarrow 9\ CO_2 + 10\ H_2O$

allow multiples

*allow **1** mark for*

$C_9H_{20} + O_2 \rightarrow CO_2 + H_2O$ with incorrect / no multipliers

2

(d) (when burned sulfur impurities) produce sulfur dioxide

1

(which) causes acid rain
or
(which) causes respiratory problems

allow specified effects of acid rain

allow specified respiratory problems

1

(e) as molecular size increases viscosity increases

1

(and) heavy fuel oil has larger molecules (than kerosene)

1

allow converse statements

(f) (name of process) cracking

1

(conditions) high temperature

allow a stated temperature in the range 300 to 900 °C

1

steam / catalyst

1

(g) C_7H_{14} and C_8H_{16}

1

[16]