

Name of the Student: _____

Max. Marks : 21 Marks

Time : 21 Minutes

Mark Schemes

Q1.

- (a) (i) A molecule/compound/it consists/it is composed/it is made up of hydrogen/H and carbon/C only (1)

QoL

- (ii) release (heat) energy (when burned) (1)
 OR provides a (useable form of) energy
 OR is a source of energy

*Accept heat $\equiv$ energy**NOT is energy / is heat**NOT burns exothermically*

- (iii) $C_4H_{10} + 6\frac{1}{2}O_2 \rightarrow 4CO_2 + 5H_2O$ (1)
 OR $2C_4H_{10} + 13 O_2 \rightarrow 8CO_2 + 10H_2O$

ignore state symbols

- (iv) $C_4H_{10} + 4\frac{1}{2}O_2 \rightarrow 4CO + 5H_2O$ (1)
 OR $2C_4H_{10} + 9O_2 \rightarrow 8CO + 10H_2O$

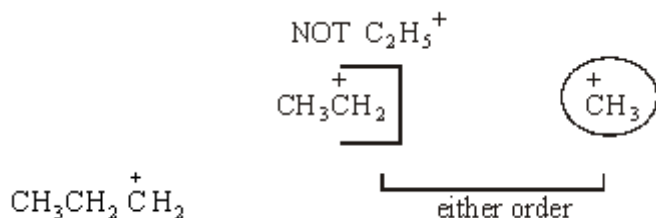
*ignore state symbols**(iii) and (iv) if not $C_4H_{10} = CE$*

- (v) Limited or reduced supply of air / oxygen (1)
 OR low temperature OR poor mixing
 OR insufficient oxygen / air OR shortage of O_2

NOT no oxygen / lack of oxygen / not in excess

5

- (b) *Structure 1* *Structure 2* *Structure 3*



allow credit for positive charge around C atom
no alternative carbocations allowed

2

- (c) (i) $C_2H_6 / CH_3CH_3 \rightarrow CH_2=CH_2 / H_2C=CH_2 / C_2H_4 + H_2 / CH_2CH_2$
NOT $CH_2 \cdot CH_2$

(ii) Al_2O_3 OR Zeoli(y)te OR aluminosilicate **(1)**

NOT bauxite

ignore SiO_2

NOT Aluminium Silicate

NOT porous pot

NOT SiO_2 alone

(iii) More useful / needed fuels / products OR implied

OR more valuable products

OR qualified demand exceeds supply

OR to produce motor fuels OR petrol OR cycloalkanes OR aromatic hydrocarbons OR balanced alkanes OR smaller molecules OR alkenes

Q2.

- (a) Crude oil is heated to vaporise it / **oil vaporised (1)**
(Vapour passed into fractionating) tower / column (1)
Top of tower cooler than bottom
or **negative temperature gradient (1)**
fractions separated by b.p
OR condensed at different temperatures OR levels
OR low boiling fractions at the top
OR at the top small molecules or light components (1)

max 3

- (b) (i) Identify shortfall in supply - e.g. petrol / small molecules (1)
Higher value products **OR more useful products (1)**
OR cracking produces more of material (problem solving)
- (ii) Motor fuels
Aromatic hydrocarbons
Branched alkanes / hydrocarbons
Cycloalkanes
Any two (2)
Ignore specific fractions, alkanes, shorter alkanes, penalise alkenes, and hydrogen

4

- (c) *Catalyst:* Zeolite / aluminosilicate (1)
Type of mechanism: Carbocation / heterolytic fission (1)
Conditions: High temp OR around 450 °C [300 – 600] °C **NOT heat / warm (1)**
Slight pressure [$> 1 \text{ atm} \leq 10 \text{ atm}$ **OR 1 megaPa, 1000 kPa**] (1)
NOT high pressure

4

[11]