



Name \_\_\_\_\_ Class: \_\_\_\_\_

Start Time \_\_\_\_\_ End Time \_\_\_\_\_ Time Taken \_\_\_\_\_

**Time allowed: 36 minutes**

## INSTRUCTIONS TO CANDIDATES

- This document is designed to be used as a practice test.
- Complete the test under exam conditions in one sitting.
- Optional: Before marking it, go through the paper with a set of notes and improve your answers.
- Mark the test using the mark scheme make corrections on the paper.
- Complete the table on the front page.
- Improve your notes so that they better reflect your weaknesses.
- Make a note of your strengths and weaknesses for future revision.

Success Criteria	Questions in Paper	Mark	Out of	%	Rank Order
Fractional Distillation	1a		3		
Cracking - economics	1bi		2		
Catalytic Cracking	1bii, 1c		6		
Thermal Cracking	2,		2		
Combustion of Alkanes	4, 5ai		5		
Indirect pollutants	5aii, 5b, 5c		6		
Chlorination of Alkanes	6				
<b>Total</b>			33		



**Q1.**

- (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]

**Q2.**

C

*C-C bonds are broken*

[1]

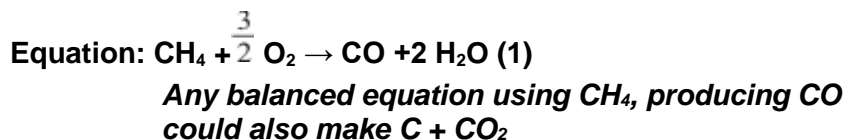
**Q3.**

A

[1]

**Q4.**

- (i)  $\text{C}_{15}\text{H}_{32} + 23 \text{O}_2 \rightarrow 15 \text{CO}_2 + 16 \text{H}_2\text{O}$   
*Products (1)*  
*Balance (1)*  
*If wrong reactant C.E*
- (ii) Identity of product: CO or carbon monoxide (1)



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**Q5.**

- (a) (i)  $\text{C}_8\text{H}_{18} + 8\frac{1}{2}\text{O}_2 \rightarrow 8\text{CO} + 9\text{H}_2\text{O}$  (1)  
*OR double this equation*
- (ii) *Condition: Spark OR high T OR T = 2500 – 4000 °C* (1)  
*Equation:  $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$*  (1)  
*OR half this equation*

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- (b) (i) platinum OR rhodium OR palladium (1)
- (ii)  $2\text{CO} + 2\text{NO} \rightarrow \text{N}_2 + 2\text{CO}_2$  (1)  
*OR half this equation*

2

- (c) *Reason for SO<sub>2</sub> in exhaust gases: fraction / petrol / fuels contain sulphur or sulphur-containing impurities (which burn to give SO<sub>2</sub>)* (1)  
*Environmental effect SO<sub>2</sub>: acid rain OR a specific effect* (1)  
*NOT greenhouse effect*  
*NOT damages ozone layer*

2

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**Q6.**

- (a) *Condition: U.V. light or sunlight or 450°C or high temp* (1)  
*Explanation: U.V. light etc. provides energy to break(Cl-Cl) bond* (1)  
*Do not accept reference to E<sub>a</sub> or wrong bond or 'to make Cl radicals'*
- (b) (i) (Free) radical substitution (1)
- (ii) *Step 1: initiation* (1)  
*Step 2: propagation* (1)  
*Step 3: termination* (1)  
*Any order*  
*Don't be too harsh on spelling*
- (c) (i) *Equation 1:  $\text{CH}_3 + \text{Cl}\cdot \rightarrow \text{CH}_2\text{Cl}\cdot + \text{HCl}$*  (1)  
*Equation 2:  $\text{CH}_2\text{Cl}\cdot + \text{Cl}_2 \rightarrow \text{CH}_2\text{Cl}_2 + \text{Cl}\cdot$*  (1)  
*or  $\text{CH}_2\text{Cl}\cdot + \text{Cl}\cdot \rightarrow \text{CH}_2\text{Cl}_2$*   
*Mark equ independently*  
*any order*

2

4



- (ii)  $\text{CH}_2\text{Cl}\cdot + \text{CH}_3\cdot \rightarrow \text{CH}_3\text{CH}_2\text{Cl}$  (1)  
or  $\text{CH}_3\text{CH}_2\cdot + \text{Cl}_2 \rightarrow \text{CH}_3\text{CH}_2\text{Cl} + \text{Cl}\cdot$   
or  $\text{CH}_3\text{CH}_2\cdot + \text{Cl}\cdot \rightarrow \text{CH}_3\text{CH}_2\text{Cl}$   
*Equ must have  $\text{CH}_3\text{CH}_2\text{Cl}$  as product*  
*Accept  $\text{C}_2\text{H}_5\text{Cl}$*   
*Penalise absence of  $\cdot$  once only*

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[9]