

INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answer **ALL** questions.

ARAHAN:

*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1**SOALAN 1**

- CLO1 a) For dry natural gas, acid gases and water vapour must be removed. List **THREE (3)** methods of the acid gas treatment.
*Untuk gas asli kering, gas asid dan wap air mesti disingkirkan. Senaraikan **TIGA (3)** kaedah untuk rawatan gas asid.*

[3 marks]
[3 markah]
- CLO1 b) Natural gas and crude oils are the main sources for hydrocarbon intermediates for the production of petrochemicals. There are four types of hydrocarbon intermediates which are paraffinic hydrocarbons, olefinic hydrocarbons, aromatic hydrocarbons, as well as liquid petroleum fractions and residues. Explain the following hydrocarbon intermediates:
Gas asli dan minyak mentah adalah sumber utama perantaraan hidrokarbon untuk pengeluaran petrokimia. Terdapat empat jenis perantaraan hidrokarbon iaitu hidrokarbon parafin, hidrokarbon olefin, hidrokarbon aromatik, serta pecahan dan sisa petroleum cecair. Terangkan perantaraan hidrokarbon yang berikut:
- i. paraffinic hydrocarbons. [5 marks]
hidrokarbon paraffin. [5 markah]
- ii. olefinic hydrocarbons. [5 marks]
hidrokarbon olefin. [5 markah]

CLO1

- c) The non-hydrocarbon compounds portion of may be composed of nitrogen (N_2), carbon dioxide (CO_2), helium (He), hydrogen sulphide (H_2S), water vapor (H_2O), and other sulphur compounds such as carbonyl sulphide (COS) and mercaptans (CH_3SH) and trace amounts of other gases. Write the characteristics of the following non-hydrocarbon compounds in crude oil:

Sebatian bukan hidrokarbon mungkin terdiri daripada nitrogen (N_2), karbon dioksida (CO_2), helium (He), hidrogen sulfida (H_2S), wap air (H_2O), dan sebatian sulfur lain seperti karbonil sulfida (COS) dan mercaptans (CH_3SH) dan mengesan jumlah gas lain. Tuliskan ciri-ciri sebatian bukan hidrokarbon berikut dalam minyak mentah:

- | | | |
|------|--------------------------------------|------------|
| i. | nitrogen compounds. | [4 marks] |
| | <i>sebatian nitrogen.</i> | [4 markah] |
| ii. | non basic nitrogen compounds. | [4 marks] |
| | <i>sebatian nitrogen bukan asas.</i> | [4 markah] |
| iii. | sulphur compounds. | [4 marks] |
| | <i>sebatian sulphur.</i> | [4 markah] |

QUESTION 2

SOALAN 2

CLO1

- a) Alkanes are organic compounds that consist of single-bonded carbon and hydrogen atoms. Identify **THREE (3)** physical properties of alkanes.

*Alkana adalah sebatian organik yang terdiri daripada karbon terikat tunggal dan atom hidrogen. Kenalpasti **TIGA (3)** sifat fizikal alkana.*

[3 marks]

[3 markah]

CLO1

- b) 1-hexene is a colourless liquid with a gasoline-like odour. It is used in fuels and to make flavours, perfumes, dyes, and plastic resins. Express the balanced chemical equation for 1-hexene with the following reactions:

1-hexene ialah cecair tidak berwarna dengan bau seperti gasolin. Ia digunakan dalam bahan api dan untuk membuat perisa, minyak wangi, pewarna, dan resin plasti. Ekspresikan persamaan kimia seimbang bagi 1-hexene untuk tindak balas berikut:

- i. hydration and hydrogenation. [5 marks]
penghidratan dan penghidrogenan. [5 markah]
- ii. halogenation and hydrohalogenation. [5 marks]
halogenasi dan hidrohalogenasi. [5 markah]

CLO1

- c) Draw the molecular structure for each of the following hydrocarbons:

Lukiskan struktur molekul bagi setiap hidrokarbon berikut:

- i. 2-chloro-2,3-dimethylbutane. [4 marks]
2-kloro-2,3-dimetilbutana. [4 markah]
- ii. 3-bromo-1,2-dimethylcyclohexene. [4 marks]
3-bromo-1,2-dimetilsikloheksena. [4 markah]
- iii. 3,5-dimethyl-1,3-hexadiene. [4 marks]
3,5-dimetil-1,3-heksadiena. [4 markah]

QUESTION 3

SOALAN 3

- CLO1 a) Benzene is a chemical that is colourless or light-yellow liquid at room temperature. Give **THREE (3)** physical properties of benzene.
*Benzena ialah bahan kimia yang merupakan cecair tidak berwarna atau kuning muda pada suhu bilik. Berikan **TIGA (3)** sifat fizikal benzena.*
[3 marks]
[3 markah]
- CLO1 b) Benzene is found in crude oil as a major part of gasoline. Explain the following reactions of benzene in terms of catalyst, chemical reaction and applications:
Benzena terdapat dalam minyak mentah sebagai sebahagian besar gasolin. Terangkan tindak balas benzena berikut daripada segi mangkin, tindak balas kimia dan aplikasi:
- i. Chlorination of benzene. [5 marks]
Pengklorinan benzena. [5 markah]
- ii. Hydrogenation of benzene. [5 marks]
Penghidrogenan benzena. [5 markah]
- CLO1 c) Draw the molecular structure for the following benzene and its derivatives:
Lukiskan struktur molekul bagi benzena dan terbitan berikut:
- i. 2,4,6-trimethyltoluene. [4 marks]
2,4,6-trimetiltoluena. [4 markah]
- ii. 2,4-dinitro-ethylbenzene. [4 marks]
2,4-dinitro-etilbenzena. [4 markah]
- iii. 4-bromo-1,2-dimethylbenzene. [4 marks]
4-bromo-1,2-dimetilbenzena. [4 markah]

QUESTION 4

SOALAN 4

- CLO1 a) A few intermediates are produced from natural gas, crude oils and other fossil materials such as coal, are not hydrocarbon compounds. State **THREE (3)** non-hydrocarbon intermediate compounds except for hydrogen.
- Beberapa perantaraan dihasilkan daripada gas asli, minyak mentah dan bahan fosil lain seperti arang batu, bukan sebatian hidrokarbon. Nyatakan **TIGA (3)** sebatian bukan hidrokarbon kecuali hidrogen.*
- [3 marks]
[3 markah]
- CLO1 b) Ethylene is sometimes known as the “king of petrochemicals” because more commercial chemicals are produced from ethylene than from any other intermediate. Explain the following reactions of ethylene in terms of chemical reaction and applications:
- Etilena kadangkala dikenali sebagai "raja petrokimia" kerana lebih banyak bahan kimia komersial dihasilkan daripada etilena berbanding mana-mana perantaraan lain. Terangkan tindak balas etilena berikut dari segi tindak balas kimia dan aplikasi:*
- i. Chlorination of ethylene. [5 marks]
Pengklorinan etilena. [5 markah]
- ii. Hydration of ethylene. [5 marks]
Penghidratan etilena. [5 markah]

CLO1

- c) More than 90% of the world's propylene is produced as a co-product from ethylene steam which convert a range of hydrocarbon molecules into ethylene and other basic chemicals or from fluid catalytic crackers at oil refineries. Write the balanced chemical equation for the following reactions:

Lebih daripada 90% propilena di dunia dibuat sebagai hasil bersama daripada stim etilena yang menukarkan pelbagai molekul hidrokarbon kepada etilena dan bahan kimia asas lain atau daripada keropok pemangkin cecair di kilang penapisan minyak. Tuliskan persamaan kimia seimbang bagi tindak balas berikut:

- | | | |
|------|--|------------|
| i. | Chlorination and hydration of propylene. | [4 marks] |
| | <i>Pengklorinan dan penghidratan propilena.</i> | [4 markah] |
| ii. | Oxidation of propylene to produce acrylic acid. | [4 marks] |
| | <i>Pengoksidaan propilena untuk menghasilkan asid akrilik.</i> | [4 markah] |
| iii. | Oxyacylation of propylene. | [4 marks] |
| | <i>Oksiasilasi propilena.</i> | [4 markah] |

SOALAN TAMAT