INSTRUCTION:

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

ARAHAN:

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

QUESTION 1

SOALAN 1

CLO1 C1

(a) State **TWO (2)** types of operation mode in size reduction equipment and sketch the diagram.

*Nyatakan **DUA (2)** jenis mod operasi dalam peralatan pengurangan saiz dan lakarkan gambarajah.*

[6 marks]
[*6 markah*]

CLO1 C2

(b) Determine **FOUR (4)** criterion for proper and economical operation in size reduction equipment.

*Tentukan **EMPAT(4)** kriteria operasi yang bersesuaian dan ekonomi bagi peralatan pengecilan saiz.*

[8 marks]
[*8 markah*]

CLO1 C3

(c) Filtration may be defined as the separation of solid from fluid by using a porous medium that retains the solid but allows the fluid to pass.

Penapisan boleh ditakrifkan sebagai pemisahan pepejal daripada bendalir melalui medium berongga yang mengekalkan pepejal tetapi membenarkan cecair melaluinya.

i. The viscosity of the filtrate will increase the resistance of flow. Choose **TWO (2)** methods to overcome this problem.

*Kelikatan turasan akan meningkatkan rintangan aliran. Pilih **DUA (2)** kaedah untuk mengatasi masalah ini.*

[2 marks]
[*2 markah*]

ii. Illustrate dead end and cross flow filtration process.
Lakarkan proses penurasan secara 'dead end' dan 'cross flow filtration'.

[9 marks]
[9 *markah*]

QUESTION 2

SOALAN 2

CLO2 C1 (a) State **THREE (3)** ways of how solids are exposed to the gas in adiabatic dryers.
*Nyatakan **TIGA (3)** cara bagaimana pepejal terdedah kepada gas dalam pengering adiabatik*

[6 marks]
[*6 markah*]

CLO2 C2 (b) Crystallization refers to the formation of solid crystals from a homogeneous solution. It is a solid – liquid separation technique.
Penghabluran merujuk kepada pembentukan kristal pepejal dari larutan homogeny. Ia adalah teknik pemisahan cacair – pepejal.

i. List **FOUR (4)** methods of reaching supersaturation solution in industrial process.
*Senaraikan **EMPAT (4)** kaedah untuk mencapai larutan tepu lampau dalam proses industry.*

ii. Discuss the crystallization process.
Bincangkan proses pengkristalan.

[9 marks]
[*9 markah*]

CLO2 C3 (c) A solid with $L_s/A = 21.5 kg/m^2$ is dried from a free moisture content $x_1 = 0.34$ kgH_2O/kg dry solid to $x_2 = 0.15$ kgH_2O/kg dry solid. By referring appendix A and B, calculate the time required using
Sebuah pepejal dengan $L_s/A = 21.5 kg/m^2$ dikeringkan daripada kandungan lembapan $x_1 = 0.34$ kgH_2O/kg pepejal kering kepada $x_2 = 0.15$ kgH_2O/kg pepejal kering. Dengan merujuk kepada Apendiks A dan B , kirakan masa yang diperlukan dengan menggunakan

i. A Graph
Graf

ii. An Equation $t = \frac{L_s}{AR_c}(x_2 - x_1)$

Persamaan $t = \frac{L_s}{AR_c}(x_2 - x_1)$

[10 marks]
[*10 markah*]

QUESTION 3
SOALAN 3

CLO1
C1

(a) The extraction process is a method to separate compounds based on their relative solubility in two different immiscible liquids, usually water and an organic solvent.
Proses pengekstrakan adalah kaedah untuk memisahkan sebatian berdasarkan kelarutan relatifnya dalam dua cecair yang tidak terlarutcampur, biasanya air dan pelarut organik.

i. Define extract and raffinate.
Definasikan ekstrak dan 'raffinate'.

ii. State **TWO (2)** solvent selection criterion.
*Nyatakan **DUA (2)** kriteria pemilihan pelarut.*

[6 marks]
[*6 markah*]

CLO1
C2

(b) Describe **TWO (2)** differences between horizontal-tube natural circulation evaporator and vertical-type natural circulation evaporator by using a simple sketch.
*Huraikan **DUA (2)** perbezaan di antara horizontal-tube natural circulation evaporator dan vertical-type natural circulation evaporator dengan menggunakan gambarajah mudah*

[8 marks]
[*8 markah*]

CLO1
C3

(c) Multi – effect Evaporation is an important procedure adopted to economize the consumption of energy.
Penyejat multi Effect merupakan prosedur penting yang digunakan untuk menjimatkan penggunaan tenaga.

i. Illustrate and label the forward feed operation
Lakar dan labelkan operasi bahan masukan hadapan.

ii. Discuss the forward feed operation.
Bincangkan operasi bahan masukan hadapan.

[11 marks]
[*11 markah*]

QUESTION 4
SOALAN 4

CLO1
C1

(a) In absorption process of ammonia from air-ammonia mixture by water state the :
Di dalam proses penyerapan ammonia daripada campuran udara – ammonia dengan air sila nyatakan:

i. Carrier gas
Gas pembawa

ii. Solutes
Bahan larut

iii. Absorbent
Bahan penyerap

[3 marks]
[*3 markah*]

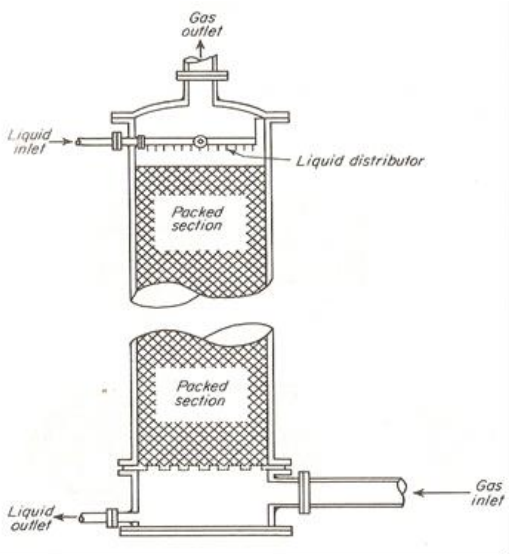


Diagram 4(b) / Rajah 4 (b)

CLO1 C2

(b) By referring to the diagram 4(b), explain the mechanism of absorption process in a packed tower.

Dengan merujuk kepada rajah 4(b), terangkan mekanisme proses penyerapan dalam menara terpadat.

[10 marks]
[*10 markah*]

CLO1 C3

(c) Adsorption is a separation process which certain components of a fluid phase are transferred to the surface of a solid adsorbent.

Penjerapan adalah proses pemisahan di mana komponen tertentu fasa bendalir dipindahkan ke permukaan penjerap pepejal.

i. Differentiate Physical and Chemical adsorption

Bezakan penjerapan fizikal dan kimia.

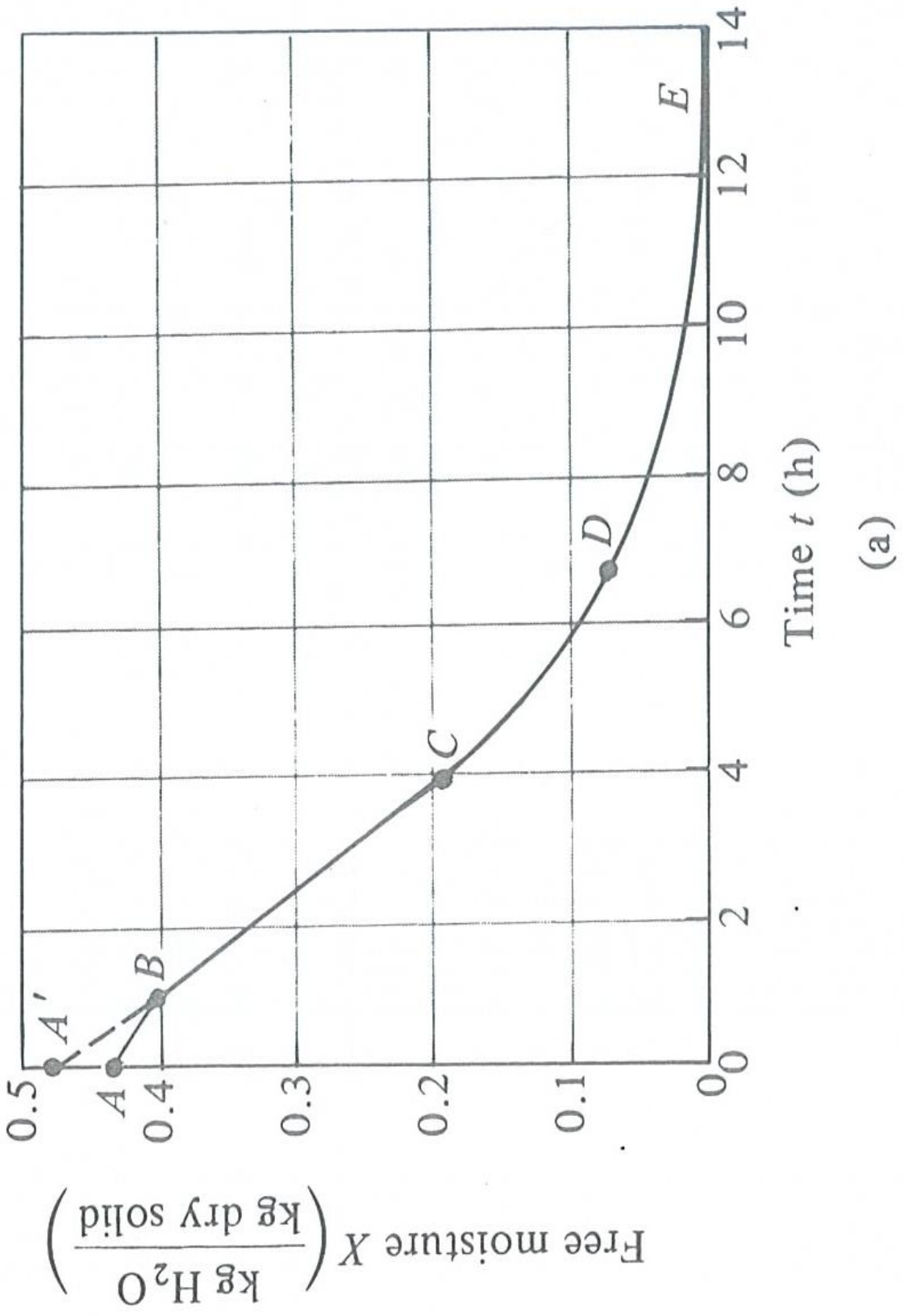
ii. List **TWO (2)** assumptions of the Langmuir adsorption isotherm.

*Terangkan **DUA (2)** andaian untuk isoterma penjerapan Langmuir.*

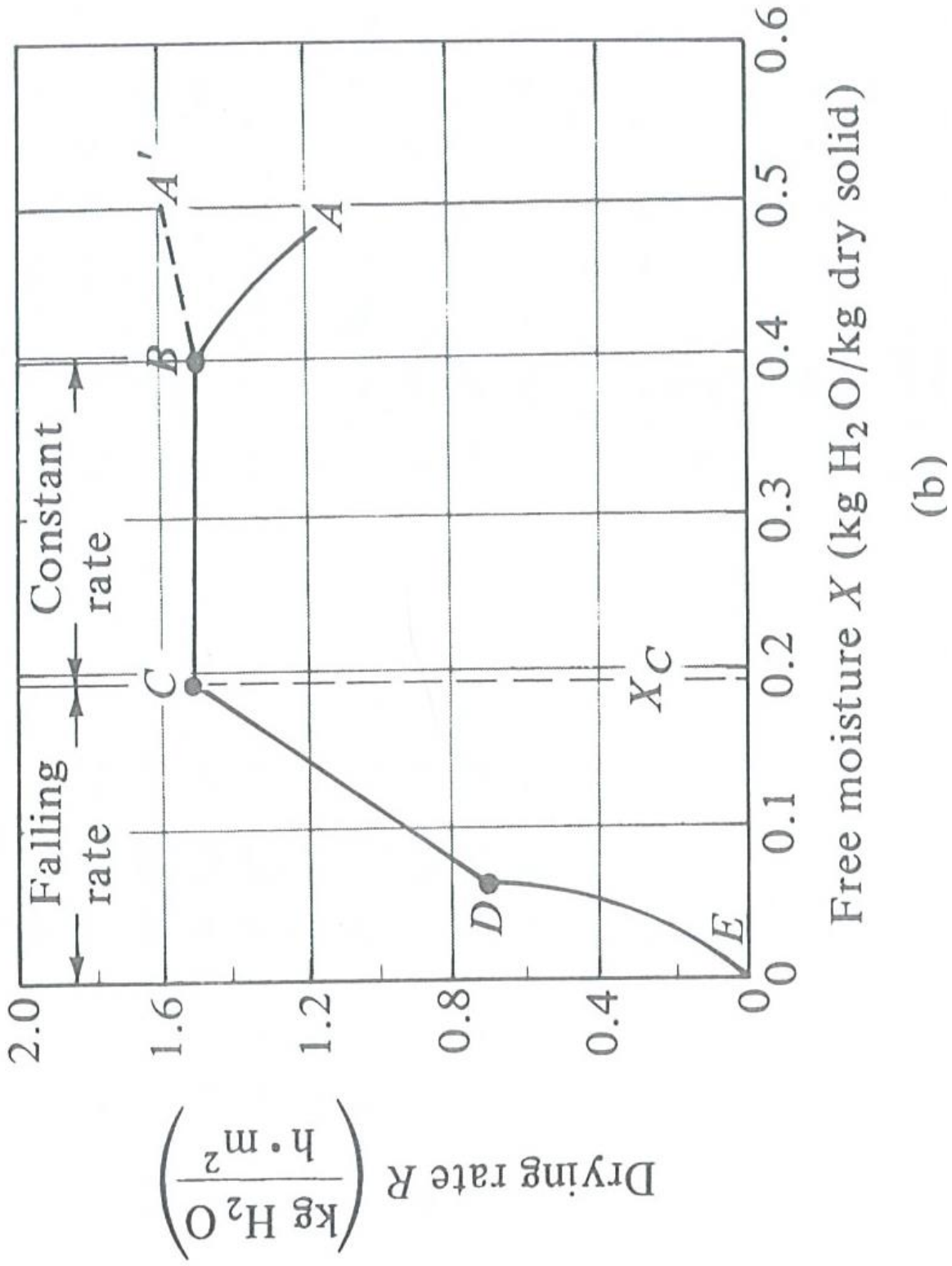
[12 marks]
[*12 markah*]

SOALAN TAMAT

APPENDIX A


Free moisture X $\left(\frac{\text{kg } H_2O}{\text{kg dry solid}}\right)$
0.5
0.4
0.3
0.2
0.1
0
A'
A
B
C
D
E
0
2
4
6
8
10
12
14
Time t (h)
(a)

APPENDIX B


Drying rate R $\left(\frac{\text{kg } H_2O}{h \cdot m^2}\right)$
2.0
1.6
1.2
0.8
0.4
0
Falling rate
Constant rate
A'
B
A
C
X_C
D
E
0
0.1
0.2
0.3
0.4
0.5
0.6
Free moisture X (kg H_2O/kg dry solid)
(b)