



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017**

COURSE NAME : FUNDAMENTAL TO PLANT TECHNOLOGY

COURSE CODE : BNL 20103

PROGRAMME CODE : BNL

EXAMINATION DATE : JUNE 2017

DURATION : 2 HOURS 30 MINUTES

INSTRUCTION : ANSWERS ALL QUESTIONS

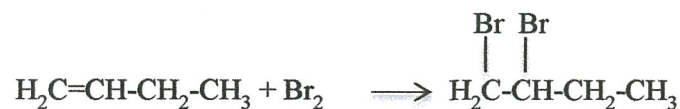
THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

Q1 (a) Define the term endothermic and exothermic process.

(4 marks)

(b) Calculate the energy/enthalpy required or consumed for the following reactions by using the bond energy as shown in **Table Q1 (b)**, and estimate either the reactions is exothermic or endothermic process.

(i) Bromination of alkene



(8 marks)

(ii) Combustion of butane



(8 marks)

Q2 (a) Calculate the percentage of hydrogen, carbon and oxygen in ethanol ($\text{C}_2\text{H}_5\text{OH}$), where the molar mass of C = 12.01 (g/mol), H = 1.01 (g/mol) and O = 16 (g/mol), respectively.

(8 marks)

(b) A mixture of gases is analyzed and found to have the following composition as shown in **Table Q2 (b)**.

Table Q2 (b)
The properties of mixture gases

Compound	MW (g/mol)	Compositions (%)
CO ₂	44.01	14.2
CO	28.01	8
CH ₄	16.04	19.6
N ₂	28.01	30.7
H ₂	2.02	10.3
H ₂ O	18	11.8
SO ₂	64.06	5.4

Determine the mass of 8 mol of the gas mixture.

(12 marks)

- Q3** An aqueous solution of sodium hydroxide contains 30 % NaOH by mass. It is desired to produce an 12 % NaOH solution by diluting a stream of the 30 % solution with a stream of pure water as shown in **Figure Q3**.
- (a) Calculate the ratios of (g H₂O / g feed solution) and (g product solution / g feed solution).
(10 marks)
- (b) Determine the feed rates of 30 % solution and diluting water needed to produce 1048 kg/min of the 12 % solution.
(10 marks)
- Q4** (a) Describe the difference between process flow diagram (PFD) and process & instrumentation diagram (P&ID).
(8 marks)
- (b) Name the following process symbols shows in **Figure Q4(b)** and briefly explain the function of each equipment.
(9 marks)
- (c) Identify the primary difference between a pump and a compressor.
(3 marks)
- Q5** (a) Describe:
- (i) Dalton's Law
(4 marks)
- (ii) Raoult's Law
(4 marks)
- (b) Determine the volume of 500 g of iodine that will occupy under the conditions of temperature is 300 °C and the pressure is 740 mm Hg, respectively.
(12 marks)

– END OF QUESTIONS –

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Table Q1(b)

Table of Bond Enthalpies (kJ/mole) at 25 °C					
Bond	Enthalpy	Bond	Enthalpy	Bond	Enthalpy
H-H	435	C-N	301	P≡P	490
H-F	569	C-O	352	Br-Br	193
H-Cl	431	C=O	532	Cl-Cl	243
H-Br	364	C-Br	234	H-Se	276
H-I	297	C-Cl	331	H-Te	243
H-C	414	C-F	440	S=S	427
H-N	460	N≡N	950	C-S	260
H-O	465	N-N	297	H-Si	393
H-S	377	O=O	498	H-P	318
C-C	368	O-O	213	C-Si	289
C=C	724	F-F	159	I-I	151
C≡C	963	Si-Si	339		

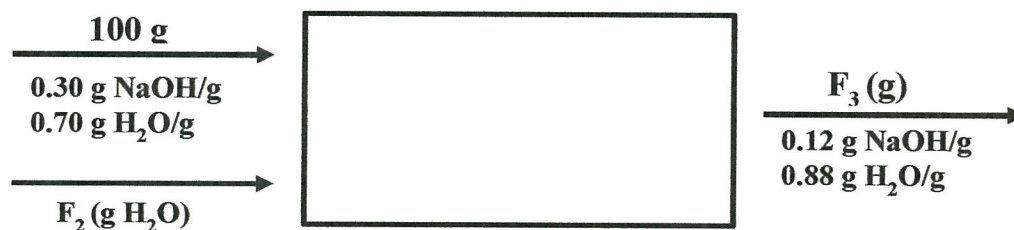


Figure Q3

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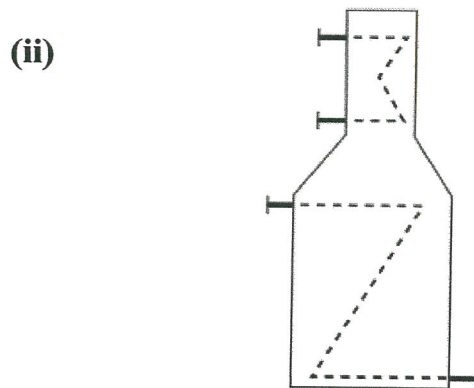
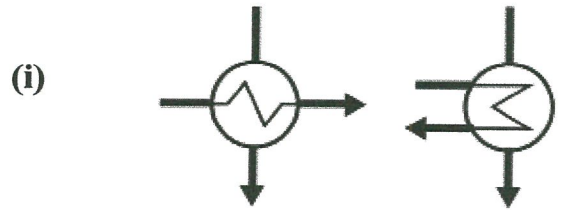


Figure Q4(b)