Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	FOUNDATION OF CHEMICAL ENGINEERING TECHNOLOGY
COURSE CODE	:	DAK 12302
PROGRAMME	:	DAK
EXAMINATION DATE	:	DECEMBER 2019 / JANUARY 2020
DURATION	:	2 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) The presence of gases may contribute to a certain transition of moles number when there are influences of temperature or pressure. This condition has been recognized and regarded in gas laws.

(i) State the definition of Boyle's Law.

(2 marks)

(ii) Distinguish **three (3)** different properties of gases and liquids.

(6 marks)

(iii) A 4.0 L air sample at -50 °C has a pressure of 110 kPa. The temperature is raised to 100 °C and the volume expands to 8.0 L. According to combined gas law, determine the new pressure of air.

(4 marks)

(b) In a process pipeline, a chemical fluid flows through a 5 cm pipe with a velocity of 3.7 m/s. Determine the density of the fluid when it has the viscosity at 0.7 N.s/m^2 and the Reynolds number is 300.

(3 marks)

(c) A mixture of 1500 kg/h containing equal parts by mass of ethanol and water is distilled. Product leave via the top stream whereas by-product leave through the bottom stream on the distillation column. The flow rate of the bottom stream is measured and found to be 1000 kg/h, and the overhead stream is analyzed and found to contain 92.0 wt.% of ethanol.

(i) Draw and label a flowchart of the process.

(4 marks)

(ii) Calculate the mass flow rate at the overhead stream and mass fractions of ethanol and water in the bottom product stream.

(6 marks)

Q2 (a) Piping and instrumentation diagram (P&ID) illustrates the piping processes and interactions with other installed equipment and instrumentation. Explain **four (4)** graphical elements that should be understand by the stakeholders in designing the industrial plant.

(4 marks)

(b) The presence or absence of a line determines the location of the physical device. Compare all the **three (3)** different lines in discrete instrument.

(6 marks)

(c) Distinguish the differences between Block Flow Diagram (BFD), Process Flow Diagram (PFD) and Piping and Instrumentation Diagram (P&ID).

(6 marks)

(d) In terms of processing facilities, Piping and Instrumentation Diagram (P&ID) is one type of a graphic representation.

(i) Explain briefly the information obtained from P&ID.

(4 marks)

(ii) Outline the importance of P&ID.

(5 marks)

Q3 (a) Natural resources are components that are within the atmosphere. They may exist in different entity to give rise into different functions for human being.

(i) Describe the definition of **two (2)** different natural resources based on their origin by providing the examples of each type.

(4 marks)

(ii) Construct the chronology that has produce the crude oil.

(3 marks)

(b) Explain **four (4)** types of in-situ bioremediation treatment.

(8 marks)

(c) Compute **five (5)** advantages of bioremediation.

(5 marks)

(d) Phytoremediation is the application of plants to remove contaminants. Demonstrate and explain all the classifications in phytoremediation.

(5 marks)

Q4 In a biodiesel industry, the fermentation process is carried out in order to produce the bio-product. During the processes, the workers are exposed to microorganisms that help in fermentation of biomass. However, there are some leaking in a pipeline along the plant and causing the floor to wet and the sharp edge of pipe protruded.

(a) Based on this situation occur, explain **five (5)** types of hazards exposed by the workers in the plant.

(5 marks)

(b) In order to reduce the hazards, determine the steps should be taken to mitigate the possibility for the accident to occur in the plant.

(4 marks)

(c) As a safety officer, explain the HAZOP studies needed to be carried out in plant to ensure the operation is in a safer environment.

(7 marks)

(d) Every worker should notice the basic symbols of hazards in the plant. Hence, if a chemical industry was exposed to hazardous substances, explain all of its classes that should be understand by every individual in the plant.

(9 marks)

- END OF QUESTIONS -

FINAL EXAMINATION

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UNIT CONVERSION

Mass	1 kg	= 1000 g = 0.001 metric ton = 2.20462 lb_m = 35.27392 oz
	1 lb_m	= 16 oz = 5 x 10^{-4} ton = 453.593 g = 0.453593 kg
Length	1 m	= 100 cm = 1000 mm = 10^6 microns (μm) = 10^{10} angstroms ($\overset{0}{A}$)
		= 39.37 in = 3.2808 ft = 1.0936 yd = 0.0006214 mile
	1 ft	= 12 in = 1/3 yd = 0.3048 m = 30.48 cm
Volume	1 m^3	= 1000 liters = 10^6 cm^3 = 10^6 ml
		= 35.3145 ft^3 = 220.83 imperial gallons = 264.17 gal
		= 1056.68 qt
	1ft^3	= 1728 in^3 = 7.4805 gal = 0.028317 m^3 = 28.317 liters
		= 28 317 cm^3
Force	1 N	= 1 kg.m/s^2 = 10^5 dynes = 10^5 g.cm/s^2 = 0.22481 lb_f
	1 lb_f	= 32.174 lb_m.ft/s^2 = 4.4482 N = 4.4482 x 10^5 dynes
Pressure	1 atm	= 1.01325 x 10^5 N/m^2 (Pa) = 101.325 kPa = 1.01325 bars
		= 1.01325 x 10^6 dynes/cm^2
		= 760 mm Hg at 0°C (torr) = 10.333 m H_2O at 4°C
		= 14.696 lb_f/in^2 (psi) = 33.9 ft H_2O at 4°C
		= 29.921 in Hg at 0°C
Energy	1 J	= 1 N.m = 10^7 ergs = 10^7 dyne.cm
		= 2.778 x 10^{-7} kW.h = 0.23901 cal
		= 0.7376 ft-lb_f = 9.486 x 10^{-4} Btu
Power	1 W	= 1 J/s = 0.23901 cal/s = 0.7376 ft.lb_f/s = 9.486 x 10^{-4} Btu/s
		= 1.341 x 10^{-3} hp