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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2022/2023

COURSE NAME : FOUNDATION OF CHEMICAL
ENGINEERING TECHNOLOGY

COURSE CODE : DAK 13303

PROGRAMME CODE : DAK

EXAMINATION DATE : FEBRUARY 2023

DURATION : 3 HOURS

INSTRUCTIONS : 1. ANSWER ALL QUESTIONS

2. THIS FINAL EXAMINATION IS
CONDUCTED VIA **CLOSED BOOK**.

3. STUDENTS ARE **PROHIBITED** TO
CONSULT THEIR OWN MATERIAL OR
ANY EXTERNAL RESOURCES DURING
THE EXAMINATION CONDUCTED VIA
CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

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TERBUKA

Q1 (a) Convert all the followings.

(i) 400 in⁵/year to cm⁵/s

(3 marks)

(ii) $\frac{6(in)(cm^2)}{(yr)(s)(lb_m)(ft^2)}$ to all SI unit

(7 marks)

(b) Caffeine has the following molecular composition of C₄H₅N₂O. Find the percentage composition of each element in the mixture.

(5 marks)

(c) Chemical engineers play a very important role in making modern society from creating simple products such as paper, plastic, rubber, pharmaceuticals, gasoline and cement.

(i) Define chemical engineering.

(2 marks)

(ii) Chemical engineering technologists play an important role in determining our standard of living and quality of life in most such as manufacturing, health, information and communication and lastly the environment. Describe the role of chemical engineer technologists in each area with an example.

(8 marks)

Q2 (a) Determine the total pressure in a 0.065 m³ vessel containing the following mixture of gases at 52.8°C: 0.05 mol Ne, 0.078 mol H₂, and 0.423 mol He. (PV=nRT, R = 0.08206 L.atm/K.mol)

(3 marks)

(b) Two different sizes of steel pipes are pumped with oil at the same speed of 5.8 m/s. Calculate each **TWO (2)** inner pipe diameter so that the oil flow in the first pipe is laminar and the second pipe is turbulent. (For oil, specific volume = 0.00125 m³/kg and viscosity μ = 0.0103 kg/ms).

(6 marks)

- (c) Mr. Ali is an engineer at Company A. His boss asked him to prepare 1000 kg of mixed acid containing 60wt% H_2SO_4 , 32wt% HNO_3 , and 8wt% water by mixing **THREE (3)** types of solution. The solution are (a) 11.3wt% HNO_3 , 44.4wt% H_2SO_4 and 44.3wt% water, (b) 80wt% HNO_3 aqueous solution and (c) 95wt% H_2SO_4 aqueous solution. The mass stream of each solution is X kg, Y kg and Z kg respectively.
- (i) Draw and label a flowchart of the process. (4 marks)
- (ii) Calculate the mass stream of each solution based on the flowchart in **Q2(c)(i)**. (12 marks)

- Q3** (a) Identify the limitations of
- (i) plastic pyrolysis process. (2 marks)
- (ii) recycling process. (4 marks)
- (b) Sketch a flow diagram for the process of generating energy starting from its sources for the following
- (i) hydroelectric dam. (4 marks)
- (ii) solar energy. (4 marks)
- (iii) geothermal energy. (4 marks)
- (c) Describe the challenges of future renewable energy in Malaysia. (4 marks)
- (d) Select the most feasible renewable energy and describe your choice. (3 marks)

- Q4** (a) Three elements in the fire triangle are required for a flammable substance to be ignited.
- (i) Describe the flammability limit in a closed room and sketch a diagram to support the description (4 marks)
- (ii) Write **THREE (3)** examples of sources of ignition and their potential control. (3 marks)
- (b) Write the risk control or barrier in the management system for hazardous substances. (6 marks)

- (c) Identify and solve the following situation.
- (i) Your employer did illegal chemical waste dumping (4 marks)
 - (i) Neighbours use illegal poisons on crops (4 marks)
 - (iii) Saw the local authorities extorting traders (4 marks)

-END OF QUESTIONS –

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APPENDIX

FACTORS FOR UNIT CONVERSIONS

Quantity	Equivalent Values
Mass	$1 \text{ kg} = 1000 \text{ g} = 0.001 \text{ metric ton} = 2.20462 \text{ lb}_m = 35.27392 \text{ oz}$ $1 \text{ lb}_m = 16 \text{ oz} = 5 \times 10^{-4} \text{ ton} = 453.593 \text{ g} = 0.453593 \text{ kg}$
Length	$1 \text{ m} = 100 \text{ cm} = 1000 \text{ mm} = 10^6 \text{ microns } (\mu\text{m}) = 10^{10} \text{ angstroms } (\text{Å})$ $= 39.37 \text{ in} = 3.2808 \text{ ft} = 1.0936 \text{ yd} = 0.0006214 \text{ mile}$ $1 \text{ ft} = 12 \text{ in} = 1/3 \text{ yd} = 0.3048 \text{ m} = 30.48 \text{ cm}$