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CHUKA**UNIVERSITY****UNIVERSITY EXAMINATIONS****EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF
SCIENCE IN INDUSTRIAL CHEMISTRY****CHIN 323: INDUSTRY FORMULATION CHEMISTRY AND TECHNOLOGY****STREAMS: BSc. INDUSTRIAL CHEMISTRY****TIME: 2 HOURS****DAY/DATE: TUESDAY 18/4/2023****8.30 A.M. – 10.30 A.M.****Instructions: Answer Question ONE and any other TWO questions.****QUESTION ONE (30 MARKS)**

a) (I) Explain the meaning of the following terms in formulation chemistry

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|-------|------------------------|-----------|
| (i) | Anionic surfactant | (2 marks) |
| (ii) | Active ingredient | (2 marks) |
| (iii) | Rheological agents | (2 marks) |
| (iv) | Antifreeze agents | (2 marks) |
| (v) | Amphoteric surfactants | (2 marks) |
| (vi) | Amphiphilic | (2 marks) |

(II) Briefly outline the major steps in Cussler and Moggridge Framework as a

Methodology of Chemical Product design. (4 marks)

(b) Explain the concept of quality function deployment in formulations (2 marks)

(c) Give any 3 procedures applied for emulsion stability assessment (6 marks)

(d) Using suitable examples discuss two industrial applications of emulsions (4 marks)

- (e) Explain why cationic surfactants are incompatible with anionic surfactants (2 marks)

QUESTION TWO (20 MARKS)

- a) Discuss the following terms in relation to formulation chemistry:
- i) Suspensions (2 marks)
 - ii) Coarse suspension (2 marks)
 - iii) Suspoemulsions (2 marks)
 - iv) Nanosuspensions (2 marks)
- b) Give three techniques for evaluation of suspensions (3 marks)
- c) Briefly discuss three tests used to identify emulsion types (6 marks)
- d) Differentiate W/O/W and O/W/O multiple emulsion (3 marks)

QUESTION THREE (20 MARKS)

- a) Explain the limitations of Cussler and Mogridge and Stage-gate Chemical product designs (CPD) mitigated by the combined CPD (3 marks)
- b) Briefly discuss the following stages in combined chemical process design:
- i) Preliminary stage (2 marks)
 - (ii) Stage 2: Feasibility study (2 marks)
 - (iii) Stage 3: Product development (2 marks)
 - (iv) Stage 4: Test and Validation (2 marks)
- (c) Explain how surfactants and antimicrobial agents work in formulations (5 marks)
- (d) Explain the role of Buffers in formulations (4 marks)

QUESTION FOUR (20 MARKS)

- a) Briefly explain the effects of main process variables on emulsion stability (6 marks)
 - b) Discuss registration steps for a pest control product in Kenya as per the Pest Control Board (6 marks)
 - c) Discuss deception and unsanitary conditions in relation to chemicals according to Kenyan law (4 marks)
 - d) Briefly discuss the following methods of formulation analysis in relation to pharmaceuticals , cosmetics or pest control products
 - i) Nuclear magnetic resonance (NMR) (2 marks)
 - ii) High pressure liquid chromatography-Mass spectrometry (2 marks)HPLC-MS
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