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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023**

COURSE NAME : COLLOID AND SURFACE CHEMISTRY

COURSE CODE : BWK 20403

PROGRAMME CODE : BWK

EXAMINATION DATE : JULY / AUGUST 2023

DURATION : 3 HOURS

INSTRUCTION : 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) Adsorption can be defined as the phenomenon of accumulation of large number of molecular species at the surface of liquid or solid phase in comparison to the bulk. Physical and chemical adsorption respond differently with a rise in temperature. With the aid of illustration, briefly explain this phenomenon. (5 marks)
- (b) The Tyndall effect refers to the phenomenon of light scattering by colloidal particles or small particles suspended in a transparent medium.
- (i) Describe the phenomenon of light scattering. (2 marks)
- (ii) Demonstrate **TWO (2)** examples of Tyndall effect phenomenon that is commonly seen in daily situations. (4 marks)
- (c) Oil spills pose a significant environmental threat, contaminating water bodies, harming marine life, and impacting the ecosystems. In this situation, the use of surfactants can enhance oil dispersion which helps to break down the oil into smaller droplets, increasing the oil-water interface and aiding microbial degradation. Despite the benefits of the surfactant in facilitating the cleaning process, suggest the consideration that should be taken into account in term of environmental impact and the application methods of surfactant. (5 marks)
- (d) A micelle is a self-assembled structure formed by the aggregation of amphiphilic molecules in a solvent. Explain the significance of micelles structure in terms of their surface activity and colloidal stability. (4 marks)
- Q2 (a) Discuss **TWO (2)** major factors affecting surface roughness. (4 marks)
- (b) A chemist makes a hypothesis whereby “the rolling friction of a sample is less than the sliding friction of a sample with identical weight”. Tabulate the differences between the **TWO (2)** types of friction to justify the claim. (3 marks)
- (c) *“Maximum pit, slit, and crack depth are the parameters for assuming the corrosion damages”*
- (i) Classify the type of corrosion that occurred as mentioned above. (2 marks)

- (ii) Construct a complete illustration of the corrosion phenomena in Q2 (c)(i).
(7 marks)
- (d) pH is an important factor that influences the rate and nature of corrosion.
- (i) Explain why pH value contributes to the rate of corrosion?
(2 marks)
- (ii) Describe another ONE (1) factor that influences the occurrence of corrosion.
(2 marks)
- Q3** (a) Given the initial weight of the metal pipe (W1) was 500 grams, and after exposure time of 1 year, the final weight of the pipe (W2) was recorded as 480 grams. Calculate the corrosion rate for the metal pipe mentioned above. Consider the surface area of the metal pipe is 100 cm^2 and the conversion factor is $8.96 \times 10^{-6} \text{ mm/g}$.
(5 marks)
- (b) Surface tension is responsible for the shape of liquid droplets. In the absence of other forces, drops of all liquids would be approximately spherical.
- (i) An air bubble with a diameter of 0.5 cm is in a liquid with surface tension and density of 0.06 N/m and 1.03 g/cm^3 respectively. The pressure inside the bubble was found to be 1300 Nm^{-2} . Approximate the depth of the bubble below the surface of the liquid if the acceleration of gravity is equal to 9.8 ms^{-2} .
(11 marks)
- (ii) With the aid of illustration, briefly explain the difference between the surface energy of liquid drop and soap bubble.
(4 marks)
- Q4** (a) In a spontaneous adsorption process conducted at 298 K, the entropy and free energy were found to be $161 \text{ JK}^{-1} \text{ mol}^{-1}$ and 130 kJmol^{-1} respectively. Calculate the enthalpy change for this adsorption process.
(5 marks)
- (b) Capillary action is the movement of liquid in the upward direction with the solid surface. This is caused by the attraction between the molecules of liquid and solid.
- (i) A chemist did an experiment in the lab at a constant temperature of 293 K. With the aid of Table Q4(b)(i), determine the diameter (in cm) of a capillary tube dipped vertically in water with a density of 0.9 g/cm^3 which causes the

water to climb up to a height of 12.5 cm within it. Given that the contact angle between the glass and the water and acceleration of gravity are 25° and 9.8 ms^{-2} .

(11 marks)

(ii) With the aid of illustration, briefly derive the Laplace equation.

(4 marks)

-END OF QUESTIONS -

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Table Q4(b)(i): Variation of water surface tension with temperature

Temperature (°C)	Surface Tension (N/m)
0	0.0757
10	0.0742
20	0.0728
30	0.0712
40	0.0696
50	0.0679
60	0.0662
70	0.0644
80	0.0626
90	0.0608
100	0.0588