BACHELOR OF ENGINEERING IN CHEMICAL ENGINEERING EXAMINATION, 2017

(1st Year, 2nd Semester)

PHYSICAL CHEMISTRY

Time : Three hours   Full Marks : 100

(50 marks for each Group)

Use a separate Answer-Script for each Group

GROUP A

1. a) Briefly discuss about the 'capillary action'. Give its practical example.

b) Why does oil spread over the surface of water?

c) How does the surface tension of a liquid vary with temperature?

d) A drop of water, 0.4 cm in radius, is split up into 125 tiny drops. Find the increase in surface energy. [γ_{water} = 72 dynes/cm]

e) By how much will the surface of a liquid be depressed in a glass tube of radius 0.02 cm if the angle of contact of the liquid is 135° and its surface tension 547 dynes / cm? Density of the liquid = 13.5 g / c.c.

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2. a) Distinguish between streamline flow and turbulent flow of a liquid.

b) State Newton's law of viscous flow.

c) How does the viscosity of a liquid vary with temperature? Is this nature of a liquid different from a gas?

d) In a certain experiment on the flow of liquid through a capillary tube, the following data were obtained:

Volume of liquid collected per minute = 7.06 c.c.; Height of the water column = 34.1 cm.; Length of the tube = 56.45 cm.; Radius of the tube = 0.0514 cm.; g = 980 cm / s^2. Calculate the coefficient of viscosity.

e) Two drops of water of the same size are falling through air with terminal velocities of 10 cm. / s. If the two drops coalesce to form a single drop, what will be the new terminal velocity?

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e) Define sedimentation potential.

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4. a) Explain why river mouths have to be periodically dredged to keep it navigable.

b) Briefly discuss about optical properties of a lyophobic colloid.

c) What is Schultze–Hardy rule and what does this rule predict about the lyophobic sol?

d) Write a short note on protective action and gold number.

e) When an animal moves on quicksand, it gets sucked up – explain.

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(1ST Year, 2nd Semester)
Physical Chemistry

GROUP-B

1 a)   Calculate the pH of water at 25 °C (Given: Ionic product of water at 25 ^{0}C is 1 × 10^{-14}).

b)   How would you determine the equivalent conductance of ammonium hydroxide solution at infinite dilution?

c)   Derive the relevant equation to calculate the pH of an aqueous solution of 0.1 (N) sodium acetate.

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2 a)   Draw, with justification, the variation of conductance of a NH$_4$OH solution as a function of volume of hydrochloric acid solution gradually added to it from the burette.

b)   A silver nitrate solution containing 0.00739 g of AgNO^3 per g of water is electrolyzed between silver electrodes. During the experiment 0.078 g of Ag was deposited on the cathode. At the end of the experiment the anode solution contained 23.14 g of water and 0.236 g of AgNO$_3$. What is the transport number of Ag ion?

c)   To determine the transport number of K$^+$ ion in 0.1 N KCl solution by moving boundary method CdCl$_2$ solution is used as the indicator electrolyte. The solutions are taken in a capillary of internal diameter 2.124 mm. The cationic boundary shifts by 100 mm when a steady current of 14mA is passed for 497 secs. Find out the transport number of K$^+$ ion.

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3 a)   Represent the Daniell cell and write the overall reaction taking place in the cell.

b)   The electrode potential Cu | Cu^{++} (1M) is –0.62 volt. At what concentration of copper ions will this electrode potential be zero?

c)   A real electrochemical cell can not have a negative potential – Explain.

<div align="right">(3 + 2) + 5 + 3</div>