RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. FOURTH SEMESTER EXAMINATION, SEPTEMBER 2020

SECOND YEAR [BATCH 2018-21]

Date : 26/09/2020 **INDUSTRIAL CHEMISTRY (Honours)**

Time : 11.00 am – 3.00 pm **Paper : IV** Full Marks : 50

Group : A

Answer <u>any five</u> questions from Question Nos. 1-7 : [5×5]

All symbols are of usual significance

1. a) Check the dimensional consistency of the following equation

$$\frac{1}{2}mv^2 = mgh$$

b) The speed of sound v in a gas might plausibly depends on the pressure, P, the density, ρ, and volume, V of the gas. Use dimensional analysis to determine the exponents x, y, and z in the formula

$v = CP^x \rho^y V^z$

Where C is the dimensionless constant. [2+3]

2 a) Explain why the viscosity of liquid decreases with increase of temperature for liquid and for gas it is reverse?

b) Define ideal and real fluid.

c) Write the examples of pseudoplastic, dilatant and bingham fluid.

d) Explain why pseudoplastic liquid is call shear thinning liquid? [2+1+1+1]

3 a) Differentiate between (i) Absolute and Gauge pressure, (ii) Simple manometer and differential manometer.

b) A differential manometer is connected at the two points A and B of two pipes as shown in Figure 1. The pipe contains a liquid of density 1500 kg/m^3 , while pipe B contains a liquid of density 900 kg/m^3. The pressures at A and B are 1 kg$_f$/cm^2 and 1.80 kg$_f$/cm^2 respectively. Find the difference in mercury level in the differential nanometer.

Given Density of Hg = 13600 kg/m^3 [2+3]

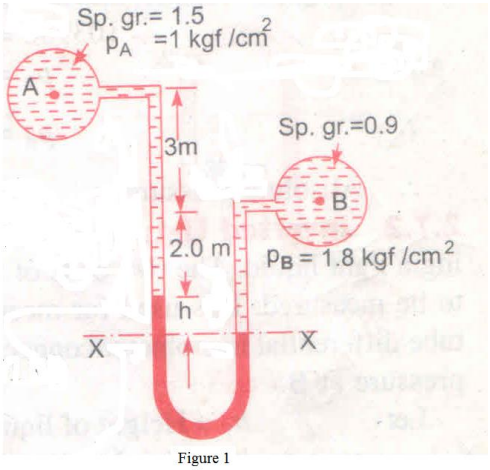

Figure 1

4. a) Differentiate between (any three)
   (i) Steady and unsteady flow;
   (ii) laminar and turbulent flow;
   (iii) rotational and irrotational flow,
   (iv) Compressible and incompressible flow.

   b) Write and explain continuity equation.
   c) State and explain the Bernoulli's theorem.
   d) Write the assumptions made in the derivation of the Bernoulli's equation. [1.5+1+1.5+1]

5. a) Discuss the relative merits and demerits of venturimeter with respect to orifice-meter.
   b) An oil of sp. Gr. 0.8 is flowing through a venturimeter having inlet diameter 20 cm and throat diameter 10 cm. The oil-mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal venturimeter. Take $C_d = 0.98$, $\rho_{Hg} = 13600$ kg/m^3 [2+3]

6. a) How does the binary gas-phase diffusivity depend upon the total pressure and temperature? Can you give the qualitative explanation?
   b) Alcohol vapour is diffusing through a layer of water vapour under equimolar counter diffusion at 35^{o}C and 1 atm pressure . The molar conc. of alcohol on the two sides of the gas film (water vapour) 0.3 mm thick are 80% and 10% respectively. Assuming the diffusivity of alcohol – water vapour to be 0.18 cm^2/s. (i) calculate the rate of diffusion of alcohol and water vapour in kg/hr through an area of 100 cm^2; (ii) if the water vapour layer is stagnant, estimate the rate of diffusion of alcohol vapour. [1+4]

7. a) Write the types of internals used in a distillation column.
   b) Write the conditions favouring the plate and packed column used in mass transfer operation.
   c) Write a note of packing materials used in the packed bed. [1+2+2]

Group : B

8. Answer **all** the questions: [1×5]

   a. What is the Functionality of resorcinol? Show structure.

   b. As the crystallinity increases The ductility of the polymer _____

   c. Give an example of a polymer synthesized by ring opening polymerization with reaction.

   d. Compare the glass transition temperature of plastic, TPE & rubber.

   e. What is the reason behind the high tensile strength of NR?

   Answer **any four** question from Question Nos. 9 - 14 : [4×5]

9. a. Polymerisation of polystyrene follows cationic mechanism whereas acrylonitrile follows the anionic mechanism-explain.

b. The degree of polymerization of Nylon 6,6 (ignore end-groups) with molar mass of 2,00,000 g mol^{-1} is _____.

c. What is gel effect? Give an example of inhibitor [1.5+1.5+2]

10. a. Enlist the distinguishing features among LDPE, LLDPE and HDPE.

b. Explain the advantages and disadvantages of Solution polymerisation. [3+2]

11. a. Typically how PET is prepared? Explain your answer with suitable equations.

b. Enlist the distinguishing features PF resins.(both novalak and bakelite).

c. State the uses of polyurathane. [2+2+1]

12. a. Name the superior vulcanizing agents except Sulphur for a product that has to work on >200 degree Celsius with reason?

b. Sulphur is a must for vulcanization. Justify.

c. Why are fillers used in rubbers? [2+1+2]

13. a. Can we use any polymer which is synthesized by an emulsion polymerization process in electrical insulation application? Explain your answer.

b. What is the basic monomer of silicone rubber?

c. Why can't EPM be vulcanized with Sulphur? [2+1+2]

14. a. Generally, SBRs are made of 75% of Butadiene and 25% of Styrene, what changes in properties will happen in respect in the T_g, if we swap the proportion of the monomers that are mentioned earlier? (Explain Mathematically). Given, $T_{g,styrene}$ = 373K and $T_{g,butadiene}$ = 173K. What is the grade called?

b. Two miscible polymers A (Tg = -50 c) & B (Tg = 100 c) are blended in weight ratio of 3:7. What will be the Tg of the blend? [4+1]

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