

Time: Three Hours

Max Marks 100

**Instructions to the candidates, if any:-**

- 1) All the questions are compulsory. Choice is internal.
- 2) Figures to the right indicate full marks.
- 3) All questions carry equal marks.
- 4) Draw flowcharts /diagrams wherever necessary.

**Q1 a) State True or False:**

(04)

- i) Strongest acid has the weakest conjugate base.
- ii)  $\text{H}_2\text{PO}_4$  represents the conjugate acid of  $\text{HPO}_4^{2-}$
- iii) The pH of a solution containing equal amounts of the acid and its conjugate base is equal to the  $\text{pK}_a$  of a weak acid.
- iv) For an acidic solution at  $25^\circ\text{C}$ ,  $[\text{H}^+] < [\text{OH}^-]$

**Q1 b) Attempt any three of the following:**

(09)

- i) What is the ionic product of water? Explain why water has a neutral pH?
- ii) Define buffer. Give one example each of an acidic and a basic buffer.
- iii) Define  $\text{pH}_m$  and dissociation constant.
- iv) Give the titration curve of phosphoric acid.
- v) Explain Sorenson's Formol titration.
- vi) Comment: "The phosphate buffer system is important for buffering intracellular fluid."

**Q1 c) Attempt any two of the following:**

(12)

- i) Discuss in detail the role and significance of protein as buffer.
- ii) Derive the Henderson Hasselbalch equation. Calculate the pH of a mixture of 0.042 M acetic acid and 0.058 M sodium acetate. ( $\text{pK}_a=4.76$ ).
- iii) Discuss in detail the relation between  $\text{pI}$ ,  $\text{pK}_{a1}$ ,  $\text{pK}_{a2}$  and  $\text{pK}_{a3}$  of aspartic acid. Draw the titration curve of the same.
- iv) Define isoelectric pH. Citing the example of casein, state the significance of isoelectric pH. What is the isoelectric pH of casein?

**Q2 a) State True or False:**

(04)

- i) Emulsoids can be precipitated faster than suspensoids.
- ii) Oil has more viscosity than water.
- iii) Viscosity of lyophobic colloids is relatively high.
- iv) Surface tension of water follows the principle of thermodynamics.

**Q2 b) Attempt any three of the following:**

(09)

- i) How much  $\text{AgNO}_3$  is required to prepare 200 ml of 0.02 M solution?
- ii) Stating an example, explain what is "Electroendosmosis"?
- iii) Define: Diffusion and osmosis. State a similarity between the processes.
- iv) Write about the significance of charge on colloidal particles.
- v) Discuss in brief: Types of colloids.
- vi) State True or false, giving reason: 'By sprinkling oil in the sea, the waves calm down'.

**Q2 c) Attempt any two of the following:**

(12)

- i) State Vant Hoff's laws of osmotic pressure. Explain how osmotic pressure is analogous to gas pressure.
- ii) Explain the role of bile in digestion of fats.
- iii) Differentiate between true solution, colloidal solution and suspension.

- iv) What is “Relative viscosity”? Elaborate on the experiment for its determination. Add a note on significance of viscosity in physiology.

**Q3 a) State True or False:**

**(04)**

- i) To determine the resolution of microscope, one must be aware of ocular and objective lens power.
- ii) Immersion oil used in 100X has refractive index identical to that of water.
- iii) Phase contrast microscopy is valuable for visualizing yeast cells.
- iv) A nanometer is equivalent to a thousandth of mm.

**Q3 b) Attempt any three of the following:**

**(09)**

- i) State the similarities between SEM and TEM microscopy
- ii) Elaborate on the applications of Dark field and bright field microscopy.
- iii) Write about the principle and significance of “Fluorescence microscopy”
- iv) Write about contribution of Galileo Galilei in microscopy
- v) State the importance of condenser and diaphragm in light microscopy.
- vi) Mention the various techniques used for specimen preparation.

**Q3 c) Attempt any two of the following:**

**(12)**

- i) Enlist specialized microscopic techniques. Elaborate on any two of them
- ii) Write a detailed account of Time lapse microscopy with its applications, advantages and disadvantages.
- iii) Write an informative note on: Applications of electron microscopy
- iv) Elaborate on DIC microscopy.

**Q4 a) Define any five of the following:**

**(10)**

- i) Diffusion coefficient
- ii) Zeta Potential
- iii) Ocular
- iv) Magnification
- v) Ka
- vi) Buffering capacity
- vii) Refractive Index

**Q4 b) Attempt any three of the following:**

**(15)**

- i) Describe how bicarbonate ions prevent the buildup of excess H<sup>+</sup>?
- ii) Schematically represent a titration curve of glycine. Write down the formulae for the calculation of the pI of the same. Also, represent on the curve the pH at which maximum charges are present. What is this pH value known as?
- iii) Write a detailed account of Confocal Scanning Laser Microscopy.
- iv) With the help of a neat labeled diagram elaborate on the important parts of the microscope and explain their functions.
- v) Explain mechanism of osmosis with special emphasis on renal dialysis.
- vi) Give a detailed account of Donnan Membrane equilibrium. Add a note on its relation with osmotic pressure.

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