2021

MICROBIOLOGY — HONOURS

First Paper

(Group – B)

Full Marks : 50

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer ***question nos.*** **1** & **2** and ***any three*** from the rest.

1. Answer ***any five*** of the following questions : 2×5

(a) What is resolution? How is it related to numerical aperture of a microscope?

(b) Define isotonic and hypotonic solutions.

(c) What is ion product of water? What is its value?

(d) Express a wavelength of 670nm as (i) a frequency, (ii) a wave number.

(e) State the units of :

(i) Coefficient of viscosity

(ii) Molar extinction coefficient.

(f) What do you mean by specific activity of a radioisotope? What is its unit?

(g) What will be the concentration of H^+ ion at pH 2 and pH10?

(h) What are the functions of (i) objective lens and (ii) condenser lens in a microscope?

2. (a) Differentiate between sample and population.

(b) Percentage of Hb of 10 patients were recorded as 8, 9, 10, 11, 12, 13, 14, 14.5, 15 and 15.5gm/100ml. Calculate the variance of the data.

(c) What is Box plot?

(d) How can you obtain the central tendency of a set of values? 2+4+2+2

***Or*,**

(a) Write two differences between correlation and regression.

(b) Define primary data and secondary data.

(c) Find the mean and median of the following data :

88, 72, 33, 29, 70, 54, 86, 91, 57 and 61. 3+3+4

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3. (a) What is buffer capacity? What is its unit?

(b) Calculate the pH of 10^{-8} M of HCl.

(c) State and explain Henderson-Hasselbach equation.

(d) Under what conditions the pH of a solution will be equal to its pK_a? 2+3+3+2

4. (a) Justify the following statement :

For a process which is spontaneous ΔG° must always be equal to zero.

(b) Explain (i) Bathochromic shift (ii) Hypsochromic shift.

(c) What is the difference between a fluorophore and a chromophore?

(d) With the help of a Jablonski's diagram describe the origin of fluorophore. 2+3+2+3

5. (a) Explain the role of the following compounds in polyacrylamide gel electrophoresis :

(i) SDS, (ii) Glycine, (iii) TEMED, (iv) Bis-acrylamide

(b) Define 'Svedberg' unit and state its dimensions.

(c) State and explain Fick's first law of diffusion.

(d) What is reverse osmosis? Suggest one application of the process.

(e) What is chemical potential? 2+2+2+2+2

6. (a) What is Becquerel? How is it related to Curie?

(b) The half-life of a radio-element is 231 minutes. How long will it take for $\frac{9}{10}$th of a sample of this element to decay?

(c) What is scintillation cocktail? Why is it used?

(d) What is the principle of phase contrast microscopy? 2+3+3+2

7. (a) How can CsCl density gradient centrifugation be used to separate DNA, RNA and protein from their mixture?

(b) Predict the mode of vibrations in H_2 and CO_2.

(c) What do you mean by isobaric and isochoric processes?

(d) Calculate the osmotic pressure of a 5% solution of glucose (MW = 180) at 18°C. 3+2+2+3

8. (a) What is an isolated system? What will be the value of ΔS for such a system?

(b) Distinguish between exothermic and endothermic processes.

(c) Discuss the criteria for spontaneity of a chemical reaction.

(d) What is the basis of separation in gel filtration chromatography? What do you mean by void volume of a gel filtration column? (2+1)+2+2+(2+1)