

## UG 5th Semester Examination 2021

## CHEMISTRY (Honours)

Paper Code: SEC-1 (A)

(IT Skills for Chemists)

(CBCS)

Full Marks: 40

Time-2hour

*The figures in the margin indicate full marks**Candidates are required to give their answers**in their own words as far as practicable**(Answer any eight questions. Each question carries 1 mark)*

1. Answer any *eight* questions from the following: (1×8=8)
- Which arithmetic operation is signified by the symbol '\*\*' in BASIC ?
  - What is the derivative of the function  $f(x) = \tan^{-1}(x)$ .
  - What is the result of the following operation of the intrinsic function 'INT' in BASIC:  
INT(10.25).
  - Enter a formula into cell D2 that will compute the mean of the numbers in cells A2 and B2.
  - Assume that a length has been measured is 37.8m with an expected random error of 0.35cm and a systematic error of 0.06cm. Find the total expected error.
  - Write down the following algebraic equation in BASIC language:  $x^x$ .
  - What is the use of Excel's NORM-INV ( ) function?
  - Draw the function  $xe^{-x^2}$ .
  - What does they vs  $\frac{1}{x}$  plot look like where  $y = \frac{m}{x} + c$ ,  $m, c$  are constants.
2. Answer any *six* questions from the following: (2×6=12)
- Sketch rough graph of the function  $e^{-x^2} \sin(x)$ .
  - Write logical expression to express the following condition  
 $X$  is less than 5 or is greater than 10.
  - Two lengths have been measured as  $24.8 \text{ m} \pm 0.4\text{m}$  and  $13.6\text{m} \pm 0.3\text{m}$ . Find the probable value of their sum and its probable error.
  - What is the algebraic expression corresponding to the following BASIC expression

$$\left(\frac{A+B}{A \times B}\right)^{**3}$$

- (e) What is the syntax of LINSET function in Excel? Explain each of the arguments.
- (f) What are the advantages and disadvantages of using Trendline in Excel?
- (g) Why we use  $t$ -test in chemical analysis?
- (h) Show that the function  $f(x) = x$  and  $g(x) = (x^2 - 1)$  are orthogonal in the interval  $[-1; 1]$ .

3. Answer any two questions from the following: (2×10=20)

(a) (i) Write down the principle of Simpson's  $\frac{1}{3}$  rule and derive it. (4)

(ii) Write down a BASIC program to find the sum of the following series: (6)

$$-1 + \frac{1}{2} - \frac{1}{3} + \frac{1}{4} - \frac{1}{5} + \dots + \frac{1}{10}$$

(b) (i) Write down the flowchart (using standard symbols) for calculating the factorial of an integer. (5)

(ii) Assuming that the ideal gas law holds, find the amount of nitrogen gas in a container if

$$P = 0.836 \text{ atm} \pm 0.003 \text{ atm}, V = 0.01985 \text{ lit} \pm 0.0008 \text{ lit}, T = 298.3 \text{ K} \pm 0.2 \text{ K}$$

Find the expected error in the amount of nitrogen. (5)

(c) (i) For acetic acid  $K_a = 1.754 \times 10^{-5}$  at  $25^\circ\text{C}$ . Find  $[H^+]$  if 0.10 mol of acetic acid is dissolved in enough water to make 1 lit of solution. Neglect the dissociation of water. (4)

(ii) Find the probability of each of the outcomes of tossing two dice and find the mean value. (6)

(d) (i) Assume that a random variable,  $x$ , is governed by the probability distribution  $f(x) = \frac{c}{x^2}$ , where  $c$  is a constant and  $x$  ranges from  $-1.00$  to  $10.00$ . Find the mean value of  $x$  and its variance. (5)

(ii) How will you determine the area under the curve of a normal Gaussian distribution? What Excel function do you use to determine the area under the curve? Write down the syntax of the function and explain the corresponding arguments. What Excel function will you use to determine the area under the standard normal curve? (5)

**Paper: SEC-1 (B)**  
**[Basic Analytical Chemistry]**  
**(CBCS)**

*The figures in the margin indicate full marks.  
Candidates are required to give their  
answers in their own words as far as  
practicable.*

Full Marks: 40

Time: Two Hours

1. Answer any *eight* questions from the following: 1 × 8 = 8

(a) The difference between the largest and smallest value of a set of results is known as -

- (i) Standard deviation
- (ii) Absolute error
- (iii) Range
- (iv) Rejection value

(b) Permanent hardness is caused due to -

- (i) Magnesium carbonate
- (ii) Magnesium bicarbonate
- (iii) Magnesium sulphate
- (iv) All of the above

(c) Which of the following is responsible for yellow colour in turmeric?

- (i) Curcumin
- (ii) Phellandrene
- (iii) Sabinene
- (iv) Cineol

(d) The colour change observed for calcon indicator used in complexometry from free indicator state to metal-indicator complex is -

- (i) Colourless to violet
- (ii) Lemon yellow to red
- (iii) Red-violet to yellow
- (iv) Blue to pink

(e) Titanium dioxide commonly used in -

- (i) Vanishing cream
- (ii) Sunscreen Cream
- (iii) Ophthalmic Cream
- (iv) Aqueous calamine cream

(f) In which chromatography stationary phase is more polar than mobile phase?

- (i) Ion exchange chromatography
- (ii) Normal phase chromatography
- (iii) Reversed chromatography
- (iv) Size exclusion chromatography

(g) Which of the following compounds acts as a food preservative?

- (i) Sodium benzoate
- (ii) Calcium tartrate
- (iii) Sodium ascorbate
- (iv) Fumaric acid

(h) Coffee is commonly adulterated with -

- (i) Saw dust
- (ii) Chicory
- (iii) Ghee
- (iv) All of the above

(i) Which of the following food colouring compounds is used for red colouration?

- (i) Amaranth
- (ii) Riboflavin-5-sodium phosphate
- (iii) Chrysoine resorcinol
- (iv) Indigo carmine

(j) Which of the following mobile phases is suitable for the separation of hydrophilic substances in paper chromatography?

- (i) Isopropanol-ammonia-water (9:1:2)
- (ii) Dimethyl formamide - cyclohexane
- (iii) Kerosene - 70% isopropanol
- (iv) Paraffin oil - dimethyl formamide - methanol - water

2. Answer any *six* questions:

$2 \times 6 = 12$

(a) Express each of the following results to the correct significant digits:

(i)  $(0.216)(47.27) - (0.111)(11.32)$

(ii)  $4.272 - \log(2.7 \times 10^{-5})$

(b) Give an example of application of masking process in complexometry.

(c) What is talcum powder? Mention the important composition of talcum powder.

(d) Explain how TLC can be applied to separate ink pigment in red ink, blue ink and black ink.

(e) Differentiate between deodorants and antiperspirants.

(f) What are the common food adulterants present in asafoetida (hing) and in turmeric powder?

(g) What do you mean by 'method of least squares'?

(h) What are the important factors that affect the column efficiency in adsorption chromatography?

3. Answer any *two* questions:

$10 \times 2 = 20$

(a) (i) Discuss briefly how anion-exchange capacity of an anion exchange resin be determined.

(ii) What do you mean by substitution titration in complexometry? Give one example.

(iii) What type of paper is used in paper chromatography? How is it modified?

(iv) Draw the structure of Patton-Reeder's indicator. Mention its use in complexometry.

$$3 = (1+1) + (1+2) + (1+1)$$

(b) (i) What is locating reagent? What is its importance in paper chromatography?

(ii) Find out the BOD of water sample which contains 1.5 g of urea for every 100 litres of water. The reaction between urea and oxygen is as follows:



(iii) Explain how the magnesium present in soil can be determined quantitatively.

(iv) Explain how the presence of iron in vitamin tablets can be determined spectrophotometrically. (1+1) + 2 + 3 + 3

(c) (i) Calculate the absolute standard deviation for the following set of data obtained for the estimation of iron in a sample as 86.1 mg, 85.2 mg, 85.8 mg, 85.7 mg, 85.5 mg and 85.3 mg.

(ii) Why alkalinity in water arises? Explain how it can be estimated.

(iii) What is the basic difference between water pollution and contamination?

(iv) Discuss briefly how ion-exchange capacity of strong acidic cation exchange resin can be determined. 2 + (1+2) + 2 + 3

(d) (i) Explain how biochemical oxygen demand (BOD) can be estimated.

(ii) What are the advantages of using EDTA as an important chelating agent in complexometry?

(iii) Discuss the process for the analysis of gasoline.

(iv) A sample of water is found to contain 0.003 mole/litre of  $\text{Ca}^{2+}$  and 0.004 mole/litre of  $\text{HCO}_3^-$ . Calculate the number of moles of  $\text{Ca}(\text{OH})_2$  and  $\text{Na}_2\text{CO}_3$  that should be added to one litre of this water to soften it. 3 + 2 + 3 + 2