2024/FYUG/EVEN/SEM/
CHMIDC–151T/087

FYUG Even Semester Exam., 2024

CHEMISTRY

(2nd Semester)

Course No. : CHMIDC–151T

(Indian Chemistry Through the Ages)

Full Marks : 70
Pass Marks : 28

Time : 3 hours

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The figures in the margin indicate full marks for the questions

SECTION—A

Answer any *twenty* questions : 1×20=20

1. Mention two important properties of metals.

2. Define boiling point.

3. Define coordinate covalent bonding with example.

4. What is meant by global warming?

5. Write the scientific notations of the following :
   (a) 6000×10^2
   (b) 0·0000423

6. What do you mean by alchemy?

7. Who is considered as the father of Rasashastra?

8. What is meant by Iatrochemistry?

9. What is the name of the book written by Acharya Nagarjuna on chemistry?

10. Mention one important contribution of 'Siddha Nityanatha' in ancient chemistry.

11. Name the primary constituent of glass.

12. Give examples of coinage metals.

13. Mention the uses of ink.

14. What is meant by metallurgy?

(Continued)

15. Mention the characteristic of a good cosmetic.

16. Who is considered as the father of Indian chemistry?

17. Which pharmaceutical company was founded by Acharya P. C. Ray?

18. Name the book on chemistry written by Acharya P. C. Ray.

19. Who was the first Indian to receive Ph.D. degree in chemistry?

20. Name an important discovery made by Acharya Prafulla Chandra Ray.

21. Who is known for interpreting the genetic code and understanding protein synthesis?

22. Name the prestigious prize award annually to Indian scientists, named after a renowned chemist.

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23. What research area earned Venkatraman Ramakrishnan the Nobel Prize in chemistry?

24. What significant biochemical compounds did Yellapragada Subbarow discover?

25. Name two medical ailments for which Dr. Asima Chatterjee formulated medications.

SECTION—B

Answer any *five* questions : 2×5=10

26. Draw the Lewis dot structure of the following :
    (a) CH_4
    (b) SO_4^{2-}

27. Differentiate between covalent bonding and ionic bonding.

28. What are the different categories of chemical substances in Rasashastra?

29. What do you mean by 'Navaratnas'? Name them.

30. What are dyeing agents? Give examples.

31. What are perfumes? Mention their uses.

32. Discovery of which organic and inorganic nitrites popularized by Acharya P. C. Ray to be regarded as 'Master of Nitrites'?

33. What is the significance of discovery of nitrites? Mention a few applications.

34. What is the field of expertize of Prof. C. N. R. Rao? What are some practical applications of his research?

35. How did Darshan Ranganathan's research impact the field of supramolecular chemistry?

SECTION—C

Answer any *five* questions : 8×5=40

36. What is acid rain? Discuss the causes and impact of acid rain. 2+(3+3)=8

37. What is meant by greenhouse effect? Describe the causes and impact of greenhouse effect. How can it be minimized? 2+(2+2)+2=8

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38. Write brief notes on the following : 4

(a) Mūsā Yantra used in ancient chemistry

(b) Kosthi Yantra

39. Write short notes on the following : 4×2

(a) Pātana Yantra

(b) Dhūpa Yantra

40. What are soaps? Name different types of surfactants. Discuss the cleansing action of soaps. 2+2+4=8

41. Distinguish between the following :

(a) Iron and Steel

(b) Copper and Bronze

Mention the advantages of alloys over the corresponding metals. 3+3+2=8

42. Discuss Ray's classification of five stages in development of chemistry in India. Mention three major honours and recognitions received by Prof. P. C. Ray. 5+3=8

(Continued)

43. Briefly describe the major contribution of Acharya P. C. Ray in chemical research.

44. Discuss the research contributions of Prof. Har Gobind Khorana to the field of molecular biology, emphasizing the significance and impacts of his findings.

45. Discuss Dr. Kamala Sohonie's multi-disciplinary research efforts and their impact on India's scientific landscape and societal welfare.

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2024/FYUG/EVEN/SEM/
CHMDSM-151T/085

FYUG Even Semester Exam., 2024

CHEMISTRY

(2nd Semester)

Course No. : CHMDSM-151T

(Fundamentals of Chemistry)

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Full Marks : 70
Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

SECTION—A

Answer any *ten* questions : 2×10=20

1. Find an expression for first radius of H-atom applying Bohr's theory.

2. Calculate the number of unpaired electrons in the following gaseous ions : ½×4=2

Mn^{3+}, Cr^{3+}, V^{3+}, Ti^{3+}

3. An electron and a proton are moving with same velocity. Compare their wavelengths.

4. With the help of MOT, show that He_2 molecule does not exist but He_2^+ exists.

5. Draw the resonance structure of NO_3^- ion.

6. Using VSEPR theory, predict and draw the shapes of the following molecules : 1+1

   (a) SF_4

   (b) ClF_3

7. Write down the basic postulates of kinetic theory of gases.

8. State the law of corresponding states.

9. Write down the SI unit of the van der Waals' constants *a* and *b*.

10. Briefly discuss the effect of temperature on surface tension.

Continued

1. What is the physical significance of lattice point?

2. Explain a method of determination of viscosity of a liquid.

3. What do you mean by inductive effect?

4. Define electrophile and nucleophile with one example each. 1+1=2

5. Which of the following carbanions is most stable and why?

   (i) $CH_2=CH-\overset{\ominus}{C}H_2$

   (ii) 

   (iii) $CH_3-\overset{\ominus}{C}H-CH_3$

SECTION—B

Answer any *five* questions : 10×5=50

16. (a) Write the Schrödinger wave equation for hydrogen atom and explain each term in the equation. 1+2=3

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(c) Designate the orbitals bearing quantum numbers : 1

(i) $n = 2,\ l = 1$

(ii) $n = 3,\ l = 2$

(c) State Heisenberg's uncertainty principle.

(d) The mass of a moving electron is $9{\cdot}11 \times 10^{-31}$ kg and its wavelength is 7·27 Å. Find out its velocity.

17. (a) Calculate the frequency, energy and wavelength of radiation corresponding to the spectral line of lowest frequency in Lyman series in the hydrogen spectrum. 1+1+1

(b) Discuss the significance of ψ and ψ^2.

(c) Write the electronic configurations of the elements chromium and copper. 1+1

(d) Deduce the expression for de Broglie's equation.

18. (a) Write down the basic postulates of valence bond (VB) theory.

(b) $[FeF_6]^{3-}$ has a magnetic moment of 5·92 BM. Explain on the basis of VBT.

(c) Write the MO electronic configuration of O_2 and draw the MO energy level diagram for O_2 molecule. Comment on its bond order and magnetic properties. 1+2+½+½=4

(d) How do you express bond strength in terms of bond order? 1

19. (a) What are bonding and antibonding molecular orbitals? 1+1=2

(b) Distinguish between a inner-orbital complex and an outer-orbital complex with examples. 3

(c) Draw the MO energy level diagram of CO molecule. Comment on its bond order and magnetic properties. 2+½+½=3

(d) What are high- and low-spin complexes? Give examples. 2

20. (a) Write down van der Waals' equation for n gm mole of a real gas. 2

(b) Critical density of a substance having molecular weight 111 is 0·555 gm-cm^{-3} and $P_c = 48$ atoms. Calculate van der Waals' constants a and b. 2

(Turn Over)

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(c) Write down the values of most probable velocity, average velocity and RMS velocity. Compare their results.

(d) What is mean free path? How does it vary with temperature and pressure? 1+2=3

21. (a) Calculate the kinetic energy of 1 gm-mole of hydrogen gas and also calculate the temperature for 16 gm of oxygen which will give same kinetic energy. 2+1=3

(b) What is compressibility factor? What is the nature of curve when compressibility factor plotted against pressure for H_2 gas at a constant temperature? 1+2=3

(c) What is collision number? How does it vary with temperature and pressure? 1+2=3

(d) What is co-volume or effective volume in van der Waals' gas? 1

22. (a) Explain the following terms : 1½+1½=3

(i) Crystal lattice

(ii) Coefficient of viscosity

(Continued)

(b) At 20 °C, toluene rises 2 cm in a capillary tube of radius 0·4 mm. Calculate the surface tension of toluene. Density of toluene at 20 °C is 0·9 gm-cm^{-3}. 2

(c) Write down the Stokes' equation for the determination of viscosity of a liquid and explain the terms involved in it. 3

(d) Draw and discuss different types of Bravais lattice for cubic system. 2

23. (a) What is the effect of temperature on viscosity of a liquid? 2

(b) Mention the characteristic features of Schottky and Frenkel defects. 1½+1½=3

(c) Calculate the number of atoms present per unit cell in different types of cubic unit cell. 2

(d) Write the principles of the drop weight method for determination of surface tension. 3

24. (a) Write the homolytic and heterolytic bond fission products of CH_3—C along the bond shown. 2

(Turn Over)

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(b) What are carbocations? Explain the hybridization and stability of carbocations. 1+

(c) What are free radicals? Explain the relative stabilities of various types of free radical. 1+

(d) Give one example each of—

(i) nucleophilic substitution reaction;

(ii) electrophilic addition reaction. 1+1

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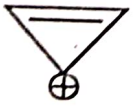
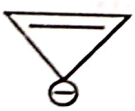
25. (a) What are carbanions? Explain, with orbital picture, the structure of methyl carbanion. 1+2

(b) What are carbenes? Write the different electronic states in which carbene exists. 1+2=

(c) State Hückel's rule of aromaticity.

(d) Which ion in each of the following pair is more stable and why?

 Or 

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2024/FYUG/EVEN/SEM/
CHMSEC-151T/086

FYUG Even Semester Exam., 2024

CHEMISTRY

(2nd Semester)

Course No. : CHMSEC-151T

(Basic Analytical Chemistry)

Full Marks : 50
Pass Marks : 20

Time : 2 hours

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The figures in the margin indicate full marks for the questions

SECTION—A

Answer any *fifteen* questions : 1×15=15

1. What is analytical chemistry?

2. Define the term 'systematic error'.

3. What is the full form of TLC?

4. Choose the correct answer :

Which one of the following is not an analytical technique?

(a) Titration

(b) Gravimetric analysis

(c) Stock analysis

(d) Spectroscopy

5. Define pH.

6. What do you mean by an indicator?

7. Define pure water.

8. Give one example of chelating agent.

9. Define cosmetic.

10. What are the basic constituents of talcum powder?

11. Write different types of cosmetics.

(Continued)

12. Give one example of antiperspirants.

13. What are the basic macronutrients present in food?

14. What are the adulterants present in coffee powder?

15. What are the functions of preservatives?

16. What is the full form of FSSAI?

17. What will happen to aquatic life when DO (dissolved oxygen) level of water is very high?

18. What is the pH of neutral, acidic and alkaline water?

19. Name two reagents mostly used in complexometric titration.

20. What are the macronutrients present in soil?

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SECTION—B

Answer any *five* questions :

21. Distinguish between qualitative and quantitative chemical analysis.

22. Explain the difference between accuracy and precision.

23. Explain how pH of the soil can be determined.

24. What are the major reasons for contamination of surface water?

25. What are the major components present in cosmetic products?

26. What is the use of emulsifiers in cosmetics? Give one example of emulsifier.

27. Give one example of natural and chemical preservative each and mention their uses.

(Continued)

28. How will you detect adulteration in asafoetida?

29. What are the factors that affect the DO level of water?

30. Give the principle of flame photometry.

SECTION—C

Answer any *five* questions : 5×5=25

31. Illustrate the procedure for the separation of a mixture of polar and non-polar compounds by TLC.

32. What are the different types of errors that can occur in analytical measurement? Explain how these errors can be minimized. 3+2=5

33. Explain the basic principle of complexometric titration. What do you mean by chelation? 3+2=5

34. What are the adverse effects of contaminated water on human body? Mention two methods to purify drinking water. 3+2=5

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35. Explain the procedure for the determinati of Zn and Al in cosmetic product.

36. How can boric acid be determined chemical method? Explain.

37. Write the basic properties of a preservative How can salt vinegar and sugar be used a preservative? 2

38. Describe procedures to determine the adulterant present in *(a)* turmeric powder and *(b)* chilli powder. 2½+2

39. Give the procedure to determine the dissolved oxygen in water.

40. Illustrate how calcium and magnesium can be determined by complexometric titration. 2½+2½

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