

Printing Pages: 2

Paper Code: BSCY-102

B

(SVSU:2025-26/R)

Enrollment No.

Program Name B.Sc. Chemistry
I Semester / 1st Year Examination
Subject Code BSCY-102

Subject Name: Nuclear and Environmental Chemistry

[Time : 03:00 Hours]

[Max. Marks : 70]

Note : Attempt all the questions as per given instructions.

1. Multiple Choice Questions (MCQs) [01×15=15]

- I** Which of the following models explains the binding energy of a nucleus?
(a) Rutherford model (b) Liquid drop model
(c) Bohr model (d) Quantum model
- II** The emission of a positron converts a neutron into:
(a) Proton (b) Electron (c) Photon (d) Alpha particle
- III** The gas mainly responsible for depletion of ozone layer is:
(a) Carbon monoxide (b) Methane
(c) Chlorofluorocarbon (d) Nitrogen
- IV** Which of the following is a secondary air pollutant?
(a) SO₂ (b) NO₂ (c) PAN (peroxyacetyl nitrate) (d) CO
- V** Which of the following parameters indicates organic pollution of water?
(a) pH (b) BOD (c) TDS (d) Temperature
- VI** The process of using ion-exchange resins for softening water removes:
(a) Suspended solids (b) Hardness-causing ions
(c) Microbes (d) Chlorine
- VII** The product of nuclear fusion of two deuterium nuclei is:
(a) Tritium+neutron (b) Helium-4
(c) Carbon-12 (d) Hydrogen-1
- VIII** Which particle has no charge but contributes to nuclear mass?
(a) Proton (b) Electron (c) Neutron (d) Alpha particle
- IX** The photochemical formation of ozone in the troposphere involves:
(a) Hydrolysis (b) Oxidation of SO₂
(c) Reaction of NO with O₂ (d) Photolysis of NO₂
- X** Which instrument works on electrostatic attraction to remove dust?
(a) Venturi scrubber (b) Settling chamber
(c) Electrostatic precipitator (d) Cyclone separator

- XI** Secondary treatment of sewage is mainly a:
(a) Chemical process (b) Biological process
(c) Physical process (d) Thermal process
- XII** The main source of thermal pollution in water bodies is:
(a) Agricultural runoff (b) Industrial cooling water
(c) Household waste (d) Acid rain
- XIII** In nuclear medicine, the radioisotope ^{99m}Tc is used primarily for:
(a) Radiation therapy (b) Diagnostic imaging
(c) Sterilization (d) Power generation
- XIV** The major greenhouse gas emitted by burning fossil fuels is:
(a) CO_2 (b) SO_2 (c) NH_3 (d) O_3
- XV** The process of burning sludge under controlled conditions is called:
(a) Filtration (b) Incineration (c) Sedimentation (d) Coagulation

2. Answer in long (any three) [10×3=30]

- a) Explain α -, β - and γ -decay processes with examples. Derive the relationship between decay constant and half-life.
- b) Describe the composition of the atmosphere and discuss the chemical reactions involved in ozone depletion.
- c) Discuss the various methods used for industrial waste management and sludge disposal.
- d) Write short notes on:
(a) Nuclear fusion
(b) Photochemical smog
(c) Reverse osmosis in water purification

3. Answer in short (any five) [5×5=25]

- a) Define radioactive series and explain radioactive displacement law.
- b) Describe the construction and working of a scintillation counter.
- c) What are the major sources of NO_x and SO_x emissions?
- d) Discuss greenhouse effect and its impact on global climate.
- e) Explain the concept of hydrological cycle and its importance.
- f) Describe any two modern water purification methods.
- g) Write a short note on the Three Mile Island nuclear disaster.

26/11/2025

Printing Pages: 2

Paper Code: BSCY-102

A

(SVSU:2025-26/R)

Enrollment No.

Program Name B.Sc. Chemistry

I Semester / 1st Year Examination

Subject Code BSCY-102

Subject Name: Nuclear and Environmental Chemistry

[Time : 03:00 Hours]

[Max. Marks : 70]

Note : Attempt all the questions as per given instructions.

1. Multiple Choice Questions (MCQs) [01×15=15]

- I** The stability of a nucleus depends mainly on the ratio of:
(a) Proton/Electron (b) Neutron/Proton
(c) Proton/Neutron (d) Proton/Mass number
- II** The process of splitting of a heavy nucleus into two or more lighter nuclei is called:
(a) Fusion (b) Chain reaction (c) Fission (d) Ionization
- III** Which layer of the atmosphere contains the ozone layer?
(a) Troposphere (b) Stratosphere (c) Mesosphere (d) Ionosphere
- IV** The main component responsible for acid rain is:
(a) CO₂ (b) CH₄ (c) SO₂ (d) O₃
- V** Which of the following is not a stage in wastewater treatment?
(a) Primary (b) Secondary (c) Tertiary (d) Quaternary
- VI** The main purpose of biological treatment in sewage plants is to:
(a) Remove suspended solids (b) Remove dissolved organic matter
(c) Filter bacteria (d) Remove heavy metals
- VII** The unit of radioactivity is:
(a) Curie (b) Joule (c) Tesla (d) Coulomb
- VIII** Which of the following instruments is used to detect and measure ionizing radiation?
(a) Ammeter (b) Spectrometer
(c) Geiger-Müller counter (d) Hygrometer
- IX** The formation of photochemical smog occurs mainly due to:
(a) Oxidation of SO₂ (b) Reaction of NO_x and hydrocarbons
(c) Burning of coal (d) Evaporation of water
- X** Which of the following is a device for air pollution control?
(a) Heat exchanger (b) Cyclone separator
(c) Venturi scrubber (d) Filter funnel

- XI** The process of removing dissolved salts from water by applying pressure is known as:
 (a) Electrolysis (b) Reverse osmosis
 (c) Distillation (d) Ion exchange
- XII** The parameter used to measure the amount of oxygen required by microorganisms to decompose organic matter is:
 (a) COD (b) DO (c) BOD (d) TOC
- XIII** The radioactive isotope used in carbon dating is:
 (a) $^1\text{H}^2$ (b) ^{14}C (c) ^{60}Co (d) $^{99\text{m}}\text{Tc}$
- XIV** The greenhouse effect is mainly due to:
 (a) O_2 (b) N_2 (c) CO_2 (d) Ar
- XV** The process used to dispose of solid industrial waste by burning at high temperature is called:
 (a) Filtration (b) Incineration (c) Sedimentation (d) Coagulation
- 2. Answer in long (any three) [10×3=30]**
- Explain the theory of nuclear fission and describe the working of a nuclear reactor with a neat labeled diagram.
 - Discuss the chemistry of photochemical smog and the methods used to control air pollution.
 - Explain in detail the various stages of wastewater treatment and purification.
 - Write short notes on:
 - Chernobyl Disaster
 - Ozone Depletion
 - Reverse Osmosis
- 3. Answer in short (any five) [5×5=25]**
- Define half-life and derive its relation with decay constant.
 - Write short notes on nuclear medicine and applications of radioisotopes.
 - What are electrostatic precipitators? Explain their working principle.
 - Discuss greenhouse gases in detail and their impact on climate.
 - Describe the hydrological cycle briefly.
 - Explain the importance of BOD and COD in water pollution.
 - What are the main sources and impacts of environmental pollution?

Printing Pages: 2

Paper Code: M-DIS-FCP

A

(SVSU:2025-26/R)

Enrollment No.

Program Name: B.Sc. Chemistry/ Zoology

I Semester / 1st Year Examination

Subject Code: M-DIS-FCP

Subject Name: Chemistry of Foods, Cosmetics and Perfumes

[Time : 03:00 Hours]

[Max. Marks : 70]

Note : Attempt all the questions as per given instructions.

1. Multiple Choice Questions (MCQs)**[01×15=15]****I Talcum powder mainly consists of:**

- (a) Magnesium silicate (b) Calcium carbonate
(c) Sodium bicarbonate (d) Aluminum oxide

II The main cleansing agent in shampoos is:

- (a) Alcohol (b) Soap or detergent
(c) Waxes (d) Glycerin

III Antiperspirants generally contain:

- (a) Sulphur (b) Sodium chloride
(c) Zinc oxide (d) Aluminum salts

IV Which of the following is used as a coloring agent in hair dyes?

- (a) Lead acetate (b) Zinc oxide
(c) Calcium carbonate (d) Sodium chloride

V The purpose of emulsifiers in creams is to:

- (a) Provide color (b) Mix oil and water
(c) Prevent bacterial growth (d) Improve fragrance

VI Preventing insect infestation is important during:

- (a) Cooking (b) Packaging (c) Transport (d) Storage

VII Cold creams are an example of:

- (a) Water-in-oil emulsions (b) Oil-in-water emulsions
(c) Suspension (d) Solution

VIII Geraniol is the main constituent of:

- (a) Rose oil (b) Sandalwood oil
(c) Lavender oil (d) Lemon oil

IX The main organization regulating food safety in India is:

- (a) WHO (b) FSSAI (c) ICMR (d) FAO

X Nail enamel removers contain:

- (a) Acetone (b) Methanol (c) Benzene (d) Toluene only

XI Which of the following helps prevent sweat odor?

- (a) Talcum powder (b) Antiperspirants (c) Creams (d) Deodorants

XII The main purpose of adulteration is:

- (a) Profit gain
- (b) Preservation
- (c) Hygiene
- (d) Nutrition improvement

XIII Clean machinery in food industries ensures:

- (a) Better flavor
- (b) No cross-contamination
- (c) Color uniformity
- (d) Cost reduction

XIV Which type of cream forms an oily layer to prevent moisture loss?

- (a) Cold cream
- (b) Vanishing cream
- (c) Shaving cream
- (d) Astringent cream

XV Food adulteration means:

- (a) Adding vitamins to food
- (b) Improving food quality
- (c) Cooking food improperly
- (d) Mixing unwanted substances in food

2. Answer in long (any three)

[10×3=30]

a) State and explain three types of food adulteration. Give suitable examples of each type.

b) Discuss the key features of the Prevention of Food Adulteration Act, 1954.

c) Write a short note on:

- Sandalwood oil
- Jasmine
- Muscone

d) Discuss the role of surfactants and humectants during the formulation of cosmetics.

3. Answer in short (any five)

[5×5=25]

a) What are the main ingredients used in the preparation/formulation of cosmetics? Discuss any two with examples.

b) Describe the common laboratory or household tests used to detect adulteration in milk and oil.

c) How do you synthesize 2-phenyl ethyl alcohol used in cosmetics? Give appropriate mechanism.

d) List the names of common preservatives used in cosmetics and give suitable examples.

e) Explain the significance and role of the Food Adulteration Act in India."

f) Define perfumes. Comment on their important classification.

g) Discuss various types of creams used in cosmetics and their functions.

Printing Pages: 2

Paper Code: SEC-FP

A

(SVSU:2025-26/R)

Enrollment No.														
----------------	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Program Name – B.Sc. Chemistry

Year/Semester- I/I Examination Year

Subject Name- Fuel and Pharmaceutical Chemistry

Subject Code-SEC-FP

Timing: 3:00 Hours

[Max. Marks: 70]

Note: Attempt all the questions as per the given instructions.

1. Multiple Choice Questions (MCQs)

[01x15=15]

I. Soda based lubricants are an example of

- a) solid lubricants
- b) semi solid lubricant
- c) liquid lubricant
- d) gaseous lubricant

II. Which of the following compound act as antioxidants?

- (a) Gallic acid
- b) benzoic acid
- c) cresol
- d) phenol

III. Which of the following fractions of coal tar is used for making road tar?

- a) Middle oil
- b) Heavy oil
- c) Pitch
- d) Light oil

IV. Which of the following is not the petroleum source?

- a) cycloalkane
- b) hydrocarbon
- c) alkane
- d) oil shales

V. The process of designing new drugs based on the knowledge of biological targets is known as:

- a) Random screening
- b) Rational drug design
- c) Serendipity
- d) Molecular mimicry

VI. LPG consist mainly of

- a) methane
- b) ethane
- c) propane
- d) all

VII. A good metallurgical coke should have:

- a) High ash and sulphur
- b) Low porosity
- c) High strength and low impurities
- d) Low carbon content

VIII. Which of the following drugs has anti-inflammatory, antipyretic, and analgesic activity?

- a) Ibuprofen
- b) Diazepam
- c) Morphine
- d) Dapsone

IX. Coal liquefaction is the process of converting:

- a) Gas to liquid
- b) Coal to liquid fuels
- c) Coke to gas
- d) Tar to solid carbon

a) Lipoxygenase b) Cyclooxygenase (COX)

c) Monoamine oxidase d) Acetylcholinesterase

XI. Hydro-gasification involves reaction of coal with:

a) Steam b) Oxygen c) Hydrogen d) Nitrogen

XII. An example of cationic surfactants

a) alkyl sulphates b) alkyl trimethyl ammonium salts

c) alkyl pyridinium d) both b and c

XIII. Paracetamol toxicity primarily affects the:

a) Liver b) Kidneys c) Lungs d) Brain

XIV. Catalytic gasification is carried out in the presence of:

a) Inert gases b) Catalysts such as Ni or Fe

c) Water

XV. Which step comes first in the drug development process?

a) Clinical trials

c) Lead identification

[10x3=30]

I. Discuss solid lubricants. Explain graphite and MoS₂ with the help of neat and clean diagram.

II. How paracetamol is synthesized? Give stepwise route for its synthesis with effects of its overdose.

III. Discuss the classification of fuels in detail.

IV Explain about HIV-AIDS. Also discuss its symptoms and the suitable drugs for its management.

[5x5=25]

I. What are the characteristics of good fuel? Give any five.

II. What is chloramphenicol? Discuss its uses and side effects.

III. Explain the difference between hydro-gasification and catalytic gasification.

IV. What is the significance of fuel and non-fuel in various industries?

V. Enlist any fives applications of lubricants.

VI. Write a short note on analgesics.

VII. Define calorific value. Distinguish between Higher and Lower Calorific Values with examples.

Printing Pages: 2

Paper Code: BSCY-101

A

(SVSU:2025-26/R)

Enrollment No.

Program Name – B.Sc. Chemistry

Year/Semester- I/I Examination

Subject Name- Atomic Structure, Chemical Bonding and Redox Reactions

Subject Code-BSCY-101

[Time : 03:00 Hours]

[Max. Marks : 70]

Note: 1. Attempt all the questions as per the given instructions.

1. Multiple Choice Questions (MCQs) [01x15=15]

I. Bohr's atomic model successfully explained the spectrum of:

- (a) Helium atom (b) Hydrogen atom
(c) Lithium atom (d) Neon atom

II. The energy of an electron in the n th orbit of hydrogen atom is proportional to:

- (a) n (b) $1/n$ (c) $1/n^2$ (d) n^2

III. The concept of matter waves was proposed by:

- (a) Heisenberg (b) Schrödinger (c) de Broglie (d) Bohr

IV. The uncertainty principle is given by:

- (a) $\Delta x \cdot \Delta p \geq h$ (b) $\Delta x \cdot \Delta p \geq h/4\pi$
(c) $\Delta x \cdot \Delta E \geq h$ (d) $\Delta x \cdot \Delta v \geq h$

V. Schrödinger's wave equation is based on:

- (a) Classical mechanics (b) Quantum mechanics
(c) Relativity (d) Kinetic theory

VI. ψ^2 represents:

- (a) Energy (b) Wave amplitude
(c) Probability density (d) Charge density

VII. Quantum number which gives the shape of orbital is:

- (a) Principal (b) Azimuthal (c) Magnetic (d) Spin

VIII. The 3p orbital has how many radial nodes?

- (a) 5 (b) 1 (c) 2 (d) 3

IX. The maximum number of electrons in an orbital is given by:

- (a) n^2 (b) $2n^2$ (c) 2 (d) 8

X. The Pauli's exclusion principle states that:

- (a) Two electrons can have same quantum numbers
(b) No two electrons can have all four quantum numbers identical
(c) Electrons fill lower energy levels first
(d) Electrons spin in opposite direction

XI. Aufbau principle fails for:

- (a) Light elements (b) Transition elements
(c) Noble gases (d) Halogens

XII. Hund's rule deals with:

- (a) Spin of electrons (b) Energy of orbitals
(c) Pairing of electrons (d) Filling of shells

XIII. The effective nuclear charge increases across a period because:

- (a) Nuclear charge increases (b) Shielding decreases
(c) Both (a) and (b) (d) None

XIV. Slater's rules are used to calculate:

- (a) Ionization energy (b) Effective nuclear charge
(c) Atomic radius (d) Electronegativity

XV. Atomic radius decreases across a period due to:

- (a) Increase in shielding (b) Increase in nuclear charge
(c) Decrease in electrons (d) None

2. Long answers type questions (any three)

[10x3=30]

- a. Explain Bohr's model of the hydrogen atom. Derive the expression for the radius and energy of an electron orbit and discuss the limitations of the model.
- b. Discuss effective nuclear charge (Z_{eff}) and shielding effect. Derive Slater's rules and discuss the trend of Z_{eff} in the periodic table.
- c. Derive the Born-Haber cycle for an ionic compound and calculate lattice energy. Discuss its applications.
- d. Elaborate redox reactions and balance them using the ion-electron method and oxidation number method.

3. Short answers type questions (any five)

[5x5=25]

- a. Derive the de Broglie wavelength equation and give one example of its application.
- b. Explain the significance of ψ and ψ^2 in Schrödinger's equation.
- c. Define electron gain enthalpy and explain its trend across a period.
- d. Discuss the difference between atomic radius, ionic radius, and covalent radius.
- e. Draw the Lewis structure of H_2O , CO_2 , and NH_3 .
- f. Define dipole moment and explain how it indicates ionic character in a molecule.
- g. Analyze the occurrence of metals in nature based on electrode potentials.

Printing Pages: 2

Paper Code: SEC-FP

B

(SVSU:2025-26/R)

Enrollment No.

Program Name – B.Sc. Chemistry

Year/Semester- I/I Examination Year

Subject Name- Fuel and Pharmaceutical Chemistry

Subject Code-SEC-FP

Timing: 3:00 Hours

[Max. Marks: 70]

Note: Attempt all the questions as per the given instructions.

1. Multiple Choice Questions (MCQs)

[01x15=15]

I. Which one of the following lubricant is not known generally?

- a) solid b) liquid c) gaseous d) none

II. The amount of heat produced by the complete combustion of a unit mass

of fuel is called its:

- a) Combustion rate b) Calorific value
c) Energy density d) Efficiency

III. The main constituent of coal responsible for its calorific value is:

- a) Oxygen b) Carbon c) Sulfur d) Nitrogen

IV. Lubrication is necessary to protect wear and tear caused due to

- a) electrostatic force b) frictional force
c) magnetic force d) gravitational force

V. Chloramphenicol contains which functional group?

- a) Nitro group b) Amide group
c) Dichloroacetyl group d) All of the above

VI. Acyclovir is an analogue of:

- a) Guanine b) Adenine c) Thymine d) Cytosine

VII. Lithium based lubricants are an example of

- a) solid b) semi solid c) liquid d) gaseous

VIII. Which of the following is a solid fuel?

- a) Petrol b) Coal c) Methane d) Propane

IX. CNG consists mainly of

- a) Methane b) Ethane c) Propane d) Butane

X. AZT (Zidovudine) is classified as a:

- a) Non-nucleoside reverse transcriptase inhibitor
b) Nucleoside reverse transcriptase inhibitor
c) Protease inhibitor d) Integrase inhibitor

XI. The calorific value of coal is approximately:

- a) 10,000 kJ/kg b) 20,000 kJ/kg
c) 33,000 kJ/kg d) 50,000 kJ/kg

XII. A good fuel must possess ____ calorific value

- (a) high (b) low (c) moderate (d) all

XIII. Analgesic drugs are primarily used to:

- a) Reduce fever b) Relieve pain
c) Reduce inflammation d) Induce sleep

XIV. Low-temperature carbonization of coal produces:

- a) Hard coke b) Soft coke c) Graphite d) Ash

XV. An example of anionic surfactants

- a) alkyl trimethylammonium salt b) alkyl pyridinium
c) alkyl sulphates d) thioethers

Long answers type questions (any three)

[10x3=30]

I. Explain the process of carbonization of coal. Describe the products obtained and their industrial applications.

II. Discuss refining of petroleum. Give the application of each of the isolated fraction.

III. Write a short note on:

- (i) Flash point (ii) Fire point (iii) Cloud point (iv) Pour point

IV. Discuss, how HIV infection leads to the development of AIDS.

Short answers type questions (any five)

[5x5=25]

I. List the major constituents of coal and describe its importance in industrial applications.

II. What is producer gas? How it can be obtained? What are the main components? Give reaction involved.

III. Differentiate between high-temperature and low-temperature carbonization of coal.

IV. What is Aspirin? Discuss the side effects and symptoms of aspirin overdose.

V. State gaseous fuels. Give suitable advantages and disadvantages.

VI. Write a short note on paracetamol.

VII. What is coal liquification and what are its benefits

Printing Pages: 2

Paper Code: BSCY-101

C

(SVSU:2025-26/R)

Enrollment No.

Program Name – B.Sc. Chemistry

Year/Semester- I/I Examination

Subject Name- Atomic Structure, Chemical Bonding and Redox Reactions

Subject Code-BSCY-101

[Time : 03:00 Hours]

[Max. Marks : 70]

Note: 1. Attempt all the questions as per the given instructions.

1. Multiple Choice Questions (MCQs) [01x15=15]

I. Bond order of N_2 is:

- (a) 2 (b) 3 (c) 1 (d) 4

II. Polarization increases with:

- (a) Small cation and large anion (b) Large cation and small anion
(c) Both large (d) None

III. The metallic bond is due to:

- (a) Free electrons (b) Ionic interaction
(c) Covalent bonds (d) Hydrogen bonding

IV. Semiconductors conduct due to:

- (a) Holes and electrons (b) Ions
(c) Covalent bonds (d) Magnetic effects

V. Hydrogen bonding is strongest in:

- (a) NH_3 (b) H_2O (c) HF (d) CH_4

VI. Dipole moment arises due to:

- (a) Equal charge separation (b) Unequal charge distribution
(c) Resonance (d) Hybridization

VII. Redox reactions involve:

- (a) Exchange of protons (b) Exchange of neutrons
(c) Exchange of electrons (d) None

VIII. Oxidation number of Cr in $Cr_2O_7^{2-}$ is:

- (a) +3 (b) +5 (c) +6 (d) +7

IX. Disproportionation involves:

- (a) Only oxidation (b) Only reduction
(c) Both oxidation and reduction (d) None

X. Standard electrode potential indicates:

- (a) Strength of oxidizing agent (b) Strength of reducing agent
(c) Both (a) and (b) (d) None

XI. Metals occur in nature as:

- (a) Oxides (b) Sulphides (c) Carbonates (d) All of these

XII. Ellingham diagram helps to predict:

- (a) Oxidation (b) Reduction of oxides
(c) Metallurgy (d) Corrosion

XIII. Kroll process is used for extraction of:

- (a) Aluminium (b) Titanium (c) Copper (d) Iron

XIV. Mond's process is used to refine:

- (a) Nickel (b) Zinc (c) Tin (d) Lead

XV. Zone refining is used for:

- (a) Alloys (b) Semiconductors (c) Metals (d) Polymers

2. Long answers type questions (any three) [10x3=30]

- Explain electronegativity and discuss the Pauling, Mulliken, and Allred-Rochow scales. Relate electronegativity to bond properties.
- Analyse the quantum numbers (n , l , m , s), their significance, and illustrate the shapes of s , p , d , and f orbitals.
- Draw and explain the Molecular Orbital diagrams for N_2 , O_2 , and CO . Discuss bond order, magnetic properties, and stability.
- Discuss electrolytic and pyrometallurgical methods for extraction and purification of metals. Include examples such as copper and aluminium.

3. Short answers type questions (any five) [5x5=25]

- Draw the shapes of s and p orbitals and briefly describe their features.
- Elaborate the zone refining and its importance in purifying metals.
- Explain the occurrence of metals in nature based on electrode potentials.
- Discuss hybridization and give examples of sp , sp^2 , and sp^3 hybridization.
- Define dipole moment and explain how it indicates ionic character in a molecule.
- Define electronegativity and give an example showing its effect on bond polarity.
- State Slater's rules for calculating shielding effect.