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Booklet Serial No. **856673**

Test Booklet Series

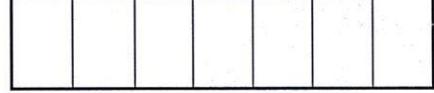
**JUNIOR SCIENTIFIC ASSISTANT
OMR Examination - 2025**

A

Time Allowed: 120 Minutes

Maximum Marks: 120

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET **DOES NOT** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. Please note that it is the candidate's responsibility to encode and fill in the Roll Number, Booklet Serial No. and Test Booklet Series Code A, B, C or D carefully and without any omission or discrepancy at the appropriate places in the OMR Answer /Response Sheet. Any omission/discrepancy will render the Response Sheet liable for rejection.
3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside.
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4. This Test booklet contains **120** items (questions). Each item comprises of four responses (answers). You will select the response which you want to mark on the Answer Sheet/Response Sheet. In case you feel that there is more than one correct response, mark the response which you consider the appropriate. In any case, choose **ONLY ONE** response for each item.
5. You have to mark all your responses **ONLY** on the separate Answer /Response Sheet provided. *See directions in the Response Sheet.*
6. All items carry equal marks.
7. After you have completed filling in all your responses on the Response Sheet and the examination has concluded, you should hand over to the Invigilator **only the Answer /Response Sheet**. You are permitted to take away with you the Test Booklet and **Candidate's Copy of the Response Sheet**.
8. Sheets for rough work are appended in the Test Booklet at the end.
9. While writing Centre Code and Roll No. on the top of the Answer Sheet/Response Sheet in appropriate boxes use "**ONLY BLUE/BLACK BALL POINT PEN**".
10. **Penalty for wrong answers:**
THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY THE CANDIDATE IN THE WRITTEN TEST (OBJECTIVE TYPE QUESTIONS PAPERS).
 - (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, $(\frac{1}{4})$ of the marks assigned to that question will be deducted as penalty.
 - (ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above for that question.
 - (iii) If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

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(Set - A)

(Set - A)

(2)

1. Which of the following statements correctly describes the entropy change in a reversible process?
 - A) The entropy of the system decreases in a reversible process.
 - B) The total entropy change of the universe is zero in a reversible process.
 - C) The entropy of the surroundings increases in a reversible process.
 - D) The entropy change of the system is always positive in a reversible process.
2. Which of the following statements correctly illustrates the Second Law of Thermodynamics?
 - A) Heat spontaneously flows from a colder body to a hotter body without external work.
 - B) A refrigerator transfers heat from a cold region to a hot region without requiring any work input.
 - C) Not all absorbed heat can be converted into work as some heat must be released to a lower-temperature reservoir.
 - D) A cyclic engine can achieve 100% efficiency if the process is perfectly reversible.
3. The coordination number and Atomic Packing Factor (APF) for a Body-Centered Cubic (BCC) crystal structure are:

A) 6 and 0.68	B) 8 and 0.52
C) 12 and 0.74	D) 8 and 0.68
4. How do impurities introduced into a pure semiconductor affect its band structure?
 - A) Impurities widen the band gap and reduce conductivity.
 - B) Impurities create additional energy levels within the band gap.
 - C) Impurities reduce the band gap and increase conductivity.
 - D) Impurities do not affect the band structure of semiconductors.
5. What are the regular singular points of Legendre's Differential Equation?

A) $x = 0, 1, -1$	B) $x = 1, -1, \infty$
C) $x = 0, \infty$	D) None of the above
6. The Gamma function $\Gamma(n)$ is related to the factorial function for positive integers. Which of the following correctly represents this relationship?
 - A) $\Gamma(n)=n!$
 - B) $\Gamma(n)=(n-1)!$
 - C) $\Gamma(n)=n^n$
 - D) $\Gamma(n)=1/n!$
7. In the context of quantum mechanics, what does the normalization of a wave function mean?
 - A) The wave function takes only real values at all points.
 - B) The total probability of finding the particle across all space is equal to 1.
 - C) To fit the wave function within a specific potential well.
 - D) To find the time-averaged probability density of the wavefunction.

8. An electron is confined within a region of space of width $\Delta x = 0.01$ nm. Using the Heisenberg Uncertainty Principle, estimate the minimum uncertainty in the electron's velocity, Rounded off to the nearest decimal place. (Take Planck's constant $h = 6.63 \times 10^{-34}$ Js, Mass of electron $m_e = 9.11 \times 10^{-31}$ kg.)
- A) 5.8×10^6 m/s. B) 6.5×10^7 m/s.
C) 7.2×10^6 m/s. D) 8.8×10^6 m/s.
9. A $3\sqrt{2}$ kg block sliding down a smooth inclined plane of length 5m is inclined at an angle of 45° with the horizontal. A horizontal force $F = 10\sqrt{2}$ N is applied to the block during its motion down the incline. Find the velocity of the block when it reaches the bottom, Rounded off to the nearest decimal place. (Take $g = 10$ m/s² and $\sqrt{2} = 1.414$).
- A) 9.7 m/s. B) 11.5 m/s.
C) 15.2 m/s. D) 8.8 m/s.
10. A body of mass 3kg is dropped from a height of 20m. It hits the ground and bounces back to a height of 10m. Calculate the velocity of the body just before it hits the ground and just after it bounces back, Rounded off to the nearest decimal place. (Take $g = 10$ m/s² and $\sqrt{2} = 1.414$)
- A) 14 m/s and 8 m/s
B) 16 m/s and 10 m/s
C) 18 m/s and 12 m/s
D) 20 m/s and 14 m/s
11. A planet has a mass twice that of the Earth and a radius three times that of the Earth. If g is the acceleration due to gravity on the Earth's surface, the acceleration due to gravity on the surface of the planet is:
- A) $g/2$ B) $2g/3$
C) $g/3$ D) $2g/9$
12. A wire of resistance R is stretched to double its original length. What will be the new resistance of the wire?
- A) R B) $2R$
C) $4R$ D) $R/2$
13. The drift velocity of electrons in a conductor is:
- A) Directly proportional to the current and inversely proportional to the area of the cross-section of the conductor
B) Inversely proportional to the current and directly proportional to the area of the cross-section of the conductor
C) Independent of both current and cross-sectional area
D) Directly proportional to both the current and cross-sectional area
14. An object moves at a constant speed along a circular path. Which of the following statements is true regarding the work done on the object?
- A) Positive work is done. B) Negative work is done.
C) No work is done. D) Can not be calculated

15. A block of mass 4kg is placed on a smooth horizontal surface. A horizontal force $F_1=10\text{N}$ and another force $F_2=5\text{ N}$ at an angle of 60° to the horizontal act on the block simultaneously in the same direction. If the block moves 3m horizontally, calculate the total work done on the block.
- A) $20 \sqrt{3}\text{J}$
B) 35 J
C) 37.5 J
D) 62 J
16. In a capillary tube, which of the following factors mainly determines the height a liquid will raise due to capillary action?
- A) The density of the liquid and the tube's length.
B) The surface tension of the liquid and the contact angle with the tube material.
C) The gravitational force acting on the liquid column and the radius of the tube.
D) The viscosity of the liquid and its temperature.
17. If the root mean square speed (RMS) of nitrogen gas at a certain temperature is known, what can be inferred about root mean square speed of helium gas at the same temperature?
- A) Helium will have a lower RMS speed than nitrogen.
B) Helium will have a higher RMS speed than nitrogen.
C) Both gases will have equal RMS speeds.
D) The comparison cannot be made without knowing their pressures.
18. Which of the following statements about the specific heat capacity of water is true?
- A) The specific heat capacity of water is lower than all other liquids.
B) The high specific heat capacity of water leads to applications such as heat fomentation.
C) Water has a low specific heat capacity, which makes it a poor coolant.
D) The specific heat capacity of water is constant and does not change with temperature.
19. How do phase changes affect the internal energy of a system?
- A) Internal energy increases during melting and evaporation, and decreases during condensation and freezing.
B) Internal energy remains constant during phase changes, as temperature does not change.
C) Internal energy decreases during melting and evaporation, and increases during condensation and freezing.
D) Internal energy changes during phase changes only if there is a temperature change.

- 20.** Match the different laws of thermodynamics with their examples:

List - A (Laws of Thermodynamics)

- i. Zeroth Law of Thermodynamics 1)
- ii. First Law of Thermodynamics 2)
- iii. Second Law of Thermodynamics 3)
- iv. Third Law of Thermodynamics 4)

List - B (Examples)

- Storage and preservation of food using deep freezers.
- Cryogenic storage of biological samples, such as blood samples, organs, or tissues
- Plants convert the radiant energy of sunlight to chemical energy through photosynthesis.
- Use thermometers to compare the temperature of any two objects

Choose the correct option:

- A) i-2, ii-1, iii-4, iv-3
- B) i-4, ii-3, iii-1, iv-2
- C) i-3, ii-2, iii-1, iv-4
- D) i-3, ii-1, iii-2, iv-4

- 21.** In a closed thermodynamic system, which of the following statements is true?

- A) Both mass and energy can enter or leave the system.
- B) Only energy can be exchanged, but not mass.
- C) Neither mass nor energy can be exchanged with the surroundings.
- D) Only Mass can be exchanged, but not energy.

- 22.** Which of the following statements about a thermodynamic system is/are correct?

- 1. A thermodynamic system is a specific part of the universe chosen for analysis, separated by boundaries.
 - 2. The surroundings are considered part of the system that affects the system.
 - 3. The boundary of a thermodynamic system can be real or imaginary.
 - 4. Energy and matter may or may not cross the system boundary, depending on the type of system.
- | | |
|--------------------|---------------------|
| A) Only 1 and 3 | B) Only 1, 2 and 3 |
| C) Only 1, 3 and 4 | D) All of the above |

- 23.** Which of the following statements about Earth's atmosphere and its properties is/are correct?

- 1. The Earth's atmosphere is primarily composed of nitrogen, oxygen, and trace gases.
 - 2. Atmospheric pressure decreases exponentially with increasing altitude.
 - 3. Earth's gravitational pull is essential for retaining the atmosphere.
 - 4. The ozone layer is located in the mesosphere.
- | | |
|---------------------|---------------------|
| A) 1 and 2 only | B) 1, 2, and 3 only |
| C) 1, 3, and 4 only | D) 1, 2, 3, and 4 |

- 24.** Arrange the following layers in chronological order of their distance above the earth's surface.

- 1. Troposphere
- 2. Exosphere
- 3. Mesosphere
- 4. Thermosphere
- 5. Stratosphere

Choose the correct option:

- | | |
|-----------------|------------------|
| A) 4,3, 2, 5,1 | B) 1,4, 2, 3, 5 |
| C) 1,5, 3, 4, 2 | D) 1, 5, 4, 3, 2 |

25. How does the mass defect in nuclear fission relate to the energy released?
- A) The mass defect is inversely proportional to the difference between the mass of the reactants and products in fission.
 - B) The greater the mass defect, the less energy is released during fission.
 - C) The mass defect represents the energy required to start the fission process.
 - D) The energy released in fission is described by Einstein's equation $E=mc^2$.
26. The nucleus of a Helium-4 atom (${}^2 {}^4 \text{He}$) has a mass of 4.0015u. The mass of a proton is 1.0078u, and the mass of a neutron is 1.0087u. Calculate the binding energy of the Helium-4 nucleus in MeV. (Take $1\text{u} = 931.5\text{MeV}/c^2$).
- A) 24.34 MeV
 - B) 27.54 MeV
 - C) 29.37 MeV
 - D) 32.54 MeV
27. Which of the following conditions must be satisfied for an oscillator to start oscillating according to the Barkhausen criterion?
- A) The total phase shift around the loop must be 180° .
 - B) The loop gain must be less than unity.
 - C) The feedback signal should be out of phase with the input signal.
 - D) The loop gain must be equal to or greater than unity.
28. Which of the following is NOT the application of Oscillators?
- A) Used to generate clock pulses for microprocessors and micro-controllers
 - B) Used in various radio, TV, and other communication devices
 - C) Used to stabilize the voltage supply to electronic devices.
 - D) Used in alarms, buzzers and quartz watches
29. Which of the following is a characteristic of an ideal op-amplifier?
- 1. Infinite input impedance
 - 2. Zero output impedance
 - 3. Infinite gain
 - 4. Zero bandwidth
- Choose the correct option:**
- A) 1, 2, and 3 only
 - B) 1 and 3 only
 - C) 1, 2, 3, and 4
 - D) 1, 2, and 4 only
30. Which of the following is NOT an advantage of negative feedback in amplifiers?
- A) It increases the bandwidth of the amplifier.
 - B) It reduces the distortion in the output signal.
 - C) It increases the gain of the amplifier.
 - D) It improves the stability of the amplifier.

31. A circular loop of wire with a radius of $r = 10$ cm carries a current $I = 3$ A. Calculate the magnitude of the magnetic field at the center of the loop. Permeability of free space $\mu_0 = 4\pi \times 10^{-7}$ H/m.
- A) 0.42×10^{-5} T
 - B) 1.88×10^{-5} T
 - C) 2.85×10^{-5} T
 - D) 3.45×10^{-7} T
32. If two wires carrying current in the same direction are moved closer together, what happens to the magnitude and nature of force between them?
- A) The force decreases and will be attractive
 - B) The force remains unchanged and will be repulsive
 - C) The force increases and will be attractive
 - D) The force increases and will be repulsive
33. Two solenoids have lengths L and $2L$, and both carry the same current but have different numbers of turns. If one has N turns and the other has $4N$, what is the ratio of their magnetic fields?
- A) 1:1
 - B) 4:1
 - C) 1:4
 - D) 1:2
34. What happens to a ferromagnetic material when it is heated above its Curie temperature?
- A) It becomes a perfect conductor of electricity.
 - B) It behaves as a paramagnetic material.
 - C) Its magnetic moment increases exponentially.
 - D) It transforms into a diamagnetic material.
35. Which of the following statements is/are true about the below statement?
"If the refractive index of the medium is equal to that of the lens"
- 1. There will be maximum refraction at the lens surfaces.
 - 2. The lens effectively loses its optical power.
 - 3. As a result, the focal length becomes infinite, and the lens behaves as a flat, transparent sheet.
- A) Only 2
 - B) 1 and 2
 - C) 2 and 3
 - D) 1, 2 and 3
36. In Young's double-slit experiment, a fringe width of 0.6 mm is obtained when light of wavelength 600nm is used. Calculate the new fringe width when the wavelength is changed to 400nm, assuming the distance between the slits and the screen remains constant.
- A) 0.3 mm
 - B) 0.4 mm
 - C) 0.5 mm
 - D) 0.6 mm

- 37.** Match the various phenomena of optics (List A) with their daily life examples (List B).

List - A	List - B
i. Refraction	1. Holography
ii. Total Internal Reflection	2. A Pencil in a Glass of Water
iii. Diffraction	3. 3D glasses
iv. Polarization	4. Brilliance and sparkle of diamonds

Choose the correct option:

- A) i-3, ii-1, iii-2, iv-3
- B) i-2, ii-4, iii-1, iv-3
- C) i-1, ii-3, iii-2, iv-4
- D) i-2, ii-1, iii-4, iv-3

- 38.** For sustained interference of light to occur, which of the following conditions must be met?

- 1. The sources of light must be monochromatic and coherent.
- 2. The amplitudes and intensities of the light sources must be nearly equal.
- 3. The interfering sources and the screen position do not affect fringe patterns.
- 4. The sources must emit light in the same state of polarization.

Choose the correct option:

- A) 1 and 2 only
- B) 1, 2, and 3 only
- C) 1, 2, and 4 only
- D) 1, 2, 3, and 4

- 39.** Which of the following is NOT an example of electromagnetic induction?

- A) Wireless Charging
- B) Transformers
- C) Tachometers
- D) Vande Graaff generator

- 40.** How does the coefficient of coupling (k) influence mutual inductance (M) between two coils?

- A) M is independent of k and remains constant.
- B) M increases linearly with k and reaches a maximum when $k=1$.
- C) M decreases as k increases.
- D) M becomes zero when $k=1$.

- 41.** Which of the following sequences of processes leads to the formation of particulate matter in the atmosphere in the correct order, from smallest to largest particle size.

- A) Condensation → Growth → Nucleation → Coagulation
- B) Nucleation → Condensation → Coagulation → Growth
- C) Coagulation → Growth → Nucleation → Condensation
- D) Growth → Nucleation → Coagulation → Condensation

42. Which of the following is the primary mechanism by which volatile organic compounds (VOCs) contribute to the formation of organic particulate matter?
- Direct emission into the atmosphere
 - Photo oxidation and subsequent condensation
 - Combustion in industrial processes
 - Interaction with mineral dust particles
43. Which of the following pollutants is NOT involved in the formation of photochemical smog?
- Nitrogen oxides (NO_x)
 - Volatile organic compounds (VOCs)
 - Sulfur dioxide (SO_2)
 - Ozone (O_3)
44. In the context of environmental monitoring, which method is commonly employed for the detection of volatile organic compounds (VOCs) in air?
- Gas Chromatography (GC)
 - High-Performance Liquid Chromatography (HPLC)
 - Fluorescence Spectrophotometry
 - Mass Spectrometry (MS)
45. Eutrophication in water bodies is often associated with:
- Low BOD and high dissolved oxygen
 - High BOD and low dissolved oxygen
 - Low microbial activity and high BOD
 - High salinity and low microbial activity
46. Which statements are correct regarding supersaturation of DO in water?
- Supersaturation occurs when the DO level exceeds the saturation limit.
 - It is harmful to aquatic organisms, causing gas bubble disease.
 - Supersaturation occurs due to mixing of oxygen-rich groundwater.
- Choose the correct statement:**
- 1 and 2 only
 - 1 and 3 only
 - 2 and 3 only
 - 1, 2, and 3
47. In a water sample, COD is higher than BOD due to:
- Presence of synthetic chemicals that are non-biodegradable
 - Faster oxidation of organic matter in COD testing
 - Higher microbial decomposition under test conditions
- Choose the correct statement:**
- 1 and 2 only
 - 1 and 3 only
 - 2 and 3 only
 - 1, 2, and 3

48. Match the coagulants with their application in water treatment:

List - A (Coagulants)	List - B (Application)
i. Alum	1. Treating highly turbid water
ii. Ferric chloride	2. Industrial wastewater treatment
iii. PAC	3. Enhanced coagulation in municipal plants
iv. Lime	4. Softening hard water

Choose the correct option:

- A) i-3, ii-2, iii-1, iv-4
- B) i-4, ii-1, iii-3, iv-2
- C) i-2, ii-4, iii-1, iv-3
- D) i-1, ii-3, iii-4, iv-2

49. The nitrogen content in urea is approximately:

- A) 20%
- B) 32%
- C) 15%
- D) 46%

50. Match the pesticide bioaccumulation effects with the organisms:

List - A

(Organism)

- i. Fish
- ii. Birds
- iii. Insects
- iv. Humans

List - B

(Effect of Pesticide Bioaccumulation)

- 1. Pesticide concentration increases as it moves up the food chain
- 2. Impact on reproduction and hatching success
- 3. Direct toxicity leading to mortality
- 4. Long-term health problems, including cancer and neurological damage

Choose the correct option:

- A) i-1, ii-2, iii-3, iv-4
- B) i-3, ii-2, iii-1, iv-4
- C) i-4, ii-3, iii-2, iv-1
- D) i-2, ii-3, iii-4, iv-1

51. Chronic exposure to arsenic has been linked to which of the following health issues besides cancer?

- A) Liver cirrhosis
- B) Respiratory infections
- C) Cardiovascular disease
- D) Neurological disorders

52. Which of the following diseases is most commonly associated with long-term mercury exposure?

- A) Parkinson's disease
- B) Alzheimer's disease
- C) Minamata disease
- D) Huntington's disease

53. Which factor contributes to the severity of CO poisoning, particularly in individuals with pre-existing cardiovascular conditions?
- The ability of CO to cross the blood-brain barrier and cause neurological symptoms.
 - The increased metabolic demand of the heart tissue and the subsequent oxygen deprivation.
 - The competition between CO and other gases for hemoglobin binding.
 - The increase in systemic inflammation and oxidative stress due to CO exposure.
54. Which of the following is a common side effect of insecticide poisoning in humans?
- Respiratory depression
 - Skin rash
 - Nausea and vomiting
 - Liver enlargement
55. What does the term "pesticide residue" refer to?
- The pesticide's effectiveness
 - The remaining pesticide after use
 - The pests that the pesticide kills
 - The pesticide's chemical structure
56. Arrange the following chemicals in decreasing order of toxicity to humans:
- Chemicals: Methyl Isocyanate, Hydrogen Cyanide, Methanol, Ammonia**
- methyl isocyanate > hydrogen cyanide > methanol > ammonia
 - hydrogen cyanide > methyl isocyanate > ammonia > methanol
 - methanol > ammonia > hydrogen cyanide > methyl isocyanate
 - ammonia > methanol > hydrogen cyanide > methyl isocyanate
57. Which of the following statements accurately describe the mechanism by which diesel exhaust causes cancer?
1. Diesel exhaust contains polycyclic aromatic hydrocarbons (PAHs), which are potent mutagens and carcinogens.
 2. Exposure to diesel exhaust leads to increased oxidative stress in lung tissues, causing inflammation and DNA damage.
 3. Diesel exhaust acts as a cocarcinogen, enhancing the carcinogenic effects of other environmental pollutants like tobacco smoke.
 4. Diesel exhaust exposure is associated with cancers of the liver and gastrointestinal system rather than the lungs.

Choose the correct statement:

- 1, 2, and 3
- 2, 3, and 4
- 1, 2, and 4
- All of the above

- 58.** In the Kjeldahl method, what is the final product after digestion and distillation?
- A) Ammonium sulfate
 - B) Ammonia gas
 - C) Nitrous oxide
 - D) Nitrogen gas
- 59.** Which of the following is commonly used as a light source in a colourimeter?
- A) Mercury vapor lamp
 - B) Sodium vapor lamp
 - C) Tungsten filament lamp
 - D) Neon lamp
- 60.** In a spectrophotometric analysis, the molar absorptivity (ε) is defined by which of the following?
- A) The ratio of the light absorbed to the concentration of the solute
 - B) The ratio of the light absorbed to the path length of the sample
 - C) The ratio of absorbance to the concentration and path length
 - D) The ratio of light absorbed to the amount of light transmitted
- 61.** Which of the following is a key intermediate compound in the production of nylon-6,6?
- A) Terephthalic acid
 - B) Hexamethylenediamine
 - C) Butadiene
 - D) Acetone
- 62.** Which of the following polymers is synthesized by the polymerization of caprolactam?
- A) Terylene
 - B) Bakelite
 - C) Nylon-6
 - D) Nylon-6,6
- 63.** The active ingredient in aspirin, which helps in reducing pain and fever, is
- A) Acetaminophen
 - B) Acetyl chloride
 - C) Ibuprofen
 - D) Acetylsalicylic acid
- 64.** In which phase of drug development is the drug typically tested on animals for safety and efficacy?
- A) Phase I
 - B) Preclinical phase
 - C) Phase II
 - D) Phase III

65. What is the function of aluminum powder in traditional firecrackers, and why is its use concerning?
- A) It acts as a stabilizer; however, it is non-biodegradable.
 - B) It produces bright flashes; however, it contributes to air pollution.
 - C) It enhances sound; however, it leads to noise pollution.
 - D) It slows down combustion; however, it increases smoke production.
66. Clean water would have Biochemical Oxygen Demand (BOD) value of less than:
- A) 55 ppm
 - B) 110 ppm
 - C) 15 ppm
 - D) 5 ppm
67. The dissolved oxygen concentration _____ with the increase in temperature of water
- A) Decreases
 - B) Increases
 - C) Remains same
 - D) Sometimes increases and sometimes decreases
68. In a COD test, which chemical is typically used as the oxidizing agent?
- A) Sodium chloride
 - B) Potassium dichromate
 - C) Sodium hydroxide
 - D) Calcium carbonate
69. What is the function of flocculation after the coagulation process?
- A) to increase the pH of water
 - B) to allow flocs to grow larger and easier to remove
 - C) to break down the organic matter
 - D) to disinfect the water
70. Which of the following processes is responsible for the formation of inorganic particulates by combining dissolved ions in a solution?
- A) Condensation
 - B) Precipitation
 - C) Combustion
 - D) Oxidation
71. What type of insecticide is commonly used to control pests in agriculture and is derived from chrysanthemums?
- A) Pyrethroids
 - B) Neonicotinoids
 - C) Carbamates
 - D) Organophosphates

72. Which of the following is NOT a potential consequence of excessive pesticide use?
- A) Harm to beneficial insects like pollinators
 - B) Disruption of local ecosystems
 - C) Increased pest resistance to chemicals
 - D) Improved soil structure
73. What does a high MIC value indicate about a microorganism's susceptibility to an antibiotic?
- A) The microorganism is highly susceptible to the antibiotic
 - B) The microorganism is resistant to the antibiotic
 - C) The microorganism is unaffected by the antibiotic
 - D) The antibiotic will be ineffective in all conditions.
74. Which of the following is the primary purpose of the Contact Process in industrial chemistry?
- A) To produce sulfuric acid by oxidizing sulfur dioxide using oxygen in the presence of a vanadium oxide catalyst, in a high-temperature environment.
 - B) To produce ammonia by combining nitrogen and hydrogen gases at high temperature and pressure, with the use of an iron catalyst.
 - C) To produce ethanol from fermentation of sugars, followed by distillation and dehydration steps.
 - D) To refine crude oil through distillation and various chemical reactions to obtain gasoline, diesel, and other petrochemicals.
75. Match the Polymer with its Chemical Structure Type
- | Column A (Polymer) | Column B (Structure Type) |
|---------------------------|----------------------------------|
| 1. Polyethylene | i. Cross-linked |
| 2. Polypropylene | ii. Linear |
| 3. Bakelite | iii. Branched |
| 4. Silicone rubber | iv. Network |
- Choose the correct option:**
- A) 1-ii, 2-iii, 3-i, 4-iv
 - B) 1-iii, 2-ii, 3-iv, 4-i
 - C) 1-iv, 2-ii, 3-i, 4-iii
 - D) 1-ii, 2-iv, 3-iii, 4-i
76. Which of the following is NOT an example of a steroidal anti-inflammatory drug?
- A) Prednisone
 - B) Hydrocortisone
 - C) Ibuprofen
 - D) Dexamethasone
77. Which of the following is a major consequence of nitrogen saturation in the soil?
- A) Decreased soil fertility
 - B) Acidification of the soil
 - C) Increased microbial diversity
 - D) Improved plant growth

78. What is the substitute used in SAFAL crackers instead of aluminum?
- A) Sulfur
 - B) Potassium nitrate
 - C) Magnesium
 - D) Phosphorus
79. What does the acronym SWAS stand for in the context of green crackers?
- A) Safe Water and Sulfur
 - B) Safe Water Releaser
 - C) Safe Water Substitute
 - D) Sulfur Without Additives
80. What method is commonly used to detect pesticides in soil samples?
- A) High-Performance Liquid Chromatography (HPLC)
 - B) Atomic Absorption Spectroscopy (AAS)
 - C) Inductively Coupled Plasma Mass Spectrometry (ICP-MS)
 - D) Gas Chromatography-Mass Spectrometry (GC-MS)
81. During DNA replication, the point where the two strands become separated is called the...?
- A) Origin of Replication
 - B) Chain Elongation
 - C) Replication Fork
 - D) Replication Bubble
82. Which of the following field is not part of the Microbiology?
- A) Bacteriology
 - B) Virology
 - C) Phycology
 - D) Herpetology
83. Who coined the term "Microbiology"?
- A) Louis Pasteur
 - B) Robert Hook
 - C) Girolamo Fracastoro
 - D) John Needham
84. What defines the single-channel energy flow in a food chain?
- A) Energy circulates between trophic levels.
 - B) Energy moves in a one-way, linear direction.
 - C) Decomposers are the main energy source.
 - D) Energy flow is cyclical.
85. What are the three R's that are used to save the environment which includes forest....?
- A) Reduce, Reserve, Recycle
 - B) Reserve, Reduce, Restore
 - C) Reduce, Reuse, Recycle
 - D) Recycle, Restore, Reduce

86. Genotype of dominant plant can be determined by:
A) Back cross B) Test cross
C) Pedigree analysis D) Dihybrid cross
87. During which phase of mitosis does the nuclear membrane reassemble?
A) Anaphase B) Telophase
C) Prophase D) Metaphase
88. Which Indian fossil provides evidence of early amphibian life?
A) Tiktaalik B) Gondwana fossils
C) Archaeopteryx D) Glossopteris flora
89. Which of the following species found in India demonstrates adaptive radiation?
A) Himalayan Monal B) Darwin's finches
C) Indian freshwater fish D) Indian fox
90. What is the primary source of energy for most ecosystems?
A) Soil B) Water
C) Sunlight D) Wind
91. Energy transfer efficiency between trophic levels is usually around:
A) 90% B) 50%
C) 25% D) 10%
92. How many contrasting characteristics of pea plant did Mendel take?
A) Five B) Six
C) Seven D) Eight
93. Which molecule is produced during the light-dependent reactions of photosynthesis and used in the Calvin cycle?
A) Glucose B) NADPH
C) Oxygen D) ATP
94. What is the role of the enzyme RuBisCO in photosynthesis?
A) It catalyzes the splitting of water molecules
B) It fixes carbon dioxide during the Calvin cycle
C) It synthesizes glucose from G3P
D) It generates ATP in the light reactions
95. Presently, the main cause of global warming is:
A) Increasing CO₂ Concentration
B) Depletion of ozone layer
C) Increased energy production by sun
D) The earth getting closer to sun.
96. What are the two main stages of photosynthesis?
A) Glycolysis and the Krebs cycle
B) Light reactions and Calvin cycle
C) Electron transport and oxidative phosphorylation
D) Carbon fixation and reduction

97. In which of the following conditions is photorespiration most likely to occur?
- A) High temperatures, high CO_2 concentration
 - B) Low temperatures, low oxygen concentration
 - C) High temperatures, low CO_2 concentration
 - D) Low temperatures, high CO_2 concentration
98. Which of the following processes directly contributes to the loss of energy as heat in an ecosystem?
- A) Photosynthesis
 - B) Decomposition
 - C) Respiration
 - D) Nitrification
99. The term 'Black gold' is used for
- A) Graphite
 - B) Coal
 - C) Petroleum
 - D) Carbon
100. Stanley Miller in his experiment synthesized simple amino acid using-
- A) H_2 , O_2 , N_2 and H_2O
 - B) CH_4 , CH , H_2 and N_2
 - C) O_2 , NH_3 , CH_4 and water vapour
 - D) NH_3 , H_2 , CH_4 and water vapour
101. Which of the following statements are true
- i. Klinefelter's syndrome has 44+XXY
 - ii. Cri-du-chat syndrome is due to chromosomal change involving deletion
 - iii. In Down's syndrome of male child, the sex complement is XY
 - iv. Formation of multivalent in meiosis is due to reciprocal translocation
- Choose the correct statement:**
- A) i, ii
 - B) ii, iii
 - C) i, ii, iv
 - D) i, ii, iii, iv
102. Which of the following is the correct sequence of events in the origin of life?
- i. Formation of photobionts.
 - ii. Synthesis of organic monomers
 - iii. Synthesis of organic polymers.
 - iv. Formation of DNA-based genetic system.
- Which of the below sequence are correct?**
- A) i, ii, iii, iv
 - B) i, iii, ii, iv
 - C) ii, iii, i, iv
 - D) ii, iii, iv, i

103. Correct for "Golden rice"

- i. Rice with beta-carotene
- ii. Yellow in colour
- iii. It is a GM rice

Choose correct combination

- | | |
|-------------------|--------------------|
| A) Only i | B) Only ii and iii |
| C) Only i and iii | D) i, ii and iii |

104. When F1 Drosophila of genotype AaBbCc is test crossed, the following progenies were obtained:

Progeny classes	ABC	Total							
Number of progenies	22	28	26	24	230	220	225	225	1000

The statements below are conclusions derived from the above result.

- i. Genes a and b are linked in trans
- ii. Genes a and b are linked in cis
- iii. Genes a and b are linked in cis, while b and c are linked in trans
- iv. The genotypes of parents are AABB and aabb
- v. The genotype of the parents are AAbb and aaBB
- vi. Genes a and b are 10 cm apart

Which of the above statements are correct?

- | | |
|----------------|------------------|
| A) iii alone | B) ii, v and vi |
| C) i, v and vi | D) ii, iv and vi |

105. Consider the following statements regarding 'Silent Mutation'

- i. Involves the second nucleotide of triplet codon
- ii. Results in polymorphism of organism
- iii. Due to degeneracy the amino acid will not be altered
- iv. Contributes to variability in DNA sequence of individuals species

Which of the above statements are true?

- A) (i), (iii) and (iv)
- B) (i), (ii) and (iv)
- C) (ii), (iii) and (iv)
- D) (i), (ii) and (iii)

106. Consider the following statement:

- I. The principle of non-regression ensures that environmental laws and protections cannot be diluted to a lower standard once implemented.
- II. E-waste contains both hazardous substances like mercury and valuable materials such as gold.
- III. Informal recycling practices for e-waste are more efficient than formal recycling methods.

Which of the following statements are correct?

- A) I, II, and III
- B) I and III only
- C) I and II only
- D) None of the above

107. Satellite RNAs (sat-RNAs) are species of RNA associated with specific strains of some plant RNA viruses, although it is not necessary for their replication. Few statements are given below on sat-RNA.

- P. Presence of sat-RNA leads to reduction in severity of disease symptoms.
- Q. Presence of sat-RNA leads to increase in severity of disease symptoms.
- R. Sat-RNA is constitutively expressed like coat proteins and is independent of virus infection.
- S. Sat-RNA is not constitutively expressed like coat proteins but is expressed like coat proteins but is expressed only after virus infection.

Which one of the following combinations of above statements regarding sat-RNA is correct?

- A) P and Q
- B) Q and R
- C) R and S
- D) P and S

108. Which of the following is true about Cadherins?

- i. They are proteins involved in cell-cell adhesion.
- ii. Cadherins require calcium ions (Ca^{2+}) for their function.
- iii. They play a critical role in maintaining tissue integrity.
- iv. They are proteins involved in cell-extracellular matrix adhesion.

Identify the correct choice from the options given.

- A) (i) only
- B) (ii) and (iii) only
- C) (i), (ii) and (iii) only
- D) All are correct

109. With reference to *Agrobacterium tumefaciens* mediated plant transformation, match the virulence factors in Group 1 with their protein types in Group - 2.

Group - 1

- P) VirG
- Q) VirA
- R) VirE
- S) VirC

Group - 2

- I) Kinase
- II) Helicase
- III) Transcriptional activator
- IV) Single strand binding protein

Choose the correct option:

- A) P-I, Q-II, R-IV, S-III
- B) P-III, Q-I, R-II, S-IV
- C) P-II, Q-IV, R-I, S-III
- D) P-III, Q-I, R-IV, S-II

110. Match the factors influencing ecosystems with their descriptions based on the dynamic stability hypothesis:

Column - A (Factors)

- 1. Increase in the number of trophic levels
- 2. Length of the food chain
- 3. Energy availability in primary producers
- 4. Variety of decomposers

Column - B (Descriptions)

- i. Directly related to the diversity of decomposers
- ii. Affects stability, with shorter chains being more stable
- iii. Enhances nutrient cycling in ecosystems
- iv. Determines the overall energy flow in the ecosystem

Choose the right answer from the options below:

- A) 1-ii, 2-i, 3-iii, 4-iv
- B) 1-iii, 2-ii, 3-i, 4-iv
- C) 1-iv, 2-iii, 3-ii, 4-i
- D) 1-i, 2-ii, 3-iv, 4-iii

111. Challenges and Opportunities in Natural Resource Management

Match the challenges with their corresponding solutions

S.No. Challenges	S.No. Opportunities
P Rising e-waste	I Developing robust recycling technologies
Q Limited public awareness	II Promoting education and stakeholder participation
R Deforestation	III Implementing conditional direct transfers (CDT)
S Legal enforcement challenges	IV Establishing specialized environmental courts

Select the correct match.....?

- A) P-I, Q-II, R-IV, S-III
- B) P-I, Q-II, R-III, S-IV
- C) P-II, Q-I, R-IV, S-III
- D) P-III, Q-II, R-I, S-IV

112. Match the evolutionary concepts in Column - I with the corresponding scientists in Column - II:

Column - I

(Evolutionary concept)

- P) Laws of heredity
- Q) Synthetic theory
- R) Mutation theory
- S) Theory of natural selection

Column - II

(Scientist)

- I) Wallace
- II) Mendel
- III) J.B.S. Haldane
- IV) Hugo de Vries
- V) Darwin

Choose the correct Answer:

- A) P-I, Q-II, R-III, S-IV
- B) P-IV, Q-I, R-II, S-V
- C) P-II, Q-I, R-III, S-IV
- D) P-II, Q-III, R-IV, S-V

113. Match the following columns A with the appropriate option in column B

Column - A

1. 1st generation biofuel
2. 2nd generation biofuel
3. 3rd generation biofuel
4. 4th generation biofuel

Column - B

- i. Produced from algal biomass
- ii. Produced from food crops
- iii. Produced from non-food crops
- iv. Produced by capturing and storing CO₂

Choose the correct option:

- A) 1-(iv), 2-(i), 3-(ii), 4-(iii)
- B) 1-(ii), 2-(iii), 3-(i), 4-(iv)
- C) 1-(iii), 2-(i), 3-(iv), 4-(ii)
- D) 1-(i), 2-(ii), 3-(iii), 4-(iv)

114. Match table A with table B and choose correct answer:

Table - A

1. Pbr322
 2. Restriction enzyme
 3. Polymerase chain reaction
 4. Construction of chimeric DNA
- A) 1-(iii), 2-(ii), 3-(iv), 4-(i)
B) 1-(i), 2-(ii), 3-(iii), 4-(iv)
C) 1-(ii), 2-(i), 3-(iv), 4-(iii)
D) 1-(iv), 2-(iii), 3-(ii), 4-(i)

Table - B

- i. EcoRT or Hind II
- ii. Vector
- iii. Ligase
- iv. DNA polymerase

115. Match List I (Gene interaction) and List II (Phenotypic ratio of F₂ generation) and choose the correct option below:

List-I(Gene interaction)

1. Complementary genes
2. Supplementary genes
3. Polymeric gene
4. Inhibitory gene

List-II (Phenotypic ratio)

- i. 13:3
- ii. 9:6:1
- iii. 9:7
- iv. 9:3:4

Choose the correct option:

- A) 1-iii, 2-iv, 3-ii, 4-i
B) 1-i, 2-ii, 3-iii, 4-iv
C) 1-iii, 2-iv, 3-i, 4-ii
D) 1-iv, 2-iii, 3-i, 4-ii

116. Matching the following components with their respective roles in photosynthesis:

Column -A

1. ATP synthase
2. Photosystem II
3. RuBisCO
4. NADP⁺ reductase
5. Cytochrome b6f complex
6. Calvin Cycle

Column -B

- P. Converts light energy into chemical energy by splitting water and producing oxygen
- Q. Fixes carbon dioxide into 3-phosphoglycerate (3-PGA) during carbon fixation
- R. Catalyzes the conversion of NADP⁺ to NADPH in the light reactions
- S. Facilitates the synthesis of ATP using the proton gradient in the thylakoid membrane
- T. Transfers electrons between Photosystem II and Photosystem I
- U. Converts 3-PGA into glyceraldehyde-3-phosphate (G3P) in the reduction phase

Choose correct match...?

- A) 1-R, 2-P, 3-Q, 4-S, 5-T, 6-U
B) 1-U, 2-P, 3-Q, 4-R, 5-T, 6-S
C) 1-S, 2-U, 3-Q, 4-R, 5-T, 6-P
D) 1-S, 2-P, 3-Q, 4-R, 5-T, 6-U

117. Read the assertion and reason carefully to mark the correct option out of the options given below:

Assertion: Bacteria are prokaryotic

Reason: Bacteria do not possess true nucleus and membrane bound cell organelles.

- A) If both the assertion and the reason are true and the reason is a correct explanation of the assertion
- B) If both the assertion and reason are true but the reason is not a correct explanation of the assertion
- C) If the assertion is true but the reason is false
- D) If both the assertion and reason are false

118. Read the assertion and reason carefully to mark the correct option out of the options given below:

Assertion (A): Evolution is a continuous process that takes millions of years for speciation.

Reason (R): During evolution, only mutation leads to speciation.

- A) Both A and R are true, and R is the correct explanation of A.
- B) Both A and R are true, but R is not the correct explanation of A.
- C) A is true, but R is false.
- D) A is false, but R is true.

119. Read the assertion and reason carefully to mark the correct option out of the options given below:

Assertion (A): Energy flow in an ecosystem is unidirectional.

Reason (R): Energy decreases as it moves up trophic levels due to heat loss.

- A) Both A and R are true, and R is the correct explanation of A.
- B) Both A and R are true, but R is not the correct explanation of A.
- C) A is true, but R is false.
- D) A is false, but R is true.

120. Read the assertion and reason carefully to mark the correct option out of the options given below:

Assertion (A): In stratosphere, the temperature rises from -57°C to -2°C .

Reason (R): In stratosphere ozone layer is present.

- A) If both assertion and reason are true and reason is a correct explanation of the assertion.
 - B) If both assertion and reason are true but reason is not correct explanation of the assertion.
 - C) If assertion is true but reason is false.
 - D) If both assertion and reason are false.
-

ROUGH WORK



(Set - A)

(24)