1. Match the following space observatories with their observation wavelengths:  
   List–I — List–II  
   a. Astrosat — 1. Ultraviolet and X-ray  
   b. Hubble Space Telescope — 2. Visible and ultraviolet  
   c. James Webb Space Telescope — 3. Infrared and visible  
   d. Chandra X-ray Observatory — 4. X-ray  
   Select the correct answer using the codes given below.  
   (A) abcd → 1234  
   (B) abcd → 1342  
   (C) abcd → 1423  
   (D) abcd → 1243

Answer 51. (B) abcd → 1342

Explanation:

* Astrosat observes mainly in ultraviolet and X-ray wavelengths, enabling study of high-energy astronomical phenomena.
* The Hubble Space Telescope operates in visible and ultraviolet regions, providing detailed space imagery.
* The James Webb Space Telescope is designed for observations primarily in the infrared, but also covers some visible wavelengths.
* Chandra X-ray Observatory is specialized for X-ray detection from high-energy cosmic sources.

1. Consider the following regarding nano-silver:  
   (i) It has antibacterial and antifungal properties.  
   (ii) Nano-silver is widely used in medical devices and wound dressings.  
   (iii) It has no impact on microbial resistance development.  
   (iv) Extensive use of nano-silver may lead to environmental toxicity.  
   Which of the above statements are correct?  
   (A) (i), (ii), and (iv) only  
   (B) (ii) and (iii) only  
   (C) (i) and (iii) only  
   (D) All the statements are correct

Answer 52. (A) (i), (ii), and (iv) only

Explanation:

* Nano-silver demonstrates well-established antibacterial and antifungal properties and is utilized in various medical and consumer products for these reasons.
* Its incorporation in medical devices and wound dressings is common due to its infection-control benefits.
* However, concern exists regarding microbial resistance—contradicting statement (iii), as inappropriate use might promote resistance.
* Excessive use of nano-silver is associated with potential risks to environmental health due to accumulation and toxicity.

1. The primary challenge in achieving controlled nuclear fusion on Earth is:  
   (A) Finding sufficient quantities of fuel  
   (B) Achieving and maintaining extremely high temperatures and pressures  
   (C) Designing materials that can withstand radiation damage  
   (D) All of the above

Answer 53. (B) Achieving and maintaining extremely high temperatures and pressures

Explanation:

* The most significant problem in controlled fusion is the need to sustain incredibly high temperatures (millions of degrees) and pressures to permit fusion reactions similar to those in the sun.
* While other challenges, such as fuel sourcing and materials science, exist, these are not as immediate or central as creating and confining the plasma at the necessary energy levels for sustained fusion.

1. Regarding the mechanism by which miRNA regulates gene expression, which of the following are true?  
   (i) miRNAs guide the RNA-induced silencing complex (RISC) to target mRNAs.  
   (ii) miRNAs cause cleavage or translational repression of target mRNAs.  
   (iii) miRNAs bind to promoters to activate gene transcription.  
   (iv) miRNA function is independent of base-pair complementarity.  
   Select the correct answer:  
   (A) (i) and (ii) only  
   (B) (ii) and (iii) only  
   (C) (iii) and (iv) only  
   (D) All of the above

Answer 54. (A) (i) and (ii) only

Explanation:

* miRNAs function by associating with the RISC complex to identify and bind target mRNAs based on sequence complementarity, leading to degradation or translational silencing of the target mRNA.
* They do not typically bind gene promoters to activate transcription, and their regulatory function fundamentally depends on complementary base pairing—contradicting both (iii) and (iv).

1. The creation of the Bose-Einstein condensate in laboratories was first achieved in the:  
   (A) 1920s  
   (B) 1950s  
   (C) 1990s  
   (D) 2010s

Answer 55. (C) 1990s

Explanation:

* Bose-Einstein condensate, a novel state of matter predicted theoretically in the early 20th century, was first realized experimentally in 1995 by cooling rubidium atoms.
* Prior decades were limited by technological capability for achieving ultra-cold temperatures required for condensate formation.

1. Consider the following about exoplanets:  
   (i) Exoplanets are planets that orbit stars outside our solar system.  
   (ii) The first confirmed exoplanet discovery was in the 1990s.  
   (iii) The Kepler Space Telescope contributed significantly to exoplanet discoveries.  
   (iv) All exoplanets detected are similar in size to Earth.  
   Which of the above statements are correct?  
   (A) (i), (ii), and (iii) only  
   (B) (ii) and (iv) only  
   (C) (i) and (iv) only  
   (D) All the statements are correct

Answer 56. (A) (i), (ii), and (iii) only

Explanation:

* Exoplanets are, by definition, planets located outside our solar system, orbiting other stars.
* The first confirmed exoplanet discovery dates to the 1990s, marking a major milestone in astronomy.
* The Kepler Space Telescope played a crucial role in confirming thousands of exoplanets.
* The sizes of exoplanets detected vary greatly; many are larger or smaller than Earth, so the claim that all are Earth-sized is incorrect.

1. Which of the following is true for the velocity-time graph of an object undergoing simple harmonic motion (SHM)?  
   (A) It is a straight line  
   (B) It is a sinusoidal curve  
   (C) It is a parabola  
   (D) It is a square wave

Answer 57. (B) It is a sinusoidal curve

Explanation:

* In SHM, velocity varies with time as a sine or cosine function, resulting in a sinusoidal velocity-time graph.
* This reflects the continuous periodic change in velocity, reaching maximum in opposite directions as the particle oscillates.

1. When a liquid flows through a narrow pipe, the flow rate is inversely proportional to which property?  
   (A) Surface tension  
   (B) Density  
   (C) Viscosity  
   (D) Vapour pressure

Answer 58. (C) Viscosity

Explanation:

* According to Poiseuille’s law, for laminar flow in a narrow tube, the volumetric flow rate is inversely proportional to the fluid’s viscosity.
* Higher viscosity means greater resistance to flow, reducing the rate at which fluid can move through the pipe.

1. Match the following books with their themes:  
   a. The Last Battle of Saraighat – Lachit Borphukan and the Mughal Army | 1. Military history of Assam  
   b. A Century of Tea in Assam | 2. Plantation and economy  
   c. With the People of Assam | 3. Gandhi’s Assam connections  
   d. History of the Assamese Literature | 4. Literary historiography  
   (A) abcd → 1 2 3 4  
   (B) abcd → 2 1 3 4  
   (C) abcd → 3 1 4 2  
   (D) abcd → 4 3 1 2

Answer 59. (A) abcd → 1 2 3 4

Explanation:

* “The Last Battle of Saraighat” is about the military confrontation involving Lachit Borphukan and the Mughal army.
* “A Century of Tea in Assam” details the region’s tea industry and its role in Assam’s economy.
* “With the People of Assam” highlights Mahatma Gandhi’s association and movements in Assam.
* “History of the Assamese Literature” documents literary developments, fitting the theme of literary historiography.

1. Which of the following SDGs have targets focusing on climate change mitigation?  
   (i) SDG 7: Affordable and Clean Energy  
   (ii) SDG 11: Sustainable Cities and Communities  
   (iii) SDG 13: Climate Action  
   (iv) SDG 15: Life on Land  
   Select the correct answer using the codes given below.  
   (A) (i), (ii), and (iii) only  
   (B) (ii) and (iii) only  
   (C) (i), (iii), and (iv) only  
   (D) All of the above

Answer 60. (A) (i), (ii), and (iii) only

Explanation:

* SDG 7 supports renewable and clean energy initiatives, central to climate mitigation.
* SDG 11 contains targets around sustainable cities and infrastructure, indirectly mitigating climate impact.
* SDG 13 directly addresses climate action and mitigation measures.
* While SDG 15 focuses on terrestrial ecosystems and biodiversity, its main emphasis is not specifically on climate change mitigation, though there are indirect benefits.