1. Match the following satellites with the space agencies they collaborated with:  
   List–I — List–II  
   a. Megha-Tropiques — 1. ISRO and CNES (France)  
   b. SARAL — 2. ISRO and CNES  
   c. Astrosat — 3. Exclusively ISRO  
   d. RISAT — 4. IRS (ISRO) only  
   Select the correct answer using the codes given below.  
   (A) abcd → 1234  
   (B) abcd → 1324  
   (C) abcd → 2134  
   (D) abcd → 1432

Answer 51. (A) abcd → 1234

Explanation:

* Megha-Tropiques was a joint Indo-French mission by ISRO and CNES for tropical climate and water cycle studies.
* SARAL (Satellite with ARgos and ALtiKa) was also an ISRO–CNES collaboration focused on oceanography and data collection.
* Astrosat is India’s first dedicated multi-wavelength space observatory, developed and operated by ISRO.
* RISAT (Radar Imaging Satellite) series are Indian remote sensing satellites under ISRO’s IRS umbrella.

1. Consider the following uses of nanomaterials:  
   (i) Enhanced drug delivery in targeted cancer therapy  
   (ii) Improved mechanical properties in composite materials  
   (iii) Nanosensors for environmental monitoring  
   (iv) Nanomaterials have no impact on renewable energy technologies  
   Which of the above statements are correct?  
   (A) (i), (ii), and (iii) only  
   (B) (ii) and (iv) only  
   (C) (iii) and (iv) only  
   (D) All the statements are correct

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

Explanation:

* Nanomaterials enable targeted drug delivery and theranostics, enhancing efficacy and reducing side effects.
* They reinforce polymers and metals to yield high-strength, lightweight composites.
* Nanosensors improve detection of pollutants and environmental parameters.
* Nanomaterials significantly impact renewable energy (e.g., perovskite and quantum dot photovoltaics, catalysts in fuel cells), so statement (iv) is incorrect.

1. Tokamak, a type of nuclear fusion device, is:  
   (A) A device that uses magnetic fields to confine hot plasma  
   (B) A type of nuclear fission reactor  
   (C) A method to enrich uranium for reactors  
   (D) A particle accelerator used in particle physics

Answer 53. (A) A device that uses magnetic fields to confine hot plasma

Explanation:

* A tokamak is a torus-shaped magnetic confinement system that traps and heats plasma to enable fusion reactions.
* It is distinct from fission reactors, enrichment methods, or particle accelerators.

1. Consider the following statements about the discovery and historical background of miRNAs:  
   (i) The first miRNA, lin-4, was discovered in C. elegans in the early 1990s.  
   (ii) miRNAs were initially considered to be a rare phenomenon.  
   (iii) miRNA-mediated gene regulation is conserved across plants and animals.  
   (iv) miRNAs were fully characterized in humans by the mid-1980s.  
   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 of the above

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

Explanation:

* lin-4 was identified in C. elegans in 1993, inaugurating the miRNA field.
* Early on, miRNAs were thought to be rare and nematode-specific before widespread discovery across taxa.
* miRNA-mediated regulation is conserved broadly in plants and animals.
* Human miRNAs were not “fully characterized” by the mid-1980s; this predates their discovery timeline, making (iv) incorrect.

1. Consider the following scientists and their contributions:  
   (i) P.A.M. Dirac — Developed quantum theory of electron spin.  
   (ii) Satyendra Nath Bose — Developed Bose-Einstein statistics.  
   (iii) Albert Einstein — Extended Bose’s work to predict Bose-Einstein condensation.  
   (iv) Erwin Schrödinger — Formulated wave mechanics.  
   Which of the above is correctly matched?  
   (A) All the scientists and contributions are correctly matched  
   (B) (i), (ii), and (iv) only  
   (C) (ii) and (iii) only  
   (D) (i) and (iii) only

Answer 55. (A) All the scientists and contributions are correctly matched

Explanation:

* Dirac’s relativistic quantum theory elucidated electron properties including spin and magnetic moment.
* Bose founded quantum statistics for photons; Einstein generalized it to massive bosons, predicting Bose-Einstein condensation.
* Schrödinger formulated wave mechanics via the Schrödinger equation, foundational to quantum theory.

1. Consider the following statements about artificial intelligence (AI) in healthcare:  
   (i) AI is used for early detection of diseases like cancer and diabetes.  
   (ii) AI-based diagnostics completely replace human physicians.  
   (iii) Machine learning models are increasingly helping in personalized treatment.  
   (iv) AI algorithms face challenges related to bias and data privacy.  
   Which of the above statements are correct?  
   (A) (i), (iii), and (iv) only  
   (B) (ii) and (iii) only  
   (C) (i) and (ii) only  
   (D) All the statements are correct

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

Explanation:

* AI supports early detection through imaging, pathology, and risk-prediction models and aids tailored therapeutics.
* It does not fully replace clinicians; instead, it augments decision-making within ethical and regulatory safeguards.
* Bias and privacy are recognized concerns requiring robust governance and technical mitigation.

1. Which of the following statements is/are true regarding relative velocity?  
   (i) Relative velocity of A with respect to B is same in magnitude but opposite in direction to that of B with respect to A.  
   (ii) Relative velocity is always less than or equal to the absolute velocity.  
   (iii) Relative velocity of an object with respect to itself is zero.  
   Select the correct statement(s):  
   (A) (i) and (iii) only  
   (B) (ii) only  
   (C) (i), (ii), and (iii)  
   (D) None of the above

Answer 57. (A) (i) and (iii) only

Explanation:

* By definition, v(A relative to B) = vA − vB, and v(B relative to A) = vB − vA = −(vA − vB), confirming equal magnitude and opposite direction.
* Relative velocity need not be less than absolute velocities; for opposite directions it can exceed either object’s speed (e.g., 2v), so (ii) is false.
* Relative velocity of an object with respect to itself is zero because v − v = 0.

1. The pressure exerted by the vapour in equilibrium with its liquid phase at a given temperature is known as:  
   (A) Osmotic pressure  
   (B) Vapour pressure  
   (C) Hydrostatic pressure  
   (D) Atmospheric pressure

Answer 58. (B) Vapour pressure

Explanation:

* Vapour pressure is defined for a closed system at a given temperature where the rate of evaporation equals the rate of condensation, establishing phase equilibrium.
* Osmotic, hydrostatic, and atmospheric pressures refer to distinct physical contexts.

1. Match the following books with their authors:  
   a. Northeast India: A Political History | 1. Samrat Choudhury  
   b. Green and Saffron: Hindu Nationalism and Politics of the Northeast | 2. Sanjib Baruah  
   c. In the Jungle of Politics: Identity, Ethnicity and Violence | 3. Kalyan Barooah  
   d. Assam: Frontier Mosaic | 4. Arupjyoti Saikia  
   (A) abcd → 1 2 3 4  
   (B) abcd → 3 4 1 2  
   (C) abcd → 1 3 2 4  
   (D) abcd → 4 1 2 3

Answer 59. (A) abcd → 1 2 3 4

Explanation:

* “Northeast India: A Political History” is by Samrat Choudhury, a contemporary account of the region’s politics.
* “Green and Saffron” examining Hindutva politics in the Northeast is by Sanjib Baruah.
* “In the Jungle of Politics: Identity, Ethnicity and Violence” is authored by Kalyan Barooah.
* “Assam: Frontier Mosaic” is by Arupjyoti Saikia.

1. The SDGs explicitly link which of the following three dimensions of sustainable development?  
   (A) Social, Political, and Economic  
   (B) Social, Environmental, and Economic  
   (C) Environmental, Economic, and Legal  
   (D) Political, Social, and Technological

Answer 60. (B) Social, Environmental, and Economic

Explanation:

* The Sustainable Development Goals integrate social inclusion, environmental sustainability, and economic growth as the three core, interdependent dimensions.
* Political, legal, and technological aspects are instrumental but not the three explicit pillars referenced in SDG framing.