1. Match the following satellites with their orbit types:  
   List–I — List–II  
   a. GSAT series — 1. Geostationary orbit  
   b. Cartosat series — 2. Polar sun-synchronous orbit  
   c. RISAT series — 3. Sun-synchronous orbit  
   d. Astrosat — 4. Low Earth orbit  
   Select the correct answer using the codes given below.  
   (A) abcd → 1234  
   (B) abcd → 1342  
   (C) abcd → 1432  
   (D) abcd → 1243

Answer 51. (C) abcd → 1432

Explanation:

* GSAT communications satellites are placed in geostationary orbit for continuous coverage over the Indian region, matching a→1.
* Cartosat Earth observation platforms operate in polar sun-synchronous orbits to image the same ground track under consistent lighting, matching b→2.
* RISAT synthetic aperture radar satellites are also flown in sun-synchronous orbits to ensure revisits and all-weather imaging schedules, matching c→3.
* Astrosat, India’s multi-wavelength space observatory, operates in a low Earth orbit optimized for astronomy payload performance and data downlink, matching d→4.

1. Which of the following statements about nanomaterials and health risks is/are correct?  
   (i) Certain nanomaterials can induce oxidative stress leading to cell damage.  
   (ii) All nanomaterials cause DNA mutations in humans.  
   (iii) Nanoparticles can penetrate biological membranes and accumulate in organs.  
   (iv) Regulation and safety assessment for nanomaterials are globally standardized.  
   Which of the above are correct?  
   (A) (i) and (iii) only  
   (B) (ii) and (iv) only  
   (C) (i), (iii), and (iv) only  
   (D) All the statements are correct

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

Explanation:

* Some engineered nanoparticles generate reactive oxygen species, causing oxidative stress and potential cellular damage, so (i) is correct.
* Nanoparticles can cross biological barriers and, depending on size, coating, and chemistry, may accumulate in particular organs, so (iii) is correct.
* It is incorrect that all nanomaterials cause DNA mutations; effects are material- and context-specific, thus (ii) is wrong.
* Global regulation is fragmented with varying national frameworks; there is no single standardized global regime, so (iv) is wrong.

1. The fuel commonly used in nuclear fusion experiments like ITER is:  
   (A) Uranium-235  
   (B) Thorium  
   (C) Deuterium and Tritium  
   (D) Plutonium-239

Answer 53. (C) Deuterium and Tritium

Explanation:

* Magnetic confinement fusion devices target the deuterium–tritium reaction because it has the highest cross-section at attainable plasma temperatures.
* Uranium-235 and plutonium-239 are fission fuels, not fusion fuels in these devices.
* Thorium is a fertile material relevant to certain fission reactor cycles, not a fusion fuel.

1. Consider the following applications of miRNAs in biomedical research:  
   (i) miRNAs are used as biomarkers for various cancers.  
   (ii) Therapeutic miRNA mimics or inhibitors are being developed for disease treatment.  
   (iii) miRNAs are used to directly edit genomic DNA sequences.  
   (iv) miRNA expression profiling helps in understanding disease progression.  
   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 of the above

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

Explanation:

* Differential miRNA signatures serve as diagnostic and prognostic biomarkers in oncology, supporting (i).
* Therapeutic strategies include delivering miRNA mimics to restore tumor suppressor function or inhibitors (antagomirs) to silence oncogenic miRNAs, supporting (ii).
* miRNAs regulate post-transcriptional gene expression; they do not directly edit DNA like CRISPR systems, making (iii) incorrect.
* Expression profiling maps dysregulation across disease stages and pathways, supporting (iv).

1. In quantum mechanics, bosons differ from fermions in that:  
   (i) Bosons obey Bose-Einstein statistics.  
   (ii) Fermions obey Fermi-Dirac statistics.  
   (iii) Bosons can occupy the same quantum state simultaneously.  
   (iv) Fermions cannot occupy the same quantum state simultaneously.  
   Which of the above statements is/are correct?  
   (A) All of the above  
   (B) (i) and (iv) only  
   (C) (ii) and (iii) only  
   (D) (i) and (ii) only

Answer 55. (A) All of the above

Explanation:

* Integer-spin particles are bosons and follow Bose–Einstein statistics, allowing multiple occupancy of a single quantum state.
* Half-integer-spin particles are fermions and follow Fermi–Dirac statistics, subject to the Pauli exclusion principle that forbids identical fermions from sharing a quantum state.
* All four statements accurately reflect the boson–fermion distinction in quantum statistics and occupancy rules.

1. Consider the following statements about perovskite solar cells:  
   (i) They are a new class of solar cells with higher efficiency potential than traditional silicon cells.  
   (ii) Stability and scalability remain major challenges for commercialization.  
   (iii) Perovskite materials are toxic and unsuitable for commercial use.  
   (iv) Perovskite cells can be produced using low-cost solution-based methods.  
   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 56. (A) (i), (ii), and (iv) only

Explanation:

* Perovskites have shown rapid efficiency gains, indicating potential to rival or exceed silicon under certain architectures, supporting (i).
* Key hurdles include long-term stability under moisture, heat, and light, and scaling to large-area, defect-tolerant modules, supporting (ii).
* While many high-performing perovskites contain lead, research explores encapsulation and lead-free variants; branding them categorically unsuitable is incorrect, making (iii) wrong.
* Solution processing (spin-coating, slot-die, inkjet) enables low-cost fabrication, supporting (iv).

1. When a stone is thrown vertically upwards, which of the following quantities is/are zero at the maximum height?  
   (i) Velocity  
   (ii) Acceleration  
   (iii) Displacement rate  
   Select the correct answer:  
   (A) Only (i)  
   (B) (i) and (ii) only  
   (C) (ii) and (iii) only  
   (D) (i) and (iii) only

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

Explanation:

* At the highest point, instantaneous velocity becomes zero before the stone begins to descend, so (i) is zero.
* Acceleration due to gravity remains downward with magnitude g, so (ii) is not zero.
* Displacement rate is another term for velocity; at the top, it is zero, so (iii) is zero along with (i).

1. Which of the following properties helps liquids to rise against gravity in a narrow tube?  
   (A) Capillarity  
   (B) Viscosity  
   (C) Density  
   (D) Vapour pressure

Answer 58. (A) Capillarity

Explanation:

* Capillary action arises from surface tension and adhesive forces between liquid and tube material, enabling rise in narrow tubes.
* Viscosity resists flow and affects rate, not the equilibrium height; density influences height inversely but is not the mechanism.
* Vapour pressure concerns phase equilibrium and does not govern capillary rise directly.

1. Match the following books on insurgency/conflicts in Assam with their authors:  
   a. Tears of the Dragon: A People’s Report on the Brahmaputra | 1. Sanjoy Hazarika  
   b. ULFA and the Politics of Identity | 2. Udayon Misra  
   c. Confronting the State | 3. Nani Gopal Mahanta  
   d. Bodo Movement: A Study in Ethnic Separatism | 4. S. K. Sharma  
   (A) abcd → 1 3 2 4  
   (B) abcd → 2 1 3 4  
   (C) abcd → 1 2 3 4  
   (D) abcd → 3 2 1 4

Answer 59. (C) abcd → 1 2 3 4

Explanation:

* “Tears of the Dragon: A People’s Report on the Brahmaputra” is associated with Sanjoy Hazarika’s reportage on the region’s conflicts and riverine challenges.
* “ULFA and the Politics of Identity” aligns with Udayon Misra’s scholarship on ethnicity and insurgency in Assam.
* “Confronting the State” is by Nani Gopal Mahanta, examining insurgency, counterinsurgency, and political processes.
* “Bodo Movement: A Study in Ethnic Separatism” is attributed to S. K. Sharma’s work on Bodo nationalism.

1. Which statement(s) is/are true regarding India’s commitment to SDGs?  
   (i) India has integrated SDGs into its national development planning.  
   (ii) The NITI Aayog is the nodal agency for coordinating SDG implementation in India.  
   (iii) India is legally bound to meet all SDG targets by 2030.  
   (iv) Sustainable development is included in India’s Constitution explicitly.  
   Select the correct answer using the codes given below.  
   (A) (i) and (ii) only  
   (B) (ii) and (iii) only  
   (C) (i), (ii), and (iv) only  
   (D) All of the above

Answer 60. (C) (i), (ii), and (iv) only

Explanation:

* National and state planning frameworks have mainstreamed SDGs into visions, indicators, and district-level monitoring, supporting (i).
* NITI Aayog coordinates SDG implementation, reporting, and cooperative federalism mechanisms, supporting (ii).
* SDGs are voluntary international commitments; there is no binding legal obligation to achieve all targets by 2030, making (iii) incorrect.
* Constitutional principles—Directive Principles and environmental jurisprudence—embed sustainable development ideals, supporting (iv).