1. Match the following ISRO launch vehicles with their payload capabilities:  
   List–I — List–II  
   a. PSLV — 1. Medium-lift vehicle for 1,750 kg to GTO  
   b. GSLV Mk III — 2. Heavy-lift vehicle for more than 4,000 kg to GTO  
   c. GSLV Mk II — 3. Intermediate lift vehicle for 2,500 kg to GTO  
   d. Small Satellite Launch Vehicle (SSLV) — 4. Small satellites up to 500 kg to LEO  
   Select the correct answer using the codes given below.  
   (A) abcd → 1342  
   (B) abcd → 1243  
   (C) abcd → 1423  
   (D) abcd → 1234

Answer 51. (A) abcd → 1342

Explanation:

* PSLV is known as a medium-lift vehicle capable of carrying approximately 1,750 kg to Geosynchronous Transfer Orbit (GTO).
* GSLV Mk III is a heavy-lift vehicle with a payload capacity exceeding 4,000 kg to GTO.
* GSLV Mk II serves as an intermediate-lift vehicle with around 2,500 kg payload capacity to GTO.
* SSLV is designed for launching small satellites up to approximately 500 kg to Low Earth Orbit (LEO).

1. Nanomaterials used in energy storage devices such as batteries exhibit which of the following properties?  
   (i) High surface area to volume ratio enhancing capacity  
   (ii) Improved charge-discharge efficiency  
   (iii) Increased occurrence of short-circuit failure  
   (iv) No improvement over conventional materials  
   Select the correct answer:  
   (A) (i) and (ii) only  
   (B) (ii) and (iii) only  
   (C) (i), (ii), and (iii) only  
   (D) All the statements are correct

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

Explanation:

* Nanomaterials offer increased surface area that improves energy storage capacity and enhances charge-discharge rates.
* However, due to their high reactivity and conductivity, they may increase the risk of short-circuit failures if not properly engineered.
* The assertion that nanomaterials show no improvement over conventional materials is incorrect given their widespread advantages.

1. Laser Ignition Fusion, as pursued in inertial confinement fusion research, uses:  
   (A) Magnetic confinement to contain plasma  
   (B) High-power lasers to compress fuel pellets  
   (C) Chemical explosions to initiate reactions  
   (D) None of the above

Answer 53. (B) High-power lasers to compress fuel pellets

Explanation:

* Inertial confinement fusion employs intense laser beams directed at tiny fuel pellets to compress and heat them rapidly, initiating fusion reactions.
* Magnetic confinement is used in different fusion approaches like tokamaks, not laser ignition fusion.
* Chemical explosions are unrelated to this precise scientific method.

1. Which of the following is/are known sources of miRNAs in cells?  
   (i) Introns of protein-coding genes  
   (ii) Non-coding RNA genes  
   (iii) Exogenous viral RNAs  
   (iv) Mitochondrial DNA  
   Select the correct answer:  
   (A) (i) and (ii) only  
   (B) (i), (ii), and (iii) only  
   (C) (ii) and (iii) only  
   (D) All of the above

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

Explanation:

* miRNAs originate from introns within protein-coding genes as well as from independent non-coding RNA genes.
* Viral infections can produce exogenous RNAs that mimic or interfere with host miRNAs.
* Mitochondrial DNA is not generally recognized as a source of miRNAs.

1. Which fundamental principle is shared by the quantum statistics named after Bose?  
   (A) Particles are indistinguishable and can share quantum states  
   (B) Particles are distinguishable and cannot share quantum states  
   (C) The uncertainty principle is violated  
   (D) The particles must have half-integer spin

Answer 55. (A) Particles are indistinguishable and can share quantum states

Explanation:

* Bose-Einstein statistics apply to bosons, particles that are indistinguishable and can occupy the same quantum state.
* This is distinct from fermions, which follow Fermi-Dirac statistics; fermions have half-integer spins and obey Pauli’s exclusion principle.
* There is no violation of the uncertainty principle in Bose statistics.

1. Consider the following about graphene:  
   (i) Graphene is a single layer of carbon atoms arranged in a hexagonal lattice.  
   (ii) It exhibits extraordinary electrical and thermal conductivity.  
   (iii) Graphene can be used in flexible display technologies.  
   (iv) It was first isolated using chemical vapor deposition in 2010.  
   Select the correct answer:  
   (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:

* Graphene consists of a single atomic layer of carbon with atoms arranged in a hexagonal pattern, allowing exceptional conductivity.
* Its unique properties have facilitated development of flexible electronic displays.
* However, it was first isolated experimentally using mechanical exfoliation in 2004, not by chemical vapor deposition in 2010.

1. The centripetal force acting on an object in circular motion depends on:  
   (i) Mass of the object  
   (ii) Velocity of the object  
   (iii) Radius of the circle  
   Select the correct answer:  
   (A) (i) and (ii) only  
   (B) (i), (ii), and (iii)  
   (C) (ii) and (iii) only  
   (D) None of the above

Answer 57. (B) (i), (ii), and (iii)

Explanation:

* Centripetal force is given by F=mv2rF = \frac{mv^2}{r}F=rmv2, meaning it depends directly on mass (m), square of velocity (v), and inversely on radius (r).
* Therefore, all three factors contribute to the magnitude of centripetal force for circular motion.

1. The density of a liquid is defined as:  
   (A) Mass per unit volume  
   (B) Volume per unit mass  
   (C) Force per unit area  
   (D) Mass per unit weight

Answer 58. (A) Mass per unit volume

Explanation:

* Density quantifies how much mass is contained in a given volume of substance.
* It is mathematically expressed as mass divided by volume (ρ=mV\rho = \frac{m}{V}ρ=Vm).
* Other options describe different physical quantities.

1. Match the following poets/authors with their sobriquets:  
   a. Bishnu Prasad Rabha | 1. Kalaguru  
   b. Jyotiprasad Agarwala | 2. Rupkonwar  
   c. Bhupen Hazarika | 3. Xudhakantha  
   d. Hem Barua | 4. Bard of Brahmaputra  
   (A) abcd → 1 2 3 4  
   (B) abcd → 2 1 4 3  
   (C) abcd → 3 4 1 2  
   (D) abcd → 1 3 2 4

Answer 59. (A) abcd → 1 2 3 4

Explanation:

* Bishnu Prasad Rabha was honored with the title "Kalaguru" for his artistic contributions.
* Jyotiprasad Agarwala is known as "Rupkonwar" (Prince of Beauty).
* Bhupen Hazarika earned the moniker "Xudhakantha" reflecting his melodious voice and poetic skill.
* Hem Barua is often called the "Bard of Brahmaputra" for his literary work inspired by the river and region.

1. Consider the following statements about the financing of SDGs:  
   (i) Achieving SDGs requires substantial investments from both public and private sectors.  
   (ii) Official Development Assistance (ODA) is the sole source of financing for SDGs in developing countries.  
   (iii) Innovative financing mechanisms like green bonds contribute to SDG funding.  
   (iv) Domestic resource mobilization is key for SDG success in middle-income countries.  
   Select the correct answer using the codes given below.  
   (A) (i), (iii), and (iv) only  
   (B) (ii) and (iii) only  
   (C) (i) and (ii) only  
   (D) All of the above

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

Explanation:

* Successful achievement of SDGs depends on mobilizing investments from public budgets and private sector capital globally.
* ODA contributes significantly but is not the sole funding source for developing countries; other sources are vital.
* Instruments like green bonds are innovative financing options supporting sustainable development goals.
* Mobilizing domestic revenues is crucial for self-sufficiency, especially in middle-income countries.