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1) With reference to the antimalarial agents, consider the following statements:

1. Statement-I: A new class of antimalarial agents, including ELQ-456, offers a promising strategy against malaria that is effective even in insecticide-resistant mosquito populations.
2. Statement-II: These agents work by killing the Anopheles mosquito upon brief contact, thereby preventing the transmission of the Plasmodium parasite.

Which one of the following is correct in respect of the above statements?

a) Both Statement-I and Statement-II are correct and Statement-II is the correct explanation for Statement-I
b) Both Statement-I and Statement-II are correct and Statement-II is not the correct explanation for Statement-I
c) Statement-I is correct but Statement-II is incorrect
d) Statement-I is incorrect but Statement-II is correct

Answer: c)

Explanation:

- The new antimalarial agents, particularly the endochin-like quinolones (ELQs), have been identified to block Plasmodium falciparum development in mosquitoes, including insecticide-resistant strains. This is a significant advantage because the widespread resistance of

mosquitoes to common insecticides is a major hurdle in malaria control. The agents target the parasite, not the mosquito's susceptibility to insecticides. Hence, Statement-I is correct.

- These compounds target the malaria parasite inside the mosquito without killing the mosquito itself. Their mechanism is not insecticidal. They work by blocking the parasite during its oocyst development stage within the mosquito's midgut. This contrasts with traditional methods like insecticide-treated nets, which aim to kill the vector. Hence, Statement-II is incorrect.

2) With reference to the integration of the Rare Donor Registry of India (RDRI) with the e-Rakt Kosh platform, consider the following statements:

1. The Rare Donor Registry of India was developed by the Centre for Development of Advanced Computing (C-DAC) under the National Health Mission.
2. The e-Rakt Kosh provides real-time information on rare blood availability, donor details, and upcoming blood donation camps across India.
3. The integration aims to reduce the need for DNA-based multiplex PCR testing for rare blood markers in India.

How many of the above statements are correct?

a) Only one
b) Only two
c) All three
d) None

Answer: b)

Explanation:

- The Rare Donor Registry of India was developed by ICMR-National Institute of Immunohaematology (NIIH), not C-DAC. Hence, Statement 1 is incorrect.
- e-Rakt Kosh provides real-time information on blood availability, donor details, and donation camps across India. Hence, Statement 2 is correct.
- The integration improves access and coordination but does not reduce the need for DNA-based multiplex PCR testing for rare blood markers. Hence, Statement 3 is incorrect.

3) With reference to the Tardigrades, consider the following statements:

1. Statement-I: Tardigrades are among the most resilient animals which can survive extreme conditions such as exposure to outer space.
2. Statement-II: Tardigrades are able to manifest the process of cryptobiosis and anhydrobiosis very efficiently.

Which one of the following is correct in respect of the above statements?

a) Both Statement-I and Statement-II are correct and Statement-II is the correct explanation for Statement-I
b) Both Statement-I and Statement-II are correct and Statement-II is not the correct explanation for Statement-I

c) Statement-I is correct but Statement-II is incorrect
d) Statement-I is incorrect but Statement-II is correct

Answer: a)

Explanation:

- Tardigrades are among the most resilient animals which can survive extreme conditions such as exposure to outer space.
- Cryptobiosis: They owe their incredible resilience to cryptobiosis.
- It is a state in which organisms bring their metabolism to a near-complete standstill in the face of adverse environmental conditions.
- Anhydrobiosis: Tardigrades can reduce their metabolism to less than 0.01% of normal, and drop their water levels by more than 95%, a state called anhydrobiosis.
- Tun state: Both anhydrobiosis and cryptobiosis result in the emergence of a durable shrunken state, called tun, in which tardigrades are able to withstand extreme conditions.

4) With reference to the microRNAs (miRNAs), consider the following statements:

1. They are small non-coding RNAs that regulate gene expression.
2. They bind to the coding region of mRNA to inhibit translation.
3. They play roles in cancer progression and genetic disorders.

How many of the above statements is/are incorrect?

a) Only one
b) Only two
c) All three
d) None

Answer: a)

Explanation:

- MicroRNAs (miRNAs) are small, non-coding RNA molecules typically 20-25 nucleotides long that regulate gene expression at the post-transcriptional level. Hence, Statement 1 is correct.
- They achieve this by binding to the 3′-untranslated region (3′-UTR) of target messenger RNAs (mRNAs), leading to mRNA degradation or inhibition of translation.
- Statement 2 incorrect, as miRNAs do not bind to the coding region of mRNA.
- Additionally, miRNAs are crucial in maintaining cellular homeostasis and are implicated in various biological processes, including development, differentiation, and apoptosis. Dysregulation of miRNAs is linked to several genetic disorders and plays a key role in the progression of cancers by acting as oncogenes or tumor suppressors. Hence, statement 3 is correct.

5) With reference to the Vehicle-to-Grid (V2G) technology, consider the following statements:

1. V2G enables Electric Vehicles (EVs) to act as decentralised energy storage systems by supplying electricity back to the grid when not in use.

2. Integration of EVs into the grid using V2G technology requires only unidirectional charging infrastructure.

Which of the statements given above is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Answer: a)

Explanation:

- V2G allows idle EVs to supply electricity back to the grid, turning them into decentralised battery energy storage units. This helps in grid balancing and renewable energy integration. Hence, Statement 1 is correct.
- V2G requires a bi-directional charging system, which supports both charging (Grid-to-Vehicle) and discharging (Vehicle-to-Grid). Unidirectional chargers can only charge the EV and cannot send power back to the grid. Hence, Statement 2 is incorrect.

6) With reference to the RNA silencing technology and its application against plant pathogens, consider the following statements:

1. RNA silencing is an artificially induced mechanism in plants, requiring genetic modification to activate the plant's latent immune responses.
2. The primary mode of transmission for Cucumber Mosaic Virus (CMV) is through contaminated soil and water resources.
3. A key advantage of RNA silencing technology is its precision in targeting viral genomes, which can help prevent the development of viral mutation and resistance.

How many of the statements given above is/are incorrect?

a) Only one
b) Only two
c) All three
d) None

7) With reference to the India's first gene-edited sheep, consider the following statements:

1. It is a Genetically Modified Organism (GMO) as it involves the insertion of foreign DNA from the Texel sheep breed.
2. The CRISPR-Cas9 technology used in this process exclusively targets the myostatin gene to enhance wool quality.
3. The research was conducted by the Indian Council of Agricultural Research (ICAR).

How many of the above statements is/are correct?

a) Only one

b) Only two
c) All three
d) None

Answer: d)

Explanation:

- The sheep is non-transgenic, which is a key feature distinguishing it from a traditional Genetically Modified Organism (GMO). The CRISPR-Cas9 technology was used to edit the sheep's existing myostatin gene, not to insert foreign DNA. This process is called gene editing, which is distinct from transgenesis. The trait of higher muscle mass is similar to the Texel breed, but the gene itself was not transferred from it. Hence, Statement 1 is incorrect
- The editing of the myostatin gene was done to enhance muscle mass by approximately 30%, not to improve wool quality. The myostatin gene is a known regulator of muscle growth in mammals. While the technology can be extended for other purposes, the primary achievement in this specific case was related to meat yield. Hence, Statement 2 is incorrect.
- This pioneering research was successfully conducted by the Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST-Kashmir), not directly by the ICAR headquarters in Delhi. While the project was supported by ICAR, the development and breakthrough occurred at SKUAST-Kashmir. Hence, Statement 3 is incorrect.

8) Which of the following are potential consequences of a GPS spoofing attack?

1. Aircraft may be redirected to incorrect coordinates during autopilot navigation.
2. Banks may face real-time transaction failure due to time drift in GPS.
3. Naval vessels may misidentify their location, violating territorial waters.
4. Cyber attackers may gain root access to GPS satellites through spoofing.

How many of the above statements is/are correct?

a) Only one
b) Only two
c) Only three
d) All four

Answer: c)

Explanation:

- GPS spoofing is a cybersecurity threat in which false signals are transmitted to GPS receivers, causing them to miscalculate their location or time.
- Aircraft, particularly during autopilot operations, heavily depend on GPS data for navigation. A spoofed signal could redirect them to erroneous coordinates, risking safety. Hence, Statement 1 is correct.
- Banking networks use GPS-based time synchronization for precise timestamping in financial transactions; spoofing can introduce subtle time drifts, leading to delays or mismatches. Hence, Statement 2 is also correct.

- Maritime vessels use GPS to navigate international waters, and a spoofed position can lead them to unknowingly violate territorial boundaries, potentially triggering diplomatic or military tensions. Hence, Statement 3 is correct.
- GPS spoofing deceives the end-user receiver, not the satellite infrastructure. Attackers cannot gain control over GPS satellites, as they are managed by secure ground control systems with no direct access via signal spoofing. Hence, Statement 4 is incorrect.

9) With reference to the Prostate Cancer, consider the following statements:

1. Prostate cancer exclusively affects men over the age of 70 and is extremely rare before this age.
2. The primary cause of prostate cancer is viral infections, similar to cervical cancer.
3. India has the highest global incidence and mortality rate for prostate cancer, surpassing all other nations.

How many of the above statements is/are correct?

a) Only one
b) Only two
c) All three
d) None

Answer: d) Explanation:

- While the risk of prostate cancer increases sharply after age 50, and it is most common in older men, it does not exclusively affect men over 70, nor is it extremely rare before this age. Cases can and do occur in men in their 50s and 60s. Hence, Statement 1 is incorrect.
- The primary causes and risk factors for prostate cancer are not viral infections. Key risk factors include age, family history, genetics (e.g., BRCA1/2 mutations, Lynch syndrome), race (higher risk in men of African ancestry), and diet & lifestyle (high intake of red meat, fats, sedentary habits). Viral infections are not identified as a primary cause. Hence, Statement 2 is incorrect.
- Globally, prostate cancer is the 2nd most diagnosed cancer in men. While India has a rising incidence, particularly in urban areas, and it ranks among the top 10 cancers in men in the country (with 37,948 new cases and 18,386 deaths in 2022 according to GLOBOCAN), it does not have the highest global incidence or mortality rate. Many Western countries have higher incidence rates. Hence, Statement 3 is incorrect.

10) With reference to the Fluorescent Nanodiamonds (FNDs) in strategic industries, consider the following statements:

1. FNDs are used in high-resolution imaging due to their ability to withstand harsh environments.
2. Their sensitivity to electric fields makes FNDs valuable for detecting electromagnetic signals.
3. FNDs are being explored as a replacement for traditional energy sources in renewable energy technologies.

How many of the above statements is/are correct?

a) Only one
b) Only two
c) All three
d) None

Answer: b)

Explanation:

- Statement 1 is correct: FNDs are used in high-resolution imaging due to their ability to maintain stability under light and in harsh conditions.
- Statement 2 is correct: FNDs are sensitive to electric fields, making them useful in sensor applications.
- Statement 3 is incorrect: FNDs are not being explored as a replacement for traditional energy sources in renewable energy technologies.

11) With reference to the superconductors and their applications, consider the following statements:

1. Superconductors are primarily used in MRI machines due to their ability to carry large currents without resistance.
2. Superconductors are widely used in electrical grids for efficient energy transmission without losses.
3. High-temperature superconductors require temperatures below -100°C to function optimally.
4. Superconductors can be used in magnetic levitation trains (maglev) for frictionless transportation.

Which of the above statements is/are correct?

a) Only one
b) Only two
c) Only three
d) All four

Answer: c)

Explanation:

- Statement 1 is correct: Superconductors are used in MRI machines due to their ability to carry large amounts of current without energy loss.
- Statement 3 is correct: High-temperature superconductors do require temperatures below -100°C to function.
- Statement 4 is correct: Magnetic levitation trains (maglev) use superconductors to achieve frictionless, high-speed transportation.
- Statement 2 is incorrect: However, superconductors are not yet widely used in electrical grids due to the difficulty of maintaining the required temperatures and costs.

12) With reference to the Carbon Credit Trading Scheme (CCTS) in India, consider the following statements:

1. The CCTS issues Carbon Credit Certificates (CCC), each representing a reduction of one tonne of CO_2 equivalent (tCO_2e).
2. The scheme includes both a compliance mechanism for mandatory sectors and an offset mechanism for voluntary participants.
3. The power sector is currently covered under the scheme.

Which of the statements given above is/are correct?

a) 1 and 2 only
b) 2 and 3 only
c) 1 and 3 only
d) 1, 2 and 3

Answer: a)

Explanation:

- Under the CCTS, each Carbon Credit Certificate (CCC) represents a reduction of one tonne of CO_2 equivalent (tCO_2e). Hence, Statement 1 is correct.
- The scheme operates through two mechanisms — a compliance mechanism for mandatory emission reduction targets in energy-intensive industries, and an offset mechanism for voluntary participants. Hence, Statement 2 is correct.
- Although the power sector contributes around 40% of India's GHG emissions, it is not yet included in the current phase of the CCTS. Hence, Statement 3 is incorrect.

13) With reference to the objectives of the Convention on Biological Diversity (CBD), consider the following statements:

1. The CBD's sole focus is on conserving endangered species.
2. Sustainable use of biodiversity resources is not included in the CBD's goals.
3. The CBD excludes benefit-sharing from genetic resources as part of its framework.
4. The CBD does not address biodiversity-related issues in national policies.

How many of the above statements is/are correct?

a) Only two
b) Only three
c) All four
d) None

Answer: d)

Explanation:

- The CBD has three main objectives: the conservation of biodiversity, sustainable use of its components, and the equitable sharing of benefits arising from genetic resources.
- The CBD's goals are broad, addressing not only endangered species but also ecosystem conservation and genetic diversity. Hence, Statement 1 is incorrect.

- Statement 2 is incorrect because sustainable use of biodiversity resources is one of the primary goals of the CBD.
- Statement 3 is incorrect as benefit-sharing from genetic resources is a crucial component of the CBD.
- Statement 4 is also incorrect because the CBD encourages the integration of biodiversity conservation and sustainable use into national policy frameworks.

14) Consider the following:

1. Carbon monoxide (CO)
2. Carbon dioxide (CO_2)
3. Water vapor
4. Nitrogen oxides (NO & NO_2)
5. Sulfur dioxide (SO_2)
6. Particulate matter

How many of the above gases/pollutants are part of flue gas being released from thermal power plants?

a) Only three
b) Only four
c) Only five
d) All six

Answer: d)
Explanation:

- Flue gas (sometimes called exhaust gas or stack gas) refers to the gas that is released from combustion plants. It is a by-product of burning fossil fuels.
- Flue gas actually contains a mixture of gases, such as carbon monoxide (CO), carbon dioxide (CO_2), water vapor, nitrogen oxides (NO & NO_2), sulfur dioxide (SO_2), other trace pollutants, and often some particulate matter.

15)With reference to the Asiatic Lions, consider the following statements:

1. They are exclusively found in the Gir National Park in Gujarat.
2. A distinct feature of Asiatic lions is a prominent belly fold, more so than in African lions.
3. Their social structure involves large, complex prides similar to African lions.
4. The 16th Asiatic Lion Census was conducted solely through direct beat verification.

How many of the above statements is/are correct?

a) Only one
b) Only two

c) Only three
d) All four

Answer: a)

Explanation:

- While Gir National Park is their primary habitat, the 16th census noted a notable range expansion beyond Gir forest, with stable sub-populations outside protected areas, covering 35,000 sq km across 11 districts. Hence, Statement 1 is incorrect.
- A distinguishing physical feature of Asiatic lions is a visible longitudinal fold of skin running along their belly (belly fold), which is less prominent or absent in African lions. Their mane is also generally less developed compared to their African counterparts. Hence, Statement 2 is correct.
- Asiatic lions live in small prides, which are generally lesser in size and complexity than the prides of African lions. This difference in social structure is a key behavioral distinction. Hence, Statement 3 is incorrect.
- The 16th Asiatic Lion Census was conducted in two phases: Phase 1 involved Direct Beat Verification, and Phase 2 was the Final Enumeration. This multi-phase approach ensures more accurate population estimation. Hence, Statement 4 is incorrect.

Thank You

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