Daily MCQs: 12-01-2024

1. Consider the following statements about hypersonic missile systems.

1. A hypersonic missile is a weapon system which flies at the speed of sound.
2. Hypersonic missiles follow a ballistic trajectory to hit the intended target.
3. India has already demonstrated the hypersonic technology.

How many of the statements given above are correct?

A. Only one
B. Only two
C. All three
D. None

2. Consider the following statements about Biochemical oxygen demand (BOD).

1. BOD represents the amount of oxygen consumed by bacteria and other microorganisms while they decompose organic matter.
2. BOD is a standard criterion for pollution assay in aquatic ecosystems.
3. A higher BOD is an indicator of lower quality water.

Which of the statements given above is/are correct?

A. 1 and 2 only
B. 2 only
C. 1 and 3 only
D. 1, 2 and 3

3. Pattadakal group of monuments, a UNESCO world heritage site, is situated in

A. Odisha
B. Karnataka
C. Kerala
D. Telangana

4. The CAR T-cell therapy is primarily used in

A. Polio vaccine
B. Controlling Anti-microbial resistance
C. Foot-and-mouth disease treatment
D. Cancer treatment

5. Consider the following statements with reference to Antimicrobial resistance.

Statement-I:

Antimicrobial resistance (AMR) is one of the top global public health and development threats.

Statement-II:

Genetic predisposition among people is a major factor for the occurrence of Drug Resistance.

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-1 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.

Solutions:

1. Answer: **A**

Explanation:

- **Statement 1 is incorrect:** A hypersonic missile is a weapon system which flies **at least at the speed of Mach 5** i.e. five times the speed of sound and is **manoeuvrable**.
- **Statement 2 is incorrect:** The manoeuvrability of the hypersonic missile is what **sets it apart from a ballistic missile** as the latter follows a set course or a ballistic trajectory. Thus, unlike ballistic missiles, hypersonic missiles **do not follow a ballistic trajectory and can be manoeuvred to the intended target.**
- The two types of hypersonic weapons systems are **Hypersonic Glide Vehicles (HGV) and Hypersonic Cruise Missiles (HCM).**
    - The HGV are launched from a rocket before gliding to the intended target while HCM is powered by air breathing high speed engines or 'scramjets' after acquiring their target.
    - The HGV leaves the Earth's atmosphere and then plunges back into it. To fool the enemy's radar, this hypersonic vehicle glides through the upper layers of the atmosphere, through a random series of curves and turns.
    - HCM is not as fast as HGV, but is designed to fly low and at extremely high speed. This is to take the enemy by surprise. And there is hardly any time for the enemy to hit back.

What are the advantages of hypersonic missiles?

- Hypersonic weapons can enable **responsive, long range strike options against distant, defended or time critical threats** (such as road mobile missiles) when other forces are unavailable, denied access or not preferred.
- Conventional hypersonic weapons use only **kinetic energy** i.e. energy derived from motion, to destroy unhardened targets or even underground facilities.

Are hypersonic missiles detectable in flight?

- Hypersonic weapons could **challenge detection and defence** due to their speed, manoeuvrability and low altitude of flight. Ground based radars or terrestrial radars **cannot detect hypersonic missiles until late in the flight of the weapon.** This delayed detection makes it difficult for the responders to the missile attack to assess their options and to attempt to intercept the missile.

India and Hypersonic technology

- **Statement 3 is correct:** In 2020, DRDO had successfully tested a Hypersonic Technology Demonstrated Vehicle (HSTDV). India became the **fourth country** to have demonstrated this technology after **the USA, Russia and China.**
- India is also developing an **indigenous, dual capable (conventional as well as nuclear) hypersonic cruise missile** as part of its Hypersonic Technology Demonstrator Vehicle programme and has successfully tested a Mach 6 scramjet in 2019 and 2020.
- A **hypersonic version of the BrahMos supersonic cruise missile (BrahMos-II)**, a joint development of India and Russia, is also under development.

2. Answer: **D**

Explanation:

- **Statement 1 is correct:** Biochemical oxygen demand (BOD) represents the **amount of oxygen consumed by bacteria and other microorganisms while they decompose organic matter** under aerobic (oxygen is present) conditions at a specified temperature.
- BOD is a standard criterion for pollution assay in aquatic ecosystems.

Dissolved oxygen and BOD

- The oxygen in water which is available for species' use is called **"dissolved oxygen".** The more organic matter there is (e.g., in sewage and polluted bodies of water), the greater the BOD; and the **greater the BOD, the lower the amount of dissolved oxygen** available for higher animals such as fishes.
- **Statement 2 is correct:** The BOD is therefore a **reliable gauge of the organic pollution of a body of water.** One of the main reasons for treating wastewater prior to its discharge into a water resource is to lower its BOD—i.e., reduce its need for oxygen and thereby lessen its demand from the streams, lakes, rivers, or estuaries into which it is released.
- **Statement 3 is correct:** Higher BOD indicates more oxygen is required, which is less for oxygen-demanding species to feed on, and signifies lower water quality. Inversely, low BOD means less oxygen is being removed from water, so water is generally purer.

3. Answer: **B**

Explanation:

- Situated in **Karnataka**, Pattadakal group of monuments are famous for their **harmonious blend of architectural forms of northern and southern India.**
- Pattadakal, the **capital of the Chalukya dynasty** of medieval India, is a famous world heritage site consisting of a group of ten major temples, each displaying interesting architectural features.
- Built in the 7th and 8th centuries, the Pattadakal monument was famous for its royal coronation called **'Pattadakisuvolal'.** Temples constructed here mark the **blending of the Rekha Nagara Prasada and the Dravida Vimana styles of temple building.**
- The oldest temple at Pattadakal is the simple but massive **Sangameshwara** built by Vijayaditya Satyasraya (A.D. 697-733).

- The **Mallikarjuna and the Virupaksha temples** at Pattadakal, were built by two queens of Vikaramaditya II, to commemorate the victory of the Chalukyas over the Pallavas. Virupaksha temple, built by Queen Lokamahadevi, was originally called **Lokeshwara**. This temple is built in the southern Dravida style and is the largest in the enclosure. It has a massive gateway and several inscriptions.
- Virupaksha temple also served as a **model for the Rashtrakuta ruler to carve out the great Kailasa at Ellora.** The sculptural art of the early Chalukyas is characterized by grace and delicate details. The narrative relief's illustrating certain episodes from the Ramayana, Mahabharata, Bhagavata and Panchatantra fitted well with these grand religious edifices.
- The **Jambulinga Temple** at Pattadakal has a fine figure of the Dancing Shiva with Nandi (bull) & Parvathi by his side. Built with a northern style tower, there is a horse-shoe arched projection on its facade.
- The **Chandrashekhara and Kadasideeshwara** are the other major temples here, and Pattadakal also has a Jaina basadi of Rashtrakuta times with two beautiful elephants in front.

4. Answer: **D**

Explanation:

- The **three major forms of treatment for any cancer** are **surgery** (removing the cancer), **radiotherapy** (delivering ionising radiation to the tumour), and **systemic therapy** (administering medicines that act on the tumour).
- Surgery and radiotherapy have been refined significantly over time – whereas advances in systemic therapy have been unparalleled.
- A new development on this front, currently holding the attention of many researchers worldwide, is **CAR T-cell therapy.**

Chemo and immunotherapy

- **Systemic therapy's earliest form** was **chemotherapy.** When administered, chemotherapy preferentially acts on cancer cells as they have rapid unregulated growth and poor healing mechanisms. Chemotherapeutic drugs have **modest response rates** and **significant side-effects** as they affect numerous cell types in the body.
- The next stage in its evolution was **targeted agents**, a.k.a. **immunotherapy:** the drugs bind to specific targets on the cancer or in the immune cells that help the tumour grow or spread. This method often has **fewer side-effects** as the impact on non-tumour cells is limited. However, it is **effective only against tumours that express these targets.**

What are CAR T-cells?

- **Chimeric antigen receptor (CAR) T-cell therapies** represent a quantum leap in the sophistication of cancer treatment. Unlike chemotherapy or immunotherapy, which **require mass-produced injectable or oral medication**, CAR T-cell therapies **use a patient's own cells.**
- They are **modified in the laboratory to activate T-cells**, a **component of immune cells,** to attack tumours. These modified cells are then **infused back into the patient's bloodstream** after conditioning them to multiply more effectively.
- The cells are **even more specific** than targeted agents and directly activate the patient's immune system against cancer, making the treatment **more clinically effective.** This is why they're called **'living drugs'.**

Where is it used?

- As of today, CAR T-cell therapy has been approved for **leukaemias** (cancers arising from the cells that produce white blood cells) and **lymphomas** (arising from the lymphatic system). These cancers occur through **unregulated reproduction of a single clone of cells:** following the cancerous transformation of a single type of cell, it produces millions of identical copies. As a result, the **target for CAR T-cells is consistent and reliable.**
- CAR T-cell therapy is also presently used among patients with cancers that have returned after an initial successful treatment or which haven't responded to previous combinations of chemotherapy or immunotherapy.
- Its **response rate is variable.** In certain kinds of leukaemias and lymphomas, the efficacy is as high as 90%, whereas in other types of cancers it is significantly lower.
- The **potential side-effects are also significant**, associated with **cytokine release syndrome** (a widespread activation of the immune system and collateral damage to the body's normal cells) and **neurological symptoms** (severe confusion, seizures, and speech impairment).

How widespread is its use?

- The **complexity of preparing CAR T-cells** has been a major barrier to their use.
- The **technical and human resources** required to administer this therapy are also considerable. Treatments in the US **cost more than a million dollars**. Trials are underway in India, with companies looking to indigenously manufacture CAR T-cells at a fraction of the cost.

5. Answer: **C**

Explanation:

- Antimicrobial resistance, also known as drug resistance, is the **resistance acquired by microorganisms such as bacteria, viruses, fungi and parasites** against antimicrobial drugs that are used to treat infections.
- When the microorganisms become resistant to most antimicrobials they are often referred to as **"superbugs"**.

- **Statement I is correct:** Antimicrobial resistance (AMR) is one of the top global public health and development threats. According to WHO, AMR is responsible for 1.27 million deaths in a year.
- A genetic predisposition (sometimes also called genetic susceptibility) is an increased likelihood of developing a particular disease based on a person's genetic makeup. Genetic predisposition is **not a cause for Antimicrobial resistance. Hence, Statement-I is correct but Statement-II is incorrect.**