

# OFFICERS IAS ACADEMY

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Daily MCQs: 09-03-2024

**1. With reference to the Laser Interferometer Gravitational-wave Observatory, consider the following statements.**

1. LIGO exploits the physical properties of light and space to detect and understand the origins of gravitational waves predicted by Einstein's General Theory of Relativity.
2. Even a single LIGO detector can detect and verify gravitational waves on its own.

**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

**2. The Cassini-Huygens space-research mission is**

- A. ISRO-NASA joint mission for outer space exploration
- B. European Space Agency's mission to discover extrasolar planetary systems and terrestrial planets
- C. A collaboration project to study Saturn and its system
- D. Mars exploration mission

**3. Consider the following statements about Dholavira.**

1. It is located in present-day Gujarat.
2. It is the largest metropolis of the Indus Valley Civilisation.

**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

**4. The MyGov platform for Citizen Engagement is designed, developed and hosted by**

- A. National Survey and Mapping Organisation
- B. Atal Innovation Centre
- C. Centre for Development of Advanced Computing
- D. National Informatics Centre

**5. Consider the following statements about Microplastics.**

1. They are poorly soluble in water and may persist in aquatic environments.

2. Secondary microplastics are particles that result from the breakdown of larger plastic items.

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

**Solutions:**

1. Answer: A

**Explanation:**

**What are Gravitational Waves?**

- Gravitational waves are '**ripples**' in **space-time** caused by some of the most violent and energetic processes in the Universe.
- **Albert Einstein** predicted the existence of gravitational waves in 1916 in his general theory of relativity. Einstein's mathematics showed that massive accelerating objects (such as neutron stars or black holes orbiting each other) would disrupt space-time in such a way that 'waves' of undulating space-time would propagate in all directions away from the source.
- These cosmic ripples would travel at the speed of light, **carrying with them information about their origins, as well as clues to the nature of gravity itself.**
- The strongest gravitational waves are produced by **cataclysmic events** such as colliding black holes, supernovae (massive stars exploding at the end of their lifetimes), and colliding neutron stars.

**Why does one study gravitational waves?**

- As a largely unknown and fundamental phenomenon, gravitational waves are interesting to scientists. But once many more detectors are in place, the study also offers a **new way to map out the universe**, using gravitational-wave astronomy.
- Extracting the information carried by the waves to **address questions in both physics and astronomy** depends on our ability to identify where the individual sources are in the sky. This requires a network of detectors spread widely over the Earth.

**About LIGO**

- LIGO stands for "**Laser Interferometer Gravitational-wave Observatory**", the **world's largest gravitational wave observatory.**
- **Statement 1 is correct:** LIGO exploits the physical properties of light and of space itself to **detect and understand the origins of gravitational waves (GW)** predicted by Einstein's General Theory of Relativity.
- LIGO consists of **two widely-separated interferometers** within the United States—one in Hanford, Washington and the other in Livingston, Louisiana—operated in unison to detect gravitational waves.

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- Each LIGO detector consists of two arms, each 4km long, comprising 1.2m-wide steel vacuum tubes arranged in an "**L**" **shape**, and covered by a concrete shelter that protects the tubes from the environment.
- LIGO's interferometers can amplify the smallest conceivable vibrations enough that they are detectable and measurable.

### Properties

- **LIGO is blind.** LIGO, unlike usual telescopes, does not "see" the incoming ripples in spacetime. It does not even need to, because gravitational waves are **not a part of the electromagnetic spectrum or light**.
- **Statement 2 is incorrect:** They are not light waves but a different phenomenon altogether — a stretching of spacetime due to immense gravity. A **single LIGO detector cannot confidently detect this disturbance on its own**. At least two detectors are needed.
- This is because the signal is so weak that even a random noise could give out a signal that can mislead one into thinking a genuine gravitational wave has been detected. It is because two detectors have detected the faint signal in coincidence that the observer is convinced it is a genuine reading and not noise.



### Detection of gravitational waves

- LIGO made its first detection of gravitational waves (in **2015**), generated by a pair of colliding black holes some 1.3 billion light years away.
- Following the 2015 detection, which later won the Physics Nobel (2017), the two LIGO detectors detected seven such binary black hole merger events before they were joined by the **European Virgo detector** in 2017. The two facilities have now detected 10 events.
- The **Japanese detector, KAGRA**, or **Kamioka Gravitational-wave Detector**, is expected to join the international network soon.
- In the meantime, in a collaboration with LIGO, a gravitational wave detector is being set up in **India**. The LIGO India project is expected to join the international network in a first science run in 2025.

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### What is the need to have another detector in India?

- Right now, with just three detectors, there is huge uncertainty in determining where in the sky the disturbance came from. Observations from a new detector in a far-off position will help locate the source of the gravitational waves more accurately.
- LIGO India will come up in **Maharashtra**.

2. Answer: C

### Explanation:

- The **Cassini-Huygens space-research mission** commonly called **Cassini** is a joint programme of **NASA, the European Space Agency (ESA), and the Italian Space Agency**.
- Under the mission, a spacecraft was launched in 1997, to study **Saturn and its system**, including its rings and natural satellites.
- The spacecraft comprised both **NASA's Cassini space probe** and **ESA's Huygens lander**, which landed on Saturn's largest moon, **Titan**. Cassini was the fourth space probe to visit Saturn and the first to enter its orbit.
- Cassini revealed new information about the **potential habitability of icy moons and it delivered a glimpse below the atmosphere of Titan**. The probe found **evidence of subsurface oceans of liquid water** on some of the moons and spotted **geysers and other geologic activity**.

3. Answer: A

### Explanation:

#### About Dholavira

- **Statement 1 is correct:** Located in the **Kutch district of Gujarat**, Dholavira is a part of the **Indus Valley Civilisation (IVC)** dating back to about 4,500 years ago.
- **Statement 2 is incorrect:** After Mohen-jo-Daro, Ganweriwala and Harappa in Pakistan and Rakhigarhi in Haryana of India, Dholavira is the **fifth largest metropolis of IVC**.
- The ancient city of Dholavira is one of the most remarkable and well-preserved urban settlements in South Asia dating from the 3rd to mid-2nd millennium BCE.
- It is the **first site of the ancient IVC in India to get the tag**.

### Why makes Dholavira special?



- Discovered in 1968, the site is set apart by its unique characteristics, such as its **water management system, multi-layered defensive mechanisms, extensive use of stone in construction and special burial structures.**
- The site has a **fortified citadel, a middle town and a lower town** with **walls made of sandstone or limestone instead of mud bricks** in many other Harappan sites.
- A **range of artefacts of copper, shell, stone, jewellery, terracotta and ivory** had been found at the site.
- Unlike graves at other IVC sites, **no mortal remains of humans** have been **discovered at Dholavira.**
- **Remains of a copper smelter** indicate Harappans, who lived in Dholavira, knew **metallurgy.** It is believed that traders of Dholavira used to **source copper ore from present-day Rajasthan and Oman and UAE and export** finished products. It was also a **hub of manufacturing jewellery** made of shells and semi-precious stones, like agate and used to export timber.
- Such **beads** peculiar to the Harappan workmanship have been **found in the royal graves of Mesopotamia,** indicating Dholavira used to trade with the Mesopotamians. Its decline also coincided with the collapse of Mesopotamia, indicating the **integration of economies.**
- From 2000 BC, Dholavira entered a phase of **severe aridity** due to climate change and rivers like Saraswati drying up. Because of a drought-like situation, people started migrating toward the Ganges valley or towards south Gujarat and further beyond in Maharashtra.

4. Answer: D

### Explanation:

- MyGov portal has been established as **Government of India's Citizen Engagement Platform** which collaborates with multiple Government bodies/ Ministries to engage with citizens for policy formulation and seeks the opinion of people on issues/ topics of public interest and welfare.
- MyGov platform is designed, developed and hosted by the **National Informatics Centre** under the **Ministry of Electronics & Information Technology (MeitY).**



- Since its launch in 2014, MyGov has more than 18.5 million registered users.
- Almost all Government Departments leverage MyGov platform for their citizen engagement activities, consultations for policy formulation and also to disseminate information to citizens for various Government schemes and programs.
- MyGov is part of **Digital India Corporation**, a not for profit Company set up by MeitY under Section 8 of Companies Act 2013.

5. Answer: C

### Explanation:

- Microplastics are tiny plastic particles **up to 5 millimetres in diameter**. In the last four decades, concentrations of these particles appear to have increased significantly in the surface waters of the ocean.
- **Statement 1 is correct:** Because microplastics are **poorly soluble in water** and do not degrade, they may persist in aquatic environments, absorb toxins in the water, be eaten by marine life and eventually enter our food chain.
- Microplastics have been detected in marine organisms from plankton to whales, in commercial seafood, and even in drinking water. Alarming, **standard water treatment facilities cannot remove all traces of microplastics**.
- To further complicate matters, microplastics in the ocean can bind with other harmful chemicals before being ingested by marine organisms.

### Where do microplastics in the ocean come from?

- Microplastics are included in **personal care products** such as toothpaste and skin care products. They tend **not to be filtered out during sewage treatment**, but to be released directly to the ocean or other water bodies such as lakes and rivers.
- Microplastics are also found in **synthetic textiles**. Similar fibres have been observed in sewage effluent and sludge on shorelines near large population centres.
- A proportion of the microplastics used in **industrial applications** also enter the environment.
- Avoiding such uses and releases of microplastics would reduce the quantities entering the marine and coastal environment. As the world population grows and more products containing microplastics are placed on the market, the amounts found there are likely to increase.
- There are **two categories of microplastics: primary and secondary**.
  - Primary microplastics are tiny particles designed for commercial use, such as cosmetics, as well as microfibers shed from clothing and other textiles, such as fishing nets.
  - **Statement 2 is correct:** Secondary microplastics are particles that result from the breakdown of larger plastic items, such as water bottles. This breakdown is caused by exposure to environmental factors, mainly the sun's radiation and ocean waves.

### Impacts

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- Scientists are still unsure whether consumed microplastics are harmful to human or animal health—and if so, what specific dangers they may pose. Even so, many countries are taking action to reduce microplastics in the environment.
- A **2017 United Nations resolution** discussed microplastics and the need for regulations to reduce this hazard to our oceans, their wildlife, and human health.

