

**09-07-2022**

## Large Hadron Collider

### Why in Newspapers?

The world's most powerful particle collider, the Large Hadron Collider (LHC), will collide protons at unprecedented levels of energy from July 5.

### Quick Issue?

- It is expected to provide evidence of "new physics" – or 'physics' beyond the Standard Model of particle physics. whereby, how the 'basic building blocks' of matter, governed by the four fundamental forces, interact with each other.

### Historical Background?

- The Large Hadron Collider (LHC) is a massive, complex machine built to study the particles of the smallest known 'building block' of all objects.
- **Structure:** LHC, which is a 27 km long 'track-loop' 100 meters underground on the Swiss-French border.
- **Operational:** In its operational state, it fires two protons at about the speed of light in opposite directions inside a ring of superconducting electromagnets.
- **Guided by a magnetic field:** The magnetic field produced by superconducting electromagnets holds protons in a 'tight beam' and guides the protons as they travel through the 'beam pipe', eventually causing them to collide.
- **High precision:** The particles are so small that the act of colliding them is like firing two needles at a distance of 10 km with such precision that they intersect halfway.
- **Supercooled:** Since the LHC's powerful electromagnets carry the same current as a lightning bolt, they have to be kept cool. The machine uses liquid helium to keep its vital components ultracold to minus 271.3 degrees Celsius, which is much colder than 'interstellar space'.
- ATLAS is the largest general-purpose particle detector experiment at the Large Hadron Collider (LHC).

### Other Key Facts?

#### Achievements

- Discovery of 'God particle': Scientists at CERN announced the discovery of 'Higgs boson' or 'God particle' during the first 'run' (flow) of the LHC.
- Due to this 'Peter Higgs' and his colleague 'François Englert' were awarded the Nobel Prize in Physics in 2013.
- The 'Higgs boson' is the fundamental particle associated with the Higgs field. Higgs field A field that gives mass to other fundamental particles such as electrons and quarks.
- 'New Physics' beyond the Standard Model: After the discovery of the Higgs boson, scientists have begun to use the collected data as a tool to look beyond the Standard Model, which is currently The most elementary 'building blocks' of the universe and the best theory of their interactions.



- The Compact Muon Solenoid (CMS) experiment is one of the largest international scientific collaborations in history. Its aiming is similar to that of the Atlas, but it uses a different magneto-system design.
- **Latest Upgrade:** Following its maintenance and upgrades, the collider was put back into operation this April. The third is the 'run' of the LHC.
- **New Exploration:** To advance information about so-called "dark matter": Dark matter is difficult to detect, and its particles are believed to make up most of the universe, but since it is completely invisible Because they neither absorb nor reflect nor emit light.

### Other Key Facts?

#### Big Bang Theory

- The Big Bang is said to be the theory, according to which about 13.7 billion years ago all physical particles and energy were confined to a single point. Then this point began to spread.
- The Big Bang was not like a bomb explosion, but in this the initial particles of the universe spread everywhere and started running away from each other. This principle was discovered by a scientist named Edwin Hubble.

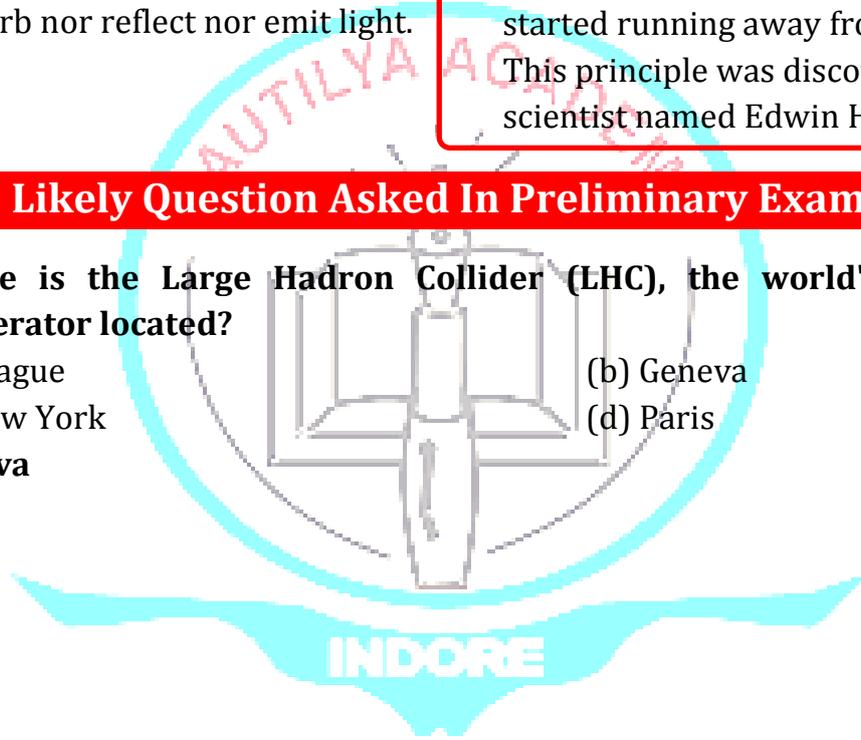
### Likely Question Asked In Preliminary Exam

**Question:** Where is the Large Hadron Collider (LHC), the world's largest particle accelerator located?

- (a) Prague
- (c) New York

- (b) Geneva
- (d) Paris

**Answer:** (b) Geneva



## NITI Aayog report on alternatives to plastic

### Why in Newspapers?

Recently, a NITI Aayog report has suggested alternatives to plastics or technologies that make plastics degradable.

### Quick Issue?

- India produces 3.47 million tonnes of plastic waste per year, of which only 60% is collected for recycling.
- Goa, Delhi and Kerala have generated the highest per capita plastic waste, while Nagaland, Sikkim and Tripura have generated the least per capita plastic waste.
- Globally, 97–99% of this plastic waste comes from fossil fuel feedstock while the remaining 1–3% comes from bio (plant) based plastics.

### Historical Background?

#### ▪ Recommendations of NITI Aayog-

- Development of emerging technologies: For example, additives/'additives' can make plastics such as polypropylene and polyethylene into biodegradable 'polyolefins'.
- **Use of Bio-plastics:** As an economical alternative to plastics.
- The contribution of the informal sector and vulnerable groups in waste recycling should be appreciated.
- Use 'Extended Manufacturer Responsibility' to reduce waste.
- Leveling and collection of compostable and biodegradable plastics.
- **Transparency:** Data on waste generation, collection and disposal should be disclosed.
- Avoid Greenwashing: Greenwashing is the process of providing 'misleading information' about how a company's products are environmentally sound.

### **Other Key Facts?**

#### Single use Plastic

- Single use plastic has been banned from July 1.
- 'Single-use plastic' is a form of disposable plastic that is thrown away with only one use, and can be used in grocery bags, food Can be recycled like packaging, bottles and straws etc.
- It has been defined by the central government as an item made of plastic intended to be used "only once" before disposal or recycling.
- A list of 21 items has been prepared under the definition of single use plastic, which includes earbud with plastic stick, plastic stick for balloons, plastic flag, candy stick, ice cream stick, thermocol for decoration, plate, cup, Glass, cutlery such as forks, spoons, knives, straws, trays, wrapping or packaging film, sweet boxes, invitation cards and cigarette packets, plastic or PVC banners less than 100 microns, stirrers, etc.
- These items were listed by the Environment Ministry under the 'Plastic Waste Management Amendment Rules', 2021.
- The above 'single use plastic' items are of "low utility and high waste potential".
- Plastic packaging waste, a major contributor to the much larger problem of plastic waste pollution – not yet covered under the phasing out of single-use plastic items.

- **Best practices in India:-**
  - **Arunachal Pradesh:** Plastic banks were set up in one district; Plastic was used in road construction in the changing districts.
  - **Delhi:** Environmental compensation of Rs.88,00,000/- imposed for violation of PWM norms.
  - **Tamil Nadu:** The collection capacity of plastic waste is 92%.
  - **Sikkim:** Use of plastic waste started in road construction.
  - **Uttarakhand:** It is proposed to use plastic waste as fuel, RDF and waste in power plants.
  - **Biodegradable cutlery:** Defense Research and Development Organization (DRDO) Lab DFRL has developed technology for biodegradable cutlery.
- **Best practices in the world:-**
  - Edible Seaweed Cups Made in Indonesia: Seaweed can grow 60 times faster than land-based plants, making it an important carbon sink.
- **Algae-Blended Ethylene-Vinyl Acetate:** A US-based firm has created algae-compounded ethylene-vinyl acetate that converts air and water pollution (ammonia, phosphate and carbon dioxide) into protein-rich 'plant biomass'.
  - **Zero plastic recycled paper bottle:** A UK firm has invented a commercially available 'zero plastic recycled paper' bottle in the world.
  - **Wood-based paper packaging:** In 2020, a Scottish paper company has developed a wood-based sustainable alternative to plastic packaging.
  - **Biotransformation process:** A UK based company has developed an additive which is added to a masterbatch of polyolefins.
- Biodegradable or biodegradable plastics means plastics, other than compostable plastics, which, without leaving any microplastics, or visible, separable or toxic residues and adverse environmental effects, are produced in the ambient environment (terrestrial or water) within a specified time period. in) undergoes complete decomposition by biological processes under conditions, and complies with the prescribed standards of BIS and certified by CPCB.
- Compostable plastics: Compostable plastics undergo decomposition by biological processes to produce CO<sub>2</sub>, water, inorganic compounds and biomass during composting, and do not leave toxic residues. Compostable plastics can be both plant based and petroleum based.
- BASF's Ecoflex is a classic example of a 'compostable polymer', which is partly petroleum based but acts as a compost in industrial compost facilities.
- **Oxo-degradable:** Conventional plastics such as 'polyethylene (PE) plastic' - which include an additive to help break down the plastic into smaller pieces, which leak microplastics into the environment It is possible



## Likely Question Asked In Preliminary Exam

**Question-** Polythene bags cannot be destroyed because they are made of-

- (a) non-degradable molecules
- (b) inorganic compounds
- (c) polymer
- (d) protein

**Answer:** (c) Polymer

**Question-** Which of the following things is not destroyed by bacteria?

- (a) dung
- (b) leaves of plants
- (c) Foods
- (d) Plastics

**Answer:** (d) Plastic

**Question-** Why is there great concern about 'microbeads' being released into the environment?

- (a) It is considered harmful to the marine ecosystems.
- (b) They are known to cause skin cancer in children.
- (c) It is so small that it is absorbed by the crop plants in irrigated areas.
- (d) They are often used for adulteration in food items.

**Answer:** (c) It is so small that it is absorbed by the crop plants in irrigated areas.

