December 11, 2017

Q.1) Mandal Commission is concerned with

a) Reservation
b) Section 377
c) National Judicial Appointments Commission
d) Capital gains tax

Q.1) Solution (a)

The Mandal Commission, or the Second Backward Classes Commission, was established in India on 1 January 1979 under Prime Minister Morarji Desai with a mandate to "identify the socially or educationally backward classes" of India.

Source: http://www.thehindu.com/news/national/24-years-on-obc-workforce-in-centre-still-short-of-mandal-mark/article21382491.ece

Q.2) Consider the following statements about Coronal Mass Ejections (CMEs)

1. They are huge explosions of charged particles extending beyond the sun's corona
2. They are responsible for geomagnetic storms and enhanced aurora
3. Visible Emission Line Coronagraph (VELC) of ISRO's Aditya - L1 will study the origin of CMEs

Select the correct statements

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All of the above

Q.2) Solution (d)

Coronal mass ejections (CMEs) are huge explosions of magnetic field and plasma from the Sun's corona. When CMEs impact the Earth's magnetosphere, they are responsible for geomagnetic storms and enhanced aurora. CMEs originate from highly twisted magnetic field structures, or "flux ropes", on the Sun, often visualized by their associated "filaments" or "prominences", which are relatively cool plasmas trapped in the flux ropes in the corona. When these flux ropes erupt from active regions on the Sun (regions associated with sunspots and very strong magnetic fields), they are often accompanied by large solar flares;

eruptions from quiet regions of the Sun, such as the "polar crown" filament eruptions, sometimes do not have accompanying flares.

CMEs travel outward from the Sun typically at speeds of about 300 kilometers per second, but can be as slow as 100 kilometers per second or faster than 3000 kilometers per second. The fastest CMEs erupt from large sunspot active regions, powered by the strongest magnetic field concentrations on the Sun. These fast CMEs can reach Earth in as little as 14--17 hours. Slower CMEs, typically the quiet region filament eruptions, take several days to traverse the distance from the sun to Earth. Because CMEs have an embedded magnetic field that is stronger than the background field of the solar wind, they will expand in size as they propagate outward from the Sun. By the time they reach the Earth, they can be so large they will fill half the volume of space between the Sun and the Earth. Because of their immense size, slower CMEs can take as long as 24 to 36 hours to pass over the Earth, once the leading edge has arrived.

CMEs that are traveling faster than the solar wind plasma's fast mode wave speed (the space equivalent of the Earth's sound speed) will generate a shock wave, just like an airplane traveling faster than the speed of sound generates a sonic boom. These shock waves accelerate charged particles ahead of them to create much of the solar radiation storm affiliated with large-scale solar eruptions. Often, the first sign of a CME hitting the Earth environment is the plasma density jump due to the shock wave's passage.

The size, speed, direction, and density of a CME are important parameters to determine when trying to predict if and when it will impact Earth. We can estimate these properties of a CME using observations from an instrument known as a coronagraph, which blocks the bright light of the solar disk, just as the moon does in a total solar eclipse, allowing the outer solar atmosphere (chromosphere and corona) to be observed. CMEs show up as bright clouds of plasma moving outward through interplanetary space.

In order to predict the strength of the resulting geomagnetic storm, estimates of the magnetic field strength and direction are important. At the present time, the magnetic field cannot be determined until it is measured as the CME passes over a monitoring satellite. If the magnetic field direction of the CME is opposite to that of the Earth's dipolar magnetic field, the resulting geomagnetic disturbance or storm will be larger than if the fields are in the same direction. Some CMEs show predominately one direction of magnetic field in their passage past the Earth, but most exhibit changing field directions as the large magnetic cloud passes over our relatively tiny magnetosphere, so most CMEs that impact the Earth's magnetosphere will at some point have magnetic field conditions that favor the generation of geomagnetic storming with the associated auroral displays and geomagnetically induced currents in the ground.

Aditya L1 - https://www.isro.gov.in/aditya-l1-first-indian-mission-to-study-sun

December 11, 2017

Source: http://www.thehindu.com/sci-tech/science/workings-of-solar-wind-flows-deciphered-by-prl-team/article21380124.ece

Q.3) Consider the following statements

1. It is the region of space surrounding Earth where the magnetic field of interplanetary space is dominant than the magnetic field of Earth
2. The magnetosphere is formed by the interaction of the solar wind with Earth's magnetic field
3. The pressure of the solar wind on Earth's magnetic field compresses the field on the dayside of Earth and stretches the field into a long tail on the nightside

Select the correct statements

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All of the above

Q.3) Solution (b)

The magnetosphere is the region of space surrounding Earth where the dominant magnetic field is the magnetic field of Earth, rather than the magnetic field of interplanetary space. The magnetosphere is formed by the interaction of the solar wind with Earth's magnetic field. This figure illustrates the shape and size of Earth's magnetic field that is continually changing as it is buffeted by the solar wind.

It has been several thousand years since the Chinese discovered that certain magnetic minerals, called lodestones, would align in roughly the north-south direction. The reason for this effect wasn't understood, though, until 1600, when William Gilbert published De Magnete and demonstrated that our Earth behaved like a giant magnet and loadstones were aligning with Earth's magnetic field.

After several more centuries of investigation, it is now known that Earth's magnetic field is quite complex, but still, to a great extent, can be viewed as a dipole, with north and south poles like a simple bar magnet. Earth's magnetic axis, the dipole, is inclined at about 11 degrees to Earth's spin axis. If space were a vacuum, Earth's magnetic field would extend to infinity, getting weaker with distance, but in 1951, while studying why comet tails always point away from the sun, Ludwig Biermann discovered that the sun emits what we now call the solar wind. This continuous flow of plasma, comprised of mostly electrons and protons, with an embedded magnetic field, interacts with Earth and other objects in the solar system.

The pressure of the solar wind on Earth's magnetic field compresses the field on the dayside of Earth and stretches the field into a long tail on the nightside. The shape of the resulting distorted field has been compared to the appearance of water flowing around a rock in a stream. On the dayside of Earth, rather than extending to infinity, the magnetic field is confined to within about 10 Earth radii from the center of Earth and on the nightside, the field is stretched out to hundreds of Earth radii, well beyond the orbit of the moon at 60 Earth radii.

The boundary between the solar wind and Earth's magnetic field is called the magnetopause. The boundary is constantly in motion as Earth is buffeted by the ever-changing solar wind. While the magnetopause shields us to some extent from the solar wind, it is far from impenetrable, and energy, mass, and momentum are transferred from the solar wind to regions inside Earth's magnetosphere. The interaction between the solar wind and Earth's magnetic field, and the influence of the underlying atmosphere and ionosphere, creates various regions of fields, plasmas, and currents inside the magnetosphere such as the plasmasphere, the ring current, and radiation belts. The consequence is that conditions inside the magnetosphere are highly dynamic and create what we call "space weather" that can affect technological systems and human activities. For example, the radiation belts can have impacts on the operations of satellites, and particles and currents from the magnetosphere can heat the upper atmosphere and result in satellite drag that can affect the orbits of low-altitude Earth orbiting satellites. Influences from the magnetosphere on the ionosphere can also affect communication and navigations systems.

Source: **http://www.thehindu.com/sci-tech/science/workings-of-solar-wind-flows-deciphered-by-prl-team/article21380124.ece**

Q.4) Consider the following statements about 'excitonium'

1. It's made up of particles that are formed of an escaped electron and the hole it left behind
2. It is a perfect insulator

Select the correct statements

a) 1 Only
b) 2 Only
c) Both 1 and 2

d) Neither 1 nor 2

Q.4) Solution (a)

Excitonium is a condensate—it exhibits macroscopic quantum phenomena, like a superconductor, or superfluid, or insulating electronic crystal. It's made up of excitons, particles that are formed in a very strange quantum mechanical pairing, namely that of an escaped electron and the hole it left behind.

Source: http://www.thehindu.com/sci-tech/science/new-form-of-matter-excitonium-discovered/article21379110.ece

Q.5) Consider the following statements about Taj Trapezium Zone (TTZ)

1. It is a defined area of 10,400 sq km around the Taj Mahal to protect the monument from pollution
2. Use of coal/ coke in industries located in the TTZ is banned

Select the correct statements

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

Q.5) Solution (c)

Taj Trapezium Zone (TTZ) is a defined area of 10,400 sq km around the Taj Mahal to protect the monument from pollution. The Supreme Court of India delivered a ruling on December 30, 1996 regarding industries covered under the TTZ, in response to a PIL seeking to protect the Taj Mahal from environmental pollution. It banned the use of coal/ coke in industries located in the TTZ with a mandate for switching over from coal/ coke to natural gas, and relocating them outside the TTZ or shutting down. The TTZ comprises over 40 protected monuments including three World Heritage Sites, the Taj Mahal, Agra Fort and Fatehpur Sikri. TTZ is so named since it is located around the Taj Mahal and is shaped like a trapezoid.

Source: http://www.thehindu.com/news/national/prepare-detailed-plan-for-taj-mahal-conservation-sc-tells-up/article21341923.ece