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INDEX

SCIENCE AND TECHNOLOGY – JUNE 2018

S.No.	Title	Page No.
1.	SPACE.....	3
2.	DEFENCE	8
3.	ENVIRONMENT	10
4.	INNOVATION	13
5.	BIO-TECHNOLOGY	14

SCIENCE AND TECHNOLOGY

JUNE 2018

1. SPACE

1.1 Europa Clipper mission

Why in News?

Europa Clipper mission, to be launched in June 2022

What is Europa Clipper mission?

- NASA's Europa Clipper mission will conduct detailed reconnaissance of Jupiter's moon Europa to see whether the icy moon could harbor conditions suitable for life.
- The mission will carry a highly capable, radiation-tolerant spacecraft that will perform repeated close flybys of the icy moon from a long, looping orbit around Jupiter.

Why Europa?

- There are 69 known moons of Jupiter.
- Main group or Galilean moons: Io, Europa, Ganymede and Callisto.
- The surface of Europa is frozen, covered with a layer of ice, but scientists think there is an ocean beneath the surface.
- The icy surface also makes the moon one of the most reflective in the solar system.
- Researchers using the Hubble Space Telescope spotted a possible water plume jetting from Europa's south polar region.
- A different research team, after repeated attempts to confirm the observations, saw apparent plumes in 2014 and 2016.

What is the list of missions to Europa?

- Pioneer 10 - flyby of Jupiter system
- Pioneer 11 - flyby of Jupiter system.
- Voyager 1- flyby of Jupiter system
- Voyager 2 - flyby of Jupiter system
- Galileo - orbited Jupiter
- Europa Clipper - Will fly by Europa dozens of times
- Jupiter Icy Moons Explorer (JUICE) - proposed for 2020s

1.2 InSight spacecraft

Why in News?

NASA launches InSight spacecraft to Mars to study Red Planet's quakes.

What is InSight?

Mission type	Mars lander
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- InSight - Interior Exploration using Seismic Investigations, Geodesy and Heat Transport.
- It is a Mars lander designed to give the Red Planet its first thorough checkup.
- It is the first outer space robotic explorer to study in-depth the "inner space" of Mars: its crust, mantle, and core.
- Studying Mars' interior structure answers key questions about the early formation of rocky planets in our inner solar system
- The InSight mission seeks to uncover how a rocky body forms and evolves to become a planet by investigating the interior structure and composition of Mars.
- The mission will also determine the rate of Martian tectonic activity and meteorite impacts.

What are the other recent missions to Mars?

InSight	NASA - United States	Lander
ExoMars Trace Gas Orbiter	ESA/Roscosmos Europe/Russia	- Orbiter
Schiaparelli EDM lander	ESA - Europe	Lander
MAVEN	NASA - United States	Orbiter
Mars Orbiter Mission (Mangalyaan)	ISRO - India	Orbiter
Curiosity (Mars Science Laboratory)	NASA - United States	Rover
Fobos-Grunt	Roskosmos - Russia	Orbiter Phobos sample
Yinghuo-1	CNSA - PR China	Orbiter
Dawn	NASA - United States	Gravity assist

1.3 ISRO's Green propellant

Why in News?

Scientists at the Indian Space Research Organisation (ISRO) have reported progress in the development of an environment-friendly propellant to power satellites and spacecraft.

What is a propellant?

- Rockets work because every action has an equal and opposite reaction (according to Sir Issac Newton's third principle).
- In order for the rocket to rush forward, something has to rush backwards, that is the propellant.
- The propellant is a material that spews out of the back of the spacecraft giving it thrust, or a push forward.

- Often the propellant is a kind of fuel which is burned with an oxidizer to produce large volumes of very hot gas.
- These gases expand until they rush out of the back of the rocket, making thrust.
- Sometimes the propellant is not burned, but pushed directly out of the spacecraft, making thrust.
- In ion propulsion, the propellant is made of electrically charged atoms, which are magnetically pushed out of the back of the spacecraft.
- For smaller altitude control thrusters, a compressed gas is pushed out of the spacecraft.

1.4 Japanese probe reached asteroid Ryugu

Why in News?

Japanese probe has reached an asteroid Ryugu 300 million km away to collect information about the birth of the solar system and the origin of life.

UN's International Asteroid Day on June 30

What is an Asteroid?

- Asteroids are actually minor planets.
- They can neither be classified either as a planet or as a comet.
- These are generally in the direct orbit around the Sun.
- They are also known as the inner solar system.
- The larger forms of asteroids are also known as planetoids.
- These are different from the minor planets in the outer solar system in their volatile-based surfaces much like comets.
- These are generally known as asteroid belt.

Why study Asteroid?

- The materials in asteroids represent the building blocks of the planets therefore they may tell us about the origins of our solar system.
- There are conditions that may have been conducive to life in the past, so they may help in understanding origin of life.
- We may want to mine near-earth asteroids for metals.
- They may someday threaten to collide with Earth.

1.5 NASA's Mission to Study Cosmic Rays

Why in News?

NASA is targeting 2024 for the launch of a new mission to learn more about the generation of cosmic rays in the heliosphere, a sort of magnetic bubble surrounding and protecting our solar system.

What is the name of the mission?

The Interstellar Mapping and Acceleration Probe (IMAP) mission will help researchers better understand the boundary of the heliosphere.

What is a heliosphere?

- The sun sends out a constant flow of charged particles called the solar wind.
- This wind ultimately travels past all the planets to some three times the distance to Pluto before being impeded by the interstellar medium.
- This forms a giant bubble around the sun and its planets, known as the heliosphere.
- The solar wind is a gas of charged particles known as plasma, a state of matter governed by its own set physical laws just as the more common solids, liquids, and gases are.
- As the solar wind sweeps out into space, it creates a space environment filled with radiation as well as magnetic fields that trail all the way back to the sun.
- This space environment is augmented by interstellar cosmic rays and occasional concentrated clouds of solar material that burst off the sun, known as coronal mass ejections.

What are other terminologies related to heliosphere?

- **Termination Shock** - Blowing outward billions of kilometers from the Sun is the solar wind, a thin stream of electrically charged gas. This wind travels at an average speed ranging from 300 to 700 kilometers per second (700,000 - 1,500,000 miles per hour) until it reaches the termination shock. At this point, the speed of the solar wind drops abruptly as it begins to feel the effects of interstellar wind.
- **Heliosheath** - The heliosheath is the outer region of the heliosphere, just beyond the termination shock, the point where the solar wind slows abruptly, becoming denser and hotter. The solar wind piles up as it presses outward against the approaching wind in interstellar space.
- **Heliopause** - The boundary between solar wind and interstellar wind is the heliopause, where the pressure of the two winds are in balance. This balance in pressure causes the solar wind to turn back and flow down the tail of the heliosphere.
- **Bow shock** - As the heliosphere plows through interstellar space, a bow shock forms, similar to what forms as a ship plowing through the ocean.

1.6 Opportunity Rover

- Opportunity rover was launched by NASA in 2003 to land in red planet Mars.
- The rover landed in 2004 and begin traversing the planet in search of signs of past life.
- It is still actively exploring the Martian terrain.
- It was originally planned for 90-day mission. But it has far outlasted its planned mission by 55 times longer than originally planned.
- Mars is prone to dust storms due to its thin atmosphere and desertic conditions.
- Recently, it witnessed an immense dust storm which led to the impenetrable, perpetual night in the planet.
- Since, opportunity rover is a solar powered, the amount of light the spacecraft receives has dropped to less than 1 percent of normal levels.
- Before the storm began, it had been rolling down a channel called Perseverance Valley, which scientists think may have been carved by water billions of years ago.
- Curiosity - It is also a rover deployed by NASA in its Mars Exploration Program in 2012 to assess whether Mars ever had an environment able to support small life forms called microbes.
- The rover captured mesas and buttes on mars geological layer called as Murray formation, which is formed from the lakebed mud deposits.

1.7 Sub-Saturn like Planet

- A team of Scientists from India has discovered a sub-Saturn or super-neptune size planet around a sun-like star.
- It has mass of about 27 Earth Mass and size of 6 Earth Radii.
- The planet will be known as EPIC 211945201b or K2-236b.
- With this discovery, India has joined a handful of countries, which have discovered planets around stars beyond our solar system.
- The discovery was made by measuring the mass of the planet using the indigenously designed “PRL Advance Radial-velocity Abu-sky Search” (PARAS) spectrograph.
- PARAS is the **first of its kind spectrograph in Asia**, which can measure the mass of a planet going around a star.
- The spectrograph is integrated with telescope at PRL's Gurushikhar Observatory in Mount Abu, India.
- Very few spectrographs exist around the world that can do such precise measurements.

1.8 Indo-UN Small Satellites Programme (UNSSP)

- UNSSP is launched by ISRO to train 90 qualifying engineers from various countries to build and test three small satellites each year.
- ISRO's Bengaluru-based U.R. Rao Satellite Centre (URSC) until recently known as ISAC will train the overseas students.
- Students will be hosted in Bengaluru for two months each year and work in three annual batches of 30.
- This capacity-building programme is in response to a request that the UN Office for Outer Space Affairs had made to space-faring nations last year.
- **UNISPACE+50** - It is an event marking the 50th year of the first UN Conference on the Exploration and Peaceful Uses of Outer Space.

1.9 Ryugu Asteroid

- A Japanese Probe “Hayabusa2” has recently reached “Ryugu”, an asteroid 300 million km away from Earth.
- Japan Aerospace Exploration Agency, JAXA has launched the probe in 2014.
- The aim of the mission is to collect information about the birth of the solar system and the origin of life.
- It identify suitable sites to take samples from once the probe touches down on the asteroid.
- It will deploy a small lander and three rovers.
- It will then blast an artificial crater to analyze material below the asteroid's surface. After that, the probe will head back to Earth, arriving near the end of 2020 with samples in tow.

1.10 Rare and Isolated Neutron Star

- The NASA scientists have discovered a special kind of neutron star for the **first time outside of the Milky Way** galaxy.
- Neutron stars are the ultra dense cores of massive stars that collapse and undergo a supernova explosion.
- The newly identified neutron star was discovered by using data from NASA's Chandra X-ray Observatory and the European Southern Observatory's Very Large Telescope (VLT) in Chile.
- It is a rare variety that has both a low magnetic field and no stellar companion.

- Oxygen-rich supernova remnants of neutron stars E0102 are important for understanding how massive stars fuse lighter elements into heavier ones before they explode.

1.11 IMAP

- NASA's Interstellar Mapping and Acceleration Probe (IMAP) mission will help researchers better understand the boundary of the heliosphere.
- NASA is targeting 2024 for the launch of a new mission to learn more about the generation of cosmic rays in the heliosphere.
- Heliosphere is the region where the constant flow of particles from our Sun, called the solar wind, collides with material from the rest of the galaxy.
- Cosmic rays created locally and from the galaxy and beyond affect human explorers in space and can harm technological systems, and likely play a role in the presence of life itself in the universe.
- The spacecraft will be positioned about 1.5 million kilometres away from Earth towards the Sun at what is called the first Lagrange point or L1.

1.12 K2 Mission

- A new mission plan named K2 "Second Light" was presented for consideration in 2013 by NASA.
- The K2 mission represents a new concept for spacecraft operations that enables continued scientific observations with the Kepler space telescope.
- K2 would involve using Kepler's remaining capability, photometric precision of about 300 parts per million, to collect data for finding and studying more exoplanets.
- In this proposed mission plan, Kepler would search a much larger area in the plane of Earth's orbit around the Sun.
- It entails a series of sequential observing Campaigns of fields distributed around the ecliptic plane and offers a photometric precision approaching that of the original Kepler mission.
- The K2 mission welcomes all proposals including, but not exclusive to, exoplanet, stellar, extragalactic, and solar system science.

2. DEFENCE

2.1 BrahMos to be a Hypersonic in a decade

Why in News?

BrahMos, the fastest missile in the world co-developed by India and Russia, will be breaching the mach 7 barrier to be a 'hypersonic' system in the next decade.

What is special about BrahMos?

- BrahMos is a joint venture of India and Russia who have together formed BrahMos Aerospace Private Limited
- The missile is named after two rivers, the Brahmaputra of India and the Moskva of Russia
- The BrahMos missiles are the fastest cruise missiles in operation in the world
- They can travel close to the surface of the Earth which makes them very difficult to detect.
- BrahMos claims to have the capability of attacking surface targets by flying as low as 10 metres in altitude.
- BrahMos is four times faster and is twice as heavier than US' Tomahawk missile.

- Around 65 per cent of the missile components were imported.
- It is a self-propelled guided missile that sustains flight through aerodynamic lift.
- Cruise missiles fly within the earth's atmosphere and use a variety of propulsion methods.
- The supersonic missile is capable of carrying conventional warheads of up to 300 kg for a range of 290 km
- It can reach a maximum speed of Mach 3.

What is a cruise missile?

- A cruise missile is an unmanned self-propelled guided vehicle that sustains flight through aerodynamic lift of most of its flight path and whose primary mission is to place an ordnance or special payload on a target.
- They fly within the earth's atmosphere and use jet engine technology.
- These vehicles vary greatly in their speed and ability to penetrate defenses.
- Cruise missile can be categorised by size, speed (subsonic or supersonic), range and whether launch from land, air, surface ship or submarine.
- Depending upon the speed such missiles are classified as:
 1. subsonic cruise missile
 2. Supersonic cruise missile
 3. Hypersonic cruise missile

2.2 Pinaka

- Pinaka Mark I is an indigenous multi-barrel **unguided rocket** launch system developed by DRDO for firing of multiple warheads.
- It was used in the 1999 Kargil conflict. It has a range of 40 km.
- It was later transformed in to a short-range precision **guided missile** and thus renamed as Guided Pinaka – Mark II.
- It has high accuracy and equipped with a navigation, guidance and control system with a range of 70 to 80 km.
- The missile is currently undergoing trials and expected to be delivered to the Army in two years.

2.3 Multi-barrel rocket Vs Guided Missile

- A Multiple rocket launcher is a type of rocket artillery system with multiple warheads and it was launched simultaneously by an unguided system.
- Guided Missile is a self propelled and launched by a precision guided system and it has 4 components such as targeting/missile guidance, flight system, engine and warhead.

2.4 Apache Helicopters

- Apache Helicopters are developed by USA which belongs to heavy helicopter weighing more than 5 tonnes.
- India signed procurement plan of Apache helicopters with USA in 2015.
- Recently, the U.S. State Department approved the sale of six additional AH-64 Apache attack helicopters to India for the Army.
- Currently, the Army operates only smaller Cheetah and ALH (Advanced Light Helicopters) that weigh less than 5 tonnes.

- All bigger helicopters, including the Mi-35 attack helicopters, and fixed-wing aircraft are operated by the Indian Air Force (IAF).
- Under the present procurement plan, the IAF will operate 22 Apache attack helicopters, while the Army will have 6 of them.

2.5 Dhanush Artillery Gun

- It is an indigenously developed gun and upgraded version of the Swedish Bofors gun procured by India.
- It is a 155 mm ammunition system with a range of 36 km.
- It is compatible with all North Atlantic Treaty Organisation (NATO) 155mm ammunition systems.
- It has successfully completed final trials and is ready for induction into the Army.

2.6 Rani Rashmoni

- It is a fast patrol vessel, indigenously built by Hindustan Shipyard.
- It is built under the Fast Patrol Vessel (FPV) project of Indian Coast Guard.
- Under the first phase of the project, 5 FPV's has been built.
- The first four such ships are ICGS Rani Abbakka, ICGS Rani Avanti Bai, ICGS Rani Durgavati and ICGS Rani Gaidinliu.
- They have been commissioned and are in active service at various locations on the eastern seaboard.
- Rani Rashmoni is the last in the first phase and recently commissioned into the ICG.
- It will be based in Visakhapatnam.

3. ENVIRONMENT

3.1 Elevated levels of Uranium in groundwater

Why in News?

Scientists have found widespread uranium contamination in groundwater from aquifers across 16 states in India.

What are the known sources of uranium?

- Naturally occurring uranium in groundwater is a result of the dissolution of uranium bearing minerals that have been in contact with groundwater for long periods of time.
- Elevated concentrations of natural uranium in well water are more likely to be found in drilled wells.
- Uranium can also be found in the environment as a result of human activities such as mill tailings, emissions from the nuclear industry, and the combustion of coal and other fuels.

What are the environmental health concerns of uranium?

- Naturally occurring uranium has very low levels of radioactivity.
- The chemical properties of uranium in drinking water are of greater health concern than its radioactivity.
- Most ingested uranium is due to food intake with lesser amounts accumulated from water or from the air.
- Uranium mostly is rapidly eliminated from the body; however a small amount is absorbed and carried through the blood stream.
- Studies show that elevated levels of uranium in drinking water can affect the kidneys.
- Bathing and showering with water that contains uranium is not considered a health concern.

- There is inadequate data available to evaluate the carcinogenicity of ingested uranium.

What are some of facts about uranium?

- Atomic number (number of protons in the nucleus): 92
- Atomic symbol (on the Periodic Table of Elements): U
- Atomic weight (average mass of the atom): 238.02891
- Density: 18.95 grams per cubic centimeter
- Phase at room temperature: Solid
- Melting point: 2,075 degrees Fahrenheit (1,135 degrees Celsius)
- Boiling point: 7,468 F (4,131 C)
- Number of isotopes (atoms of the same element with a different number of neutrons): 16, 3 naturally occurring
- Most common isotopes: U-234 (0.0054 percent natural abundance), U-235 (0.7204 percent natural abundance), U-238 (99.2742 percent natural abundance)

3.2 Western Ghats

Why in News?

Researchers have found that the vegetation in the Western Ghats determines the amount of rainfall that Tamil Nadu gets during the summer monsoon.

What are some of the important facts western ghats?

- The Western Ghats, is a mountain range that runs along the western side of India.
- It runs, about 1600 kms, North to South, along the western edge of the Deccan Plateau.
- It is one of the eight hottest hotspots of biological diversity in the world.
- It originates near the border of Gujarat and Maharashtra, and runs through the states of Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala, finally ending at Kanyakumari.
- These hills cover a total area of 160,000 square kms.
- The average elevation is about 1,200 m (3,900 ft).
- There are numerous protected areas designated by the Government of India in the Western Ghats.
- They include two bio reserves and thirteen National Parks.
- The Nilagiri Biosphere Reserve that comprises 5500 square kms of evergreen and deciduous forests forms an important part of the Western Ghats.
- The Silent Valley National Park in Kerala, which forms part of the Western Ghats, is one among the last tracts of virgin tropical evergreen forest in India.



3.3 World Environment Day

Why in News?

India hosted World Environment Day 2018

What is Bio plastic?

- A bioplastic is a substance made from organic biomass sources, unlike conventional plastics which are made from petroleum.
- Bioplastics are made through a number of different processes.
- Some use a microorganism to process base materials, such as vegetable oils, cellulose, starches, acids and alcohols.
- While almost all bioplastics produce less carbon dioxide in production than conventional plastics, they are not necessarily completely green.
- The methods by which their base materials are grown and the processing involved both impact their product footprint.
- Many bioplastics also release carbon dioxide or monoxide when biodegrading.
- Their overall environmental impact is typically lower than that of conventional plastics, and as oil costs rise, their cost becomes more and more competitive.
- Some biodegradable bioplastics can break down in 180 days, given the right conditions.
- Others are not biodegradable at all.

What are the Advantages of bioplastics?

- They reduce carbon footprint
- They providing energy savings in production
- They do not involve the consumption of non-renewable raw materials
- Their production reduces non-biodegradable waste that contaminates the environment
- They do not contain additives that are harmful to health, such as phthalates or bisphenol A
- They do not change the flavor or scent of the food contained.

3.4 Paraben Levels in Water

- A project is initiated to identify parabens and triclosan in water bodies to help develop measures to correct their harmful effects.
- Parabens are a group of organic compounds used as preservatives in cosmetics and hygiene products.
- They are harmful for human health and when they end up in water bodies with urban and hospital waste, they become a threat to corals and may cause hormonal disruptions in dolphins and other marine animals as well.
- Use of cosmetics with parabens could pose a risk of breast cancer in women.
- Multiple studies have linked chlorinated parabens to endocrine disrupting functions, specifically mimicking the effects of Estrogen.

World Environment Day: **June 5**

Theme: **Beat Plastic Pollution**

4. INNOVATION

4.1 Nanomotor for wastewater management

Why in News?

Self-propelling nanomotors, just 200 nanometre in size, could be used for wastewater management in chemical industries.

What is nanomotor?

- A motor is a device used to convert energy into movement.
- Similarly, a nanomotor is a molecular or nanoscale device capable of converting energy into movement.
- It can typically generate forces on the order of piconewtons.

What is waste water treatment?

Wastewater treatment, also called sewage treatment, the removal of impurities from wastewater, or sewage, before they reach aquifers or natural bodies of water such as rivers, lakes, estuaries, and oceans.

What is Biological Oxygen Demand?

- Biochemical oxygen demand (BOD) is the amount of dissolved oxygen used by microorganisms in the biological process of metabolizing organic matter in water.
- The more organic matter there is (e.g., in sewage and polluted bodies of water), the greater the BOD.
- The greater the BOD, the lower the amount of dissolved oxygen available for higher animals such as fishes.
- 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 of oxygen and thereby lessen its demand from the streams, lakes, rivers, or estuaries into which it is released.

4.2 Omniphobic Material

Why in News?

Researchers work on an "omniphobic" coating that shrugs off virtually any liquid (it'll even fend off peanut butter) while lasting for a long time.

What is an omniphobic material?

- Material-science researchers are looking to develop surfaces that are resistant to a wide variety of agents, or 'spills'.
- Thus, an ideal 'omniphobe' would be one that swiftly sheds water, oils, alcohols and even peanut butter.
- Researchers claim that a material recently crafted from fusing fluorinated polyurethane and a specialised fluid-repellent molecule called **F-POSS** is the closest science has got to crafting a perfect omniphobe.
- While several composites have repelled ice and water, this new coating is the first that is durable and clear and can be easily applied to virtually any surface.

What is cohesive force?

- Cohesive forces are the intermolecular forces which cause a tendency in liquids to resist separation.
- These attractive forces exist between molecules of the same substance.
- For instance, rain falls in droplets, rather than a fine mist, because water has strong cohesion which pulls its molecules tightly together, forming droplets.

- This force tends to unite molecules of a liquid, gathering them into relatively large clusters due to the molecules' dislike for its surrounding.

What is Adhesive force?

- Adhesive forces are the attractive forces between unlike molecules.
- They are caused by forces acting between two substances, such as mechanical forces (sticking together) and electrostatic forces (attraction due to opposing charges).
- In the case of a liquid wetting agent, adhesion causes the liquid to cling to the surface on which it rests.
- When water is poured on clean glass, it tends to spread, forming a thin, uniform film over the glasses surface.
- This is because the adhesive forces between water and glass are strong enough to pull the water molecules out of their spherical formation and hold them against the surface of the glass, thus avoiding the repulsion between like molecules.

4.3 Norman AI

- Norman is an artificial intelligence (AI) system created by the Massachusetts Institute of Technology (MIT).
- It is also known as the first psychopathic artificial intelligence.
- The goal is to explain in layman's terms how algorithms are made, and to make people aware of AI's potential dangers.
- Norman represents a case study on the dangers of Artificial Intelligence gone wrong when biased data is used in machine learning algorithms,
- The AI was named after the psychopathic killer Norman Bates in the 1960 Alfred Hitchcock film "Psycho."

5. BIO-TECHNOLOGY

5.1 Gene editing may increase cancer risk

Why in News?

CRISPR-Cas9, a gene-editing technology that is being explored by scientists worldwide as a way of removing and replacing gene defects might inadvertently increase cancer risk in cells, scientists warned.

What are Genome, Gene and DNA?

- In most living things, the genome is made of a chemical called DNA.
- The genome contains genes, which are packaged in chromosomes and affect specific characteristics of the organism.
- The genome is divided into chromosomes, chromosomes contain genes, and genes are made of DNA.

What is Gene Editing?

- Gene editing (or genome editing) is the insertion, deletion or replacement of DNA at a specific site in the genome of an organism or cell.
- It is usually achieved in the lab using engineered nucleases also



known as *molecular scissors*

What are the methods of gene editing?

- There are a number of recognised gene editing methods.
- Editing the genome can be achieved using engineered nucleases.
 - CRISPR-Cas9,
 - ZFNs or TALENs,
 - viral systems such as rAAV and
 - transposons.

5.2 Growing Thalassaemia disorder

Why in News?

India has the highest number of thalassaemia majors and carriers

What is thalassemia?

- Thalassaemia is an inherited blood disorder in which the body makes an abnormal form of hemoglobin.
- Hemoglobin is the protein molecule in red blood cells that carries oxygen.
- The disorder results in excessive destruction of red blood cells, which leads to anemia.
- Anemia is a condition in which your body doesn't have enough normal, healthy red blood cells.
- Thalassaemia is inherited, meaning that at least one of your parents must be a carrier of the disease.
- It's caused by either a genetic mutation or a deletion of certain key gene fragments.

What are the functions of red blood cells?

- Red blood cells, also called erythrocytes.
- They are the most abundant cell type in the blood.
- The primary function of red blood cells is to transport oxygen to body cells and deliver carbon dioxide to the lungs.
- A red blood cell has what is known as a biconcave shape.
- Both sides of the cell's surface curve inward like the interior of a sphere.
- This shape aids in a red blood cell's ability to maneuver through tiny blood vessels to deliver oxygen to organs and tissues.
- Red blood cells are also important in determining human blood type.
- Blood type is determined by the presence or absence of certain identifiers on the surface of red blood cells.
- These identifiers, also called antigens, help the body's immune system to recognize its own red blood cell type.
- Red blood cells contain enormous amounts of a protein called hemoglobin.
- This iron-containing molecule binds oxygen as oxygen molecules enter blood vessels in the lungs.
- Hemoglobin is also responsible for the characteristic red color of blood.
- Unlike other cells of the body, mature red blood cells do not contain a nucleus, mitochondria, or ribosomes.

- The absence of these cell structures leaves room for the hundreds of millions of hemoglobin molecules found in red blood cells.

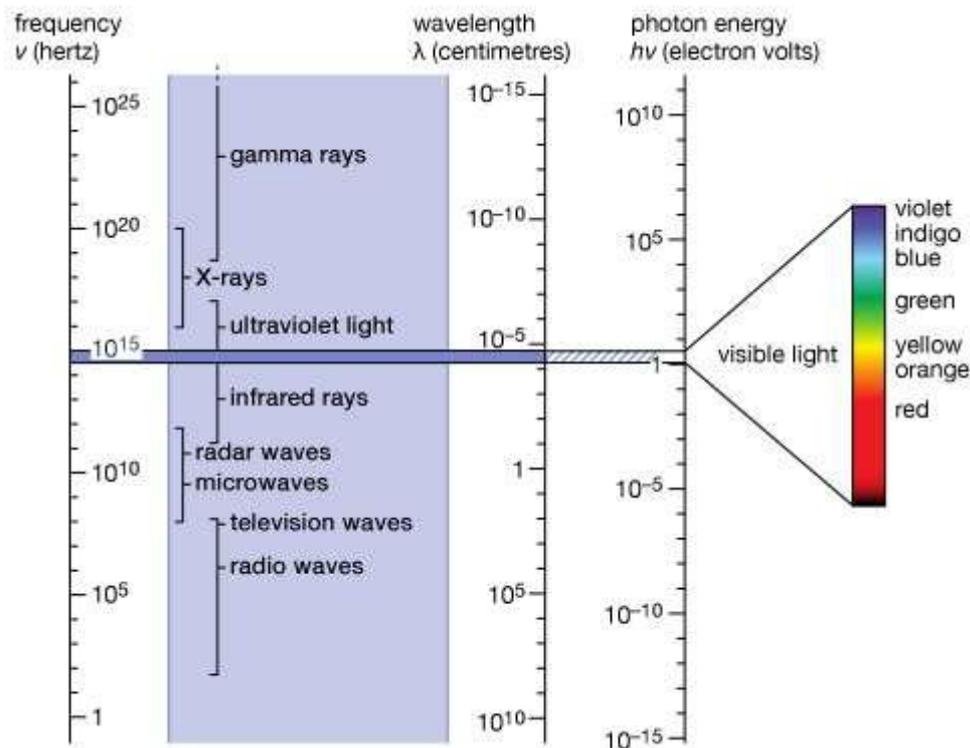
5.3 Plants don't need white light for photosynthesis

Why in News?

A new study published in *Science* says that certain bacteria don't need white light, and instead use far-red light for photosynthesis.

What is an Electromagnetic spectrum?

- Electromagnetic spectrum is the entire distribution of electromagnetic radiation according to frequency or wavelength.
- Although all electromagnetic waves travel at the speed of light in a vacuum, they do so at a wide range of frequencies, wavelengths, and photon energies.
- The electromagnetic spectrum comprises the span of all electromagnetic radiation and consists of many subranges, commonly referred to as portions, such as visible light or ultraviolet radiation.



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What is a visible spectrum?

- Visible spectrum is the portion of the electromagnetic spectrum that is visible to the human eye.
- Electromagnetic radiation in this range of wavelengths is called visible light or simply light.
- A typical human eye will respond to wavelengths from about 390 to 700 nanometers.
- In terms of frequency, this corresponds to a band in the vicinity of 430–770 THz.
- The spectrum does not contain all the colors that the human eyes and brain can distinguish.
- Unsaturated colors such as pink or purple variations like magenta, for example, are absent because they can only be made from a mix of multiple wavelengths.

- Colors containing only one wavelength are also called pure colors or spectral colors.

5.4 Types of Fats

Why in News?

WHO releases draft guidelines on daily calorie intake by adults and children.

What is Saturated/Unsaturated fat?

- A saturated fat is a type of fat in which the fatty acid chains have all or predominantly single bonds.
- A fat is made of two kinds of smaller molecules: glycerol and fatty acids. Fats are made of long chains of carbon (C) atoms.
- Some carbon atoms are linked by single bonds (-C-C-) and others are linked by double bonds (-C=C-).
- Double bonds can react with hydrogen to form single bonds.
- They are called saturated, because the second bond is broken up and each half of the bond is attached to (saturated with) a hydrogen atom.
- Most animal fats are saturated.
- The fats of plants and fish are generally unsaturated.
- Saturated fats tend to have higher melting points than their corresponding unsaturated fats.
- Saturated fats tend to be solids at room temperatures, while unsaturated fats tend to be liquid at room temperature with varying degrees of viscosity.

What are Trans Fats?

- It was long recognized that limiting animal fats and including more vegetable fats could support heart health and healthy cholesterol levels.
- But vegetable oils spoil faster, so researchers developed a method of altering a fat's chemical structure to solidify it and extend its shelf life.
- Trans fats have been altered to be more like saturated fat — and therefore more solid at room temperature.
- Trans fats are unsaturated fats with a specific chemical structure, where the hydrogen atoms are on opposite sides of the double bond.
- Trans fats are a certain type of fatty acid that have what is known as a “trans” chemical structure, which is basically a reconfiguration of the atoms.
- They last longer before going rancid, saving money.
- Trans fats do occur naturally in some foods, such as meat and milk products, but they entered the food system in a big way through chemical process of hydrogenation.

5.5 TB Vaccine for Diabetes

- A recent study has revealed that the tuberculosis vaccine called BCG (Bacillus Calmette–Guérin) might lower blood sugar in diabetes (Type 1) patients several years after they get the shot.
- **Type 1 diabetes** arises when the body's immune system kills the insulin-producing beta cells. Without insulin, cells cannot absorb sugar (glucose), which they need to produce energy.
- There is no patent for BCG, thus it promises a safe and inexpensive treatment for type-1 diabetes.
- BCG also protects against leprosy, sepsis among babies, and leishmaniasis.
- It is also the first approved immunotherapy against bladder cancer.

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