

You & Technology JUNE 2019



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GOOD MORNING TIMES S&T (JUNE-2019)

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General Studies Paper-3 – S&T – June 2019

1. SUPERCONDUCTIVITY

IISc researchers have reported superconductivity at room temperature. Their finding, now under review, will be a breakthrough if verified.

Background:

• Superconductivity is a phenomenon that, so far, has been possible only at extremely low temperatures, in the range of 100°C below zero. The search for a material that exhibits superconductivity at room temperature, or at least manageable low temperatures, has been going on for decades, without success. If the claimed discovery were confirmed, it could be one of the biggest breakthroughs in physics in this century so far.

What is superconductivity?

- It is a state in which a material shows absolutely zero electrical resistance. While resistance is a property that restricts the flow of electricity, superconductivity allows unhindered flow.
- In a superconducting state, the material offers no resistance at all. All the electrons align themselves in a particular direction, and move without any obstruction in a “coherent” manner.
- Because of zero resistance, superconducting materials can save huge amounts of energy, and be used to make highly efficient electrical appliances.

Two fundamental properties of a superconductor:

- Zero resistance to electrical current.
- Diamagnetism

How rare is this?

• The problem is that superconductivity, ever since it was first discovered in 1911, has only been observed at very low temperatures, somewhere close to what is called absolute zero (0°K or -273.15°C). In recent years, scientists have

been able to find superconductive materials at temperatures that are higher than absolute zero but, in most cases, these temperatures are still below 100°C and the pressures required are extreme. Creating such extreme conditions of temperature and pressure is a difficult task.

- Therefore, the applications of superconducting materials have remained limited as of now.

Diamagnetism is a property opposite to normal magnetism that we are used to. A diamagnetic substance repels an external magnetic field, in sharp contrast to normal magnetism, or ferromagnetism, under which a substance is attracted by an external magnetic field.

2. SPACE ACTIVITIES BILL, 2017

The government is likely to introduce the Space Activities Bill which will allow commercial use of space.

Features of Space activities bill:

- It is a proposed Bill to promote and regulate the space activities of India.
- The new Bill encourages the participation of non-governmental/private sector agencies in space activities in India under the guidance and authorisation of the government through the Department of Space.
- The provisions of this Act shall apply to every citizen of India and to all sectors engaged in any space activity in India or outside India.
- A non-transferable licence shall be provided by the Central Government to any person carrying out commercial space activity.
- The Central Government will formulate the appropriate mechanism for licensing, eligibility criteria, and fees for licence.

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- The government will maintain a register of all space objects (any object launched or intended to be launched around the earth) and develop more space activity plans for the country.
- It will provide professional and technical support for commercial space activity and regulate the procedures for conduct and operation of space activity.
- It will ensure safety requirements and supervise the conduct of every space activity of India and investigate any incident or accident in connection with the operation of a space activity.
- It will share details about the pricing of products created by space activity and technology with any person or any agency in a prescribed manner.
- If any person undertakes any commercial space activity without authorisation they shall be punished with imprisonment up to 3 years or fined more than ₹1 crore or both.

Need for a legislation on outer space:

- There is a need for national space legislation for supporting the overall growth of the space activities in India. This would encourage enhanced participation of non-governmental/private sector agencies in space activities in India, in compliance with international treaty obligations, which is becoming very relevant today.

3. SPITZER TELESCOPE

Spitzer space telescope of NASA will be retired on January 30, 2020. Spitzer is going to shut down permanently after about 16 years of exploring the cosmos in infrared light. By 2020, Spitzer space telescope will have operated for more than 11 years beyond its prime mission.

Key achievements:

- Launched into solar orbit on August 25, 2003, Spitzer was initially scheduled for a minimum 2.5-year primary mission. But the space telescope has lasted far beyond its expected lifetime.

- Spitzer's discoveries extend from our own planetary backyard, to planets around other stars, to the far reaches of the universe. And by working in collaboration with NASA's other Great Observatories, Spitzer has helped scientists gain a more complete picture of many cosmic phenomena.
- Spitzer has logged over 106,000 hours of observation time in the past 15 years. It has illuminated some of the oldest galaxies in the universe, revealed a new ring around Saturn, and peered through shrouds of dust to study newborn stars and black holes.
- The space telescope also assisted in the discovery of planets beyond our solar system, including the detection of seven Earth-size planets orbiting the star TRAPPIST-1, among other accomplishments.

About Spitzer:

- NASA's Spitzer Space Telescope was launched in 2003 to study the universe in the infrared. It is the last mission of the NASA Great Observatories program, which saw four specialized telescopes (including the Hubble Space Telescope) launched between 1990 and 2003.
- The goal of the Great Observatories is to observe the universe in distinct wavelengths of light. Spitzer focuses on the infrared band, which normally represents heat radiation from objects. The other observatories looked at visible light (Hubble, still operational), gamma-rays (Compton Gamma-Ray Observatory, no longer operational) and X-rays (the Chandra X-Ray Observatory, still operational.)
- Spitzer's highly sensitive instruments allow scientists to peer into cosmic regions that are hidden from optical telescopes, including dusty stellar nurseries, the centers of galaxies, and newly forming planetary systems.
- Spitzer's infrared eyes also allows astronomers see cooler objects in space, like failed stars (brown dwarfs), extrasolar planets, giant

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molecular clouds, and organic molecules that may hold the secret to life on other planets.

4. ISRO'S PERMANENT SPACE STATION

- ISRO is planning to build a permanent space station for itself, possibly in the next five to seven years.

Need:

- ISRO would be undertaking many prolonged space exploration projects and sending many astronauts into space. Therefore, it would require a permanent station for itself.
- ISRO needs this facility in the context of its various space missions.
- NASA's International Space Station, the only one functional right now, is slated to retire by 2025, or latest by 2028, and no replacement for it has been confirmed so far.

The Indian Space Station:

- A space station is an artificial satellite placed in orbit and is used as a long-term base for manned operations in space.
- The Indian space station would be stationed at an altitude of 400 kilometres from Earth.
- The proposed Indian space station would be similar to the International Space Station (ISS) but smaller in size weighing about 20 tonnes and would take another 5 to 7 seven years to construct.

What Is the International Space Station?

- The International Space Station is a large spacecraft in orbit around Earth. It serves as a home where crews of astronauts and cosmonauts live. The space station is also a unique science laboratory. Several nations worked together to build and use the space station. The space station is made of parts that were assembled in space by astronauts. It orbits Earth at an average altitude of approximately 250 miles. It travels at 17,500 mph. This means it orbits Earth every 90 minutes. NASA is using the space station to learn more about living and working in space. These lessons

will make it possible to send humans farther into space than ever before.

How Old Is the Space Station?

- The first piece of the International Space Station was launched in November 1998. A Russian rocket launched the Russian Zarya (zar EE uh) control module. About two weeks later, the space shuttle Endeavour met Zarya in orbit. The space shuttle was carrying the U.S. Unity node. The crew attached the Unity node to Zarya.
- More pieces were added over the next two years before the station was ready for people to live there. The first crew arrived on November 2, 2000. People have lived on the space station ever since. More pieces have been added over time. NASA and its partners from around the world completed construction of the space station in 2011.

How Big Is the Space Station?

- The space station has the volume of a five-bedroom house or two Boeing 747 jetliners. It is able to support a crew of six people, plus visitors. On Earth, the space station would weigh almost a million pounds. Measured from the edges of its solar arrays, the station covers the area of a football field including the end zones. It includes laboratory modules from the United States, Russia, Japan and Europe.

Why Is the Space Station Important?

- The space station has made it possible for people to have an ongoing presence in space. Human beings have been living in space every day since the first crew arrived. The space station's laboratories allow crew members to do research that could not be done anywhere else. This scientific research benefits people on Earth.
- Space research is even used in everyday life. The results are products called "spinoffs." Scientists also study what happens to the body when people live in microgravity for a long time. NASA and its partners have learned how to keep

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a spacecraft working well. All of these lessons will be important for future space exploration.

- NASA currently is working on a plan to explore other worlds. The space station is one of the first steps. NASA will use lessons learned on the space station to prepare for human missions that reach farther into space than ever before.

Key facts:

- ISS is the ninth space station to be inhabited by crews, following the Soviet and later Russian Salyut, Almaz, and Mir stations as well as Skylab from the US.
- The ISS programme is a joint project among five participating space agencies: NASA, Roscosmos, JAXA, ESA, and CSA.
- The ownership and use of the space station is established by intergovernmental treaties and agreements. The station is divided into two sections, the Russian Orbital Segment (ROS) and the United States Orbital Segment (USOS), which is shared by many nations.

5. DATA LOCALIZATION

In clarification to its directive in April 2018 on 'Storage of payment system data', RBI announced that the payment system providers need to store entire payments data in a system only in India.

About RBI's data localization directive

RBI issued a directive in April 2018 advising all Payment System Operators (PSOs) to ensure that the entire data relating to payment systems is stored within databases located in India within 6 months.

- Directives are applicable to Payment System providers authorized by RBI under Payment and Settlement Systems Act, 2007. This includes many companies from payment gateways like MasterCard and Visa to e-wallets like PayTM.
- It includes end-to-end transaction details and information pertaining to payment or settlement transaction.

- There is no bar on overseas processing of strictly domestic transactions; however in such cases, the data should be deleted from the systems abroad and brought back to India not later than the one business day or 24 hours from payment processing, whichever is earlier.

- Data can be shared with the overseas regulator, if required, depending upon the nature/origin of transaction with prior approval of the RBI. Need for data localization

- Economic development of the country: Data is the new oil, an economic resource, fueling the 4th Industrial Revolution.

o Digital data in India to increase from 40,000 PetaByte (PB) in 2010 to 2.3 million PB by 2020 - twice as fast as the global rate. If India houses all this data, it will become 2nd largest investor in the data centre market and 5th largest data centre market by 2050. This will give significant push to AI led economy in India.

o India has 2nd highest FinTech adoption rate amongst major economies in the world. Data localization would give a push to domestic production of high value digital products.

o Domains of cloud computing, data analytics etc. can become major job creators in future.

o There is a push among government department to use AI tools and attempt a predictive approach to policy making. With data localization, there is a scope of greater access to 'public data' collected by companies (e.g. traffic data collected by like Uber, street level data collected by Google Maps) for the Government.

- Increase India's tax revenue: Extensive data collection & processing by technology companies, and unfettered control of user data has allowed them to freely monetize Indian users' data outside the country without paying any taxes.

o Localization would lead to a larger presence of MNC's in India overall, through local offices, and increase tax liability and open more jobs.

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o Data localization is supported by domestic companies like PayTM and PhonePe as it will level the playing field, currently rendered unequal due to differences in tax liabilities of international companies

and those having permanent establishment in India. E.g. Google India tax dispute over advertisement revenue under litigation in court.

- Maintain data sovereignty & citizens' data privacy: With data stored in remote servers, the accountability of service providers (like Google, Facebook etc.) reduces as it is outside the purview of Indian regulatory authorities. With data localization, regulatory oversight on end-use of data will improve and business jurisdiction related loopholes will be plugged. E.g. Facebook shared user data with Cambridge Analytica to influence voting.

- Issue of national security: Data localization will help law enforcement agencies to get access to user data for investigation and prosecution

- o Currently, companies are dependent on Mutual Legal Assistance Treaties (MLATs) to obtain data from US companies leading to delays and legal challenges in foreign jurisdictions.

- o In many countries like US, tech companies are legally barred from disclosing data to foreign law enforcement agencies.

Challenges associated with data localization

- Economic Costs:

- o Cross-border data flows have contributed \$2.8 trillion to the global economy in 2014, set to increase to \$11 trillion by 2025. Stringent localization norms could affect innovation & ease of doing business in India.

- o India's Information Technology Enabled Services (ITeS) and Business Process Outsourcing (BPO) industries (e.g. TCS/Wipro) thrive on cross border data flows and would incur significant additional costs if data localization is strictly implemented. This could be further a drag on India's IT industry which is already under pressure

due to emergent technologies like machine learning and artificial intelligence.

- Security Concerns:

- o Isolating payment systems from global data network would reduce their operational efficiency and make transactions prone to frauds, systemic risks or a single point of failure. Moreover, according to Symantec's Internet Security Threat Report 2017, India is 3rd most vulnerable country in terms of risk of cyber threats (e.g. malware, spam & ransomware etc.) due to inadequate cybersecurity infrastructure.

- Push to protectionism in global trade:

- o It hampers a globalized, competitive internet marketplace, where costs and speeds determine information flows, rather than nationalistic borders.

- o It might trigger a vicious cycle of data localization requirements by other countries

- Access issues will remain: Law enforcement require only "access to data" for their investigation and the physical location of server is immaterial.

- o Data localization norms may not increase accessibility of data kept in encrypted form (e.g. WhatsApp)

- Privacy concerns: There is no evidence that data localization leads to better privacy or security. Threat of state surveillance and misuse of personal data of citizens by the Government will remain.

Way Forward

- Before universalizing the policy of data localization, the Government needs to provide a push to local capabilities in data storage and processing
- o Infrastructure status to data centres/server farms

- o Adequate physical infrastructure (energy, real estate and internet connectivity) for setting up such centres

- India should put in place in a cybersecurity law to ensure protection of private data of citizens.

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- To promote ease of access of data to law enforcement agencies, the government should seek to enter into bilateral agreements.

- o Clarifying Lawful Overseas Use of Data (CLOUD) Act of US seeks to de-monopolize control over data from US authorities & allows tech companies to share it with foreign governments. India must upgrade its data protection regime to qualify for the benefits under CLOUD Act.

What is data localization?

- Data localization is a concept that the personal data of a country's residents should be processed and stored in that country. It may restrict flow entirely or allow for conditional data sharing or data mirroring (in which only a copy has to be stored in the country)

- There is a growing perception that data localization will aid countries asserting sovereignty in digital domain, ensure informational security of its citizens & fare better in governance (as it goes digital).

Other measures towards data localization

- In 2018, a draft data protection law by BN Shrikrishna Committee also recommended that all personal data of Indians have at least one copy in India. It also defined a category of data as critical personal data, which must be stored and processed only in India.

- A similar clause was incorporated in Government's draft e-commerce policy, which recommended localization for "community data generated by users in India from various sources including ecommerce platforms, social media, search engines etc."

Global Practices

- China/Russia: There are stringent data localization norms in China/Russia. In China, any cross border flow of personal data requires security assessment. Additionally, "Critical Information Infrastructure Operators" need to store certain personal and business information within China.

- US: Electronics Communications Privacy Act (ECPA) bars US-based service providers from disclosing electronic communications to any law enforcement entity unless requirements under US law are met.

- European Union: General Data Protection Regulation (GDPR) allows cross-border movement of data, but requires destination country to have stringent cybersecurity rules.

6. ELIMINATION OF TUBERCULOSIS

Recently, World Bank and the Government of India signed a loan agreement of \$400 million for the Program Towards Elimination of Tuberculosis.

More about the agreement

- This program will cover nine States and it will support the government's National Strategic Plan to end TB in India by 2025.

- It will provide financial incentives to private sector care providers for reporting cases of TB and ensuring that their patients complete the treatment regimen.

- It will also provide Direct Benefit Transfers to patients for acquiring the critical nutrition needed during treatment.
- It will strengthen the detection, treatment and monitoring of Drug-Resistant Tuberculosis and will track progress in the detection of additional drug resistance.

- The program will help the Government of India strengthen the monitoring and implementation of Nikshay—the government's web-based TB case monitoring system.

About Tuberculosis

- It is communicable disease (through air) caused by bacteria (*Mycobacterium tuberculosis*) that most often affect the lungs (pulmonary TB) and sometimes also affects other organs (extrapulmonary TB).

- TB is among India's most deadly infectious diseases, with an estimated 2.8 million confirmed cases in 2015, according to a World Health Organization (WHO) report.

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- India's TB burden is the highest in the world, followed by Indonesia and China.
- About a 1/3rd of the world's population is diagnosed with latent TB (without evidence of clinically manifested active TB), which means they have been infected by the TB bacteria from actively sick people without their knowledge.
- Drug Resistant TB:
 - o Multidrug Resistance TB (MDR): It is TB that does not respond to at least isoniazid and rifampicin (2 of the most powerful first line drugs).
 - o Extensively drug-resistant tuberculosis (XDR-TB): It is resistant to at least four of the core anti-TB drugs. It involves multidrug-resistance (MDR-TB), in addition to resistance to any of the fluoroquinolones (such as levofloxacin or moxifloxacin) and to at least one of the three injectable second-line drugs (amikacin, capreomycin or kanamycin).
 - o Totally drug-resistant tuberculosis (TDR-TB): TB which is resistant to all the first- and second-line TB drugs.

Why India leads in burden in TB?

- Poor medical infrastructure: Public-health facilities that specialise in TB in India are already overstressed and unregulated, with little political will to change the situation.
- Misuse of Drugs: Irrational use of first-line and second-line anti-TB drugs is the other problem with TB care in India. New strains of TB have developed resistance to the standard medicines.
- Unaware about disease and delayed diagnosis: A high proportion of missed and mistreated cases fuel India's TB epidemic. These cases are not notified to the public system and most remain either undiagnosed or inadequately diagnosed.
- Non accessibility of drugs: Indian patients have been fighting to get access to new anti-TB drugs such as bedaquiline and delamanid which has been only introduced in few centers.
- Less effective Treatment: In India, the regimen of antimicrobial drugs is often spread out over a

longer period of time than in other countries, making it harder for patients to see signs of progress. So some people simply stop taking their medication.

- Lack of awareness: The first line of defense against the spread of TB is raising awareness in communities which is severely hampered by lack of money.
- Linkage with air pollution: Several studies have concluded there is a possible link between air pollution and the risk of active tuberculosis. In India, the rise of TB infections has coincided with the dismal air quality index in many Indian cities.
- Other health related factors: Among the other major risk factors for TB, including alcohol, smoking, diabetes, HIV and undernourishment.

Way forward

- Improve health infrastructure and diagnosis: Improve public sector clinics and hospital and improving accessibility and drugs availability.
- Increase budget allocation: to execute the TB control program more aggressively and effectively.
- Effective use of medicine: Government need to quickly roll out daily fixed-dose regimen under directly observed treatment short course throughout the country and introduce new diagnostic technology and newer anti-TB drugs.
- Effective role of private sector: The huge private sector in the country, where at least 50% cases of TB report for their treatment, needs to be engaged rapidly and effectively.
- Improve detection: An effective surveillance and follow-up of all TB patients need to be ensured.
- Use of better drugs: Prioritise newer antibiotics like bedaquiline and oral drugs over injectables, which are less effective.
- Reduce poverty: Rural Employment Guarantee Scheme is a step in the right direction. Once the socioeconomic status improves, TB declines.

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• Social acceptance: There is also a need for an adequate social, emotional, and nutritional support to all TB patients.

Global Efforts for TB

• Moscow Declaration to End TB: It is the outcome of first global ministerial conference on ending TB, in 2017.

• WHO- End TB Strategy

o Vision: A world free of TB with zero deaths, disease and suffering due to TB.

o It has three high-level, overarching indicators and related targets for 2035:

✓ 95% reduction in number of TB deaths compared with 2015.

✓ 90% reduction in TB incidence rate compared with 2015.

✓ Zero the level of catastrophic costs for TB affected families.

7. FOOD FORTIFICATION

Department of Food and Public Distribution under the Ministry of Consumer Affairs recently approved a centrally sponsored pilot scheme on fortification of rice and its dispersal through Public Distribution System (PDS). • Financial assistance of up to 90 per cent in case of North-Eastern, Hilly and Island States and up to 75 per cent in case of rest of the States has been extended by GOI.

• Government of India has also advised all states and UTs especially those states and UTs, which are distributing wheat flour through PDS, to distribute fortified wheat flour through PDS.

What is food fortification?

• Food fortification is the deliberate addition of one or more micronutrients to food so as to correct or prevent a deficiency and provide a health benefit.

• These nutrients may or may not have been originally present in the food before processing.

• Food fortification is a “complementary strategy” and not a replacement of a balanced & diversified diet to address malnutrition.

• Food fortification:

o Can improve the health of a large section of the population, all at once since the nutrients are added to staple foods that are widely consumed.

o is safe method of improving nutrition among people as the quantity added is very small and well regulated as per prescribed standards.

o is a socio-culturally acceptable way to deliver nutrients to people as it does not require any changes in food habits and patterns of people and does not alter the characteristics of the food—the taste, the feel, the look. o is cost effective and delivers quick results. The Copenhagen Consensus estimates that every 1 Rupee spent on fortification results in 9 Rupees in benefits to the economy.

Challenges to food fortification

• Voluntary nature: Fortification continues to be voluntary rather than mandatory leading to limited efforts to fortify by state governments and private sector.

• Poor implementation by states: Although some states have adopted fortification in ICDS, MDMS and PDS, but due to lack of definitive policy guidelines, budgetary constraints, technical knowledge and logistic support, states have not adopted fortification in a holistic manner.

• Weaknesses of FSSAI: It lacks resources and manpower to effectively carry out its mandate.

• Lack of awareness: There is a lot of misinformation and ignorance about the usage and benefits of fortified food as of now.

Way forward

• Nationwide Implementation: Pan-India implementation of fortification via government schemes would amount to only an increment of 1 percent of the total budget allocated annually.

• Support to states: Merely issuing orders and notifications from Government of India will not

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suffice as state governments require hand-holding support and should be sensitised about the benefits fortification and must be enabled to procure fortified staples in various programs.

- **Ensure Standards:** Compliance with FSSAI standards w.r.t macronutrient content and quality must be strictly enforced.
- **Awareness:** A mass awareness campaign about food fortification is needed to scale up demand from consumers in the open market.
- **Promote food processing industry:** It will go a long way in improving the nutritional value of staple food.

Why the need for food fortification?

- Nearly 70% of people in India consume less than half of their recommended dietary allowance (RDA) of micronutrients. The deficiency of micronutrients is also known as "hidden hunger" and leads to various diseases like Night Blindness, Goitre, Anaemia and various birth defects.
- According to the National Family Health Survey (NFHS-4):
 - o 58.4 percent of children (6-59 months) are anaemic.
 - o 53.1 percent women in the reproductive age group are anaemic.
 - o 35.7 percent of children under 5 are underweight.
 - o Around 50-70% of these birth defects are preventable, caused due to deficiency of Folic Acid.

Food Safety and Standards (Fortification of Foods) Regulations, 2018.

- It has prescribed standards for fortification of various food products such as All fortified foods must not fall below the minimum level of micro-nutrients.
- **Quality assurance:**
 - o Every manufacturer and packer of fortified food shall give an undertaking on quality assurance
 - o random testing of fortificants and fortified food

- Every package of fortified food shall carry name of the fortificant and the logo to indicate. FSSAI has recently introduced +F logo for fortified staple food products.

- The Food Authority shall take steps to encourage the production, manufacture, distribution, sale, and consumption

8. PROTON THERAPY

Vice President of India inaugurated India's first proton therapy centre in Chennai for the treatment of Cancer.

- The name of the centre is Apollo Proton Cancer Centre (APCC) and is launched by Apollo Hospitals Group. It is South Asia's first such centre.
- With this India becomes 16th country in the world to offer the therapy.

About Proton Therapy

- It is a type of radiation therapy which uses protons rather than x-rays to treat cancer.
- It is considered as one of the most advanced forms of external beam radiation therapy for cancer treatment in the world. It is also known as Proton Beam Therapy and offers high levels of precision as compared to other treatment options.
- It is particularly effective for paediatric cancers and tumours affecting the brain, eye, colon, breast, gastrointestinal area, pelvis, and prostate and those close to the spinal cord, brain stem and other vital organs.

Advantages over standard radiation therapy

- Standard radiation therapy utilises x-rays, which deposits the majority of the radiation dose immediately upon entering the body. While X-ray beams are effective in controlling many cancers, they also deliver an 'exit dose' along the path beam. This exposes not just the targeted tumor to the radiation, but also the nearby healthy tissues.

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- This exit dose is a cause of concern as the damage to the normal tissue or organs can affect the patient's quality of life post-treatment.

- In comparison, protons slowly deposit their energy as they travel towards the cancerous tumor and then due to a unique physical characteristic called the Bragg Peak, deposit the majority of the radiation dose directly in the tumor.

o Bragg Curve describes energy loss of ionizing radiation during travel through matter.

- Proton beams target the tumour with sub-millimetre accuracy, leaving the nearby tissues and organs unharmed. Also there is no 'exit dose' in case of proton beam. Protons stop after depositing the radiation dose in the tumor.

Challenges with Proton Therapy

- Proton Therapy is highly specialised and expensive treatment.
- It is not applicable to all type of cancers.
- More research and clinical trials are needed to make this treatment more affordable and applicable to all types of cancers

Proton

- Atoms are the basic units of matter and the defining structure of elements. Atoms are made up of three particles: protons, neutrons and electrons
- The proton has a positive electrical charge, equal and opposite to that of the electron.
- The number of protons in an atom determines the chemical behaviour of the element.

9. OPTOELECTRONICS

Recently, researchers from IIT Madras have found a way of enhancing the optoelectronic properties of tungsten diselenide.

About Optoelectronics

- Optoelectronics is the study and application of electronic devices and systems that source, detect and control light.

- It is based on the quantum mechanical effects of light on electronic materials, especially semiconductors.

- It encompasses the design, manufacture and study of electronic hardware devices that, as a result, converts electricity into photon signals for various purposes such as medical equipment, telecommunications and general science.

- Some materials such as tungsten diselenide and molybdenum diselenide are being studied keenly for their optoelectronic properties.

- A key property of these materials is photoluminescence, in which the material absorbs light, generating an excited state, and then light of lower frequency is re-emitted.

Applications of Optoelectronics

- Solar Cells- that use Photovoltaic, which is the direct conversion of light into electricity.

- Laser Diodes- using stimulated emission are applied in compact disc (CD) players, laser printers, remotecontrol devices, and intrusion detection systems.

- Light Emitting Diodes- using electroluminescence, emits light when current flows through it.

- Optical Fiber- where data is transmitted in the form of light particles or photons that pulse through a fiber optic cable.

10. SHORT WAVE RADIO TRANSMISSION

Prasar Bharati has asked All India Radio (AIR) to come up with a proposal to phase out Short Wave (SW) transmitters.

Short Wave Radio transmission:

- It is transmission and reception of information by means of electromagnetic waves of about 10 to 100 m in length having frequencies of approximately 3 to 30 megahertz.

- Radio waves in the shortwave band can be reflected or refracted by the ionosphere.

Such wave propagation is called skywave or "skip" propagation.

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- This refraction by ionosphere makes shortwave useful for very long distance communication, sometimes even beyond continents.

- Dearth of revenue from short wave transmission and dwindling audience with advent of digital mediums has called for phasing out of SW transmitters.

- However, AIR is resisting the move arguing that it will limit its global reach as short wave is the only effective way to reach to any part of the world, FM and other modes don't work always. It cannot be easily blocked, even when states try to disrupt its signals using jamming transmitters. It is particularly useful in areas where information is censored or religious broadcasting is banned.

- Shortwave is still significant in much of Africa, South Asia and parts of Latin America.

Medium wave radio transmission

- It covers wavelength of 100 to 1000 metres and frequency of 0.3 to 3 MHz.

- There is very little daytime reflection of medium wave radio signal from the ionosphere resulting in a coverage of about 100 kms only.

- It is mostly used for local broadcasting, particularly rural communities.

Amplitude Modulation Radio

- With AM radio, the amplitude, or overall strength, of the signal is varied to incorporate the sound information.

- While changes in amplitude occur on FM radio as well, they are more noticeable in AM radio because they result in audible static.

- Its frequency lies between 500kHz–1.7MHz and wavelength is 600-170m.

Frequency Modulation

- Unlike AM radio, sound is transmitted through changes in frequency.

- Its frequency usually lies between 88-108 MHz and wavelength is between 3.4m-2.8m.

- It is used in community-based radio stations, over a limited geographical area since it has short-range signal - generally to anywhere within

sight of the transmitter, with excellent sound quality.

11. LUNAR EVACUATION SYSTEM (LESA)

Among preparations for NASA's 2024 Moon mission, one has been to test a device called Lunar Evacuation System Assembly, or LESA.

What is LESA?

- Developed by the European Space Agency (ESA), LESA is a pyramid-like structure whose purpose is to rescue an astronaut should he or she suffer an injury on the lunar surface.

How it works?

- LESA can be operated by a single astronaut to rescue a fallen colleague. It enables an astronaut to lift their crewmate onto a mobile stretcher in less than 10 minutes, before carrying them to the safety of a nearby pressurised lander.

12. METHANE ON MARS

NASA's Curiosity rover recently discovered high amounts of methane in the air on Mars, leading to excitement whether this was an indication of life on the Red Planet, or beneath its surface. However, later it was confirmed that the methane had fallen back to usual levels.

What caused this variation?

- High amounts of methane were a transient methane plume, which has been observed in the past. • Curiosity unfortunately doesn't have the instruments to determine whether the source of methane is biological or geological. Further, scientists have yet to figure out a pattern for Martian's transient plumes.

What is Methane?

- On Earth, methane (CH₄) is a naturally occurring gas. Most of the methane on Earth is produced in biological processes — some of it by microbes, and some occurring as underground natural gas that had been formed by earlier generations of microbial life.

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• Many of these methane-producing microbes live in the digestive systems of animals, especially cows.

• However, methane can also be produced by abiotic processes (those that do not involve living organisms).

• It has been found to occur in formations such as rocks, springs and aquifers, and studies have concluded that it was formed there by chemical reactions between carbon and hydrogen atoms at low temperature.

• Once it is released into the atmospheres of either Earth or Mars, methane is relatively short-lived.

• Methane concentrations on Earth is over 1,800 parts per million.

Significance of its discovery on Mars:

• Since the time the gas was first detected on Mars, it has been considered a potential biomarker.

• Scientists are hoping to detect the source of the gas, and in the process clues that might point to the existence of life on the Red Planet.

Way ahead:

• To determine where the plumes are located on Mars, scientists would need a clearer understanding of these plumes, combined with coordinated measurements from other missions.

NASA's Curiosity:

• Curiosity is a car-sized robotic rover exploring Gale Crater on Mars as part of NASA's Mars Science Laboratory mission (MSL).

• The rover's goals include: investigation of the Martian climate and geology; assessment of whether the selected field site inside Gale Crater has ever offered environmental conditions favorable for microbial life, including investigation of the role of water; and planetary habitability studies in preparation for future human exploration.

Elon Musk's SpaceX recently launched its Falcon Heavy spacecraft on its third mission, and the most complex one yet by the company. Among the various reasons which make the mission important, one is its huge payload — 24 satellites from various organisations, including government agencies.

Various payloads:

Deep Space Atomic Clock:

• Sent by NASA and collaborators.

• DSAC is expected to be stable to better than one microsecond per decade (one second per 10 million years), which would be about 50 times more accurate than atomic clocks already aboard GPS satellites.

• The technology targets aims at helping spacecraft navigate by themselves, relying on the new atomic clock in space.

ASCENT green fuel:

• It is a safer rocket fuel.

• Unlike the traditional fuel used in satellites, which is hydrazine, which is extremely toxic to humans as well as the environment, the new alternative called ASCENT (Advanced Spacecraft Energetic Non-toxic Propellant), formerly called AF-M315E, is a hydroxyl ammonium nitrate fuel/oxidiser blend.

• First developed by the US Air Force and now launched as part of a NASA-led collaboration, ASCENT is described as a fuel with significantly reduced toxicity levels compared to hydrazine, and potentially shorter launch processing times, resulting in lower costs.

Solar-powered sail:

• LightSail 2 is a crowd-funded solar sail project from the Planetary Society.

• It seeks to become the first orbiting spacecraft to be propelled solely by sunlight.

• In 2015, LightSail 1 spacecraft successfully completed a test flight.

13. FALCON HEAVY LAUNCH

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14. INTERNET CORPORATION FOR ASSIGNED NAMES AND NUMBERS (ICANN)

Internet Corporation for Assigned Names and Numbers (ICANN) and NASSCOM (National Association of Software and Services Companies) have announced collaboration for working in developing standards and identifier technology that will feed into the global consultation for managing Internet-of-Things (IoT) devices and infrastructure using internet.

What is the ICANN?

- The Internet Corporation of Assigned Names and Numbers (ICANN) is a non profit organization that was set up in 1998 to oversee the administration of domain names. ICANN coordinates and ensures the smooth and secure functioning of the cybernetic framework.

What it does?

- The global nature of the Web today means that there are constantly increasing numbers of Domain Names, Host Names, IP addresses and web sites that are emerging on a daily basis. ICANN oversees this interconnected network and ensures that computers across the internet can find one another through defined unique pathways and identifiers.

ICANN performs four major functions namely:

- Approval of companies that can become accredited registrars for domain names.
- Decision making regarding the addition of new Top Level Domains (TLDs) to the Root system.
- Coordinating technical parameters to maintain universal connectivity.
- Creating a Uniform Domain Name Dispute Resolution Policy (UDRP) for competing domain names.

15. NAMMA KOLHAPURI CHAPPAL GETS GI BOOST

Namma Kolhapuri chappal gets GI boost.

- The approval for GI tag was jointly received by Karnataka and Maharashtra recently for making these chappals. There is a perception that these artisans are from Maharashtra alone, but a large number of them are from Karnataka, and have been making these chappals for centuries.

- These leather chappals are hand-crafted and tanned using vegetable dyes. The art of making them is passed down one generation to another.

About GI tag:

• What is it?

A GI is primarily an agricultural, natural or a manufactured product (handicrafts and industrial goods) originating from a definite geographical territory.

- Significance of a GI tag: Typically, such a name conveys an assurance of quality and distinctiveness, which is essentially attributable to the place of its origin.

- Security: Once the GI protection is granted, no other producer can misuse the name to market similar products. It also provides comfort to customers about the authenticity of that product.

- Provisions in this regard: GI is covered as element of intellectual property rights (IPRs) under Paris Convention for Protection of Industrial Property.

- At international level, GI is governed by WTO's Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). In India, Geographical Indications of Goods (Registration and Protection Act), 1999 governs it.

Registrar of Geographical Indications:

- The Controller-General of Patents, Designs and Trade Marks appointed under sub-section (1) of section 3 of the Trade Marks Act, 1999, shall be the Registrar of Geographical Indications.

- The Central Government may appoint such officers with such designations as it thinks fit for the purpose of discharging, under the superintendence and direction of the Registrar, such functions of the Registrar under this Act, as

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