

TARGETING

TNPSC

GROUP-II

2023

19th TEST

Marks : 300

Time : 3 Hrs



QUESTION
WITH
SIMPLIFIED
ANSWER

English
Medium

MAINS WRITTEN EXAM

SCIENCE & TECH
FULL TEST



SURESH'
IAS ACADEMY

THOOTHUKUDI

0461 - 4000970
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TEST

19

வெற்றி ஒன்றே
இலக்கு

Answer Key - English

Unit - 1

1) Write a short notes on Formation of Black holes? 4

Formation of Black hole

- A black hole can be formed by the death of a massive star.
- When such a star has exhausted the internal thermonuclear fuels in its core at the end of its life, the core becomes unstable and gravitationally collapses inward upon itself, and the star's outer layers are blown away.
- The crushing weight of constituent matter falling in from all sides compresses the dying star to a point of zero volume and infinite density called the singularity.
- **Radius of Black hole:**
- For a black hole with a mass 10 times as great as that of the Sun, the radius would be 30 km (18.6 miles)
- Black hole is also known as "the gentle giant at the centre of our Galaxy".

Types of Black holes

1. Stellar
2. Intermediate
3. Supermassive
4. Miniature

Latest observations

- **2019** : The scientists at the event horizon Telescope project released the first – ever image of a black hole.
- **2021** : The indian astronomers of ARIES institute reported one of the strongest flares from a blazer called BL Lacertae from 10 million light years away.
- **August 2021**: Indian scientists have discovered the merger of three super massive black holes from as many galaxies to form a triple Active Galactic nucleus.
- **2022** : Scientists from the **Event Horizon Telescope (EHT)** facility, revealed the first image of the black hole named **Sagittarius A*** at the centre of our galaxy - the Milky Way.

2) a) Define cDNA Library? 3

b) What is Bubble Boy Syndrome?

a) Define cDNA library:

- A cDNA library is a collection of cloned DNA sequences that are complementary to the

mRNA that was extracted from an organism or tissue ("c" stands for "complementary")

- **cDNA** – It is a DNA copy of an mRNA molecule generated by reverse transcriptase a DNA polymerase that can use either RNA or DNA as their template.
- These are prepared using mRNA as templates, their starting material.
- They are representative of only those genes of the genome that are expressed given specific conditions.
- cDNA does not have introns, and hence can be expressed in prokaryotic cells.
- The size of the cDNA library smaller compared to genomic DNA library.
- **Uses:** Scientists often synthesize and use cDNA as a tool in gene cloning and other research experiments

b) Bubble Boy Syndrome: 3

- Bubble boy disease, also known as severe combined immunodeficiency syndrome (SCID) is caused by genetic flow that keeps the bone Marrow from making effective version of blood cells that comprise an immune system.
- **Treatment:** A bone marrow transplant from a genetically matched sibling can cure SCID, but most people lack a suitable donor. Transplants are risky too.
- Gene therapy could be a solution. It involves removing some of a patients blood cells, using the modified HIV to insert the missing gene, and returning cells to me body.
- **Recent Study:** recent study published in the New England Journal of Medicine, U.S. scientists used 'HIV' in making a gene therapy that cured eight infants of "bubble boy" disease.

3) What is Alloys? List out its advantages? 3

- It is a homogenous mixture of two or more metals, or a metal and a non-metal.
- **Example:** Brass is an alloy formed by mixing of two metals, copper and zinc.
- In order to impart certain properties to metals, or in order to strengthen some of their. Existing properties, certain other metals /

elements can be added to the metals in specific ratios to form alloys.

Advantages of Alloys **3**

1. Increases Corrosion resistance
2. Better solderability
3. Durable parts

4. Metal alloys have greater versatility than pure metals

5. Lighter weight for the strength
6. Aids in metal casting
7. Thermal conductivity
8. Electrical conductivity

- 4) a) How is steel different from Iron? Any four points
 b) Name two advantages of converting iron into steel?
 a) How is steel different from Iron? Any four points.

Iron	Steel	3
Iron is a pure element	Steel is an alloy where iron is the main component (Iron and Carbon, Nickel, Chromium)	
Iron occurs naturally on Earth	Steel is a Man-made alloy formed by mixing iron & carbon together	
Pig Iron contains carbon content more than 2 percent	Steel contains carbon content less than 2 percent	
Iron is easier to cast than steel due to its lower point.	More carbon can result in a higher casting melting temperature which makes it more expensive to cast.	
Iron gets oxidized easily to form rust	The alloying elements in steel protect it from getting rusted	
Iron is not as strong as steel and is less brittle	The addition of carbon to steel makes it stronger than iron	

b) Name two advantages of converting iron into steel? **3**

1. Much of the iron produced is redefined and converted into steel.
2. Steel is stronger than iron
3. More Corrosion resistance
4. Improved metallurgical properties

Applications **1**

1. These reactions are now used globally to explore cells and track biological processes.
2. Using bioorthogonal reactions, researchers have improved the targeting of cancer pharmaceuticals, which are now being tested in clinical trials.

- 5) Name the laureates and explain their achievements who get Nobel prize in chemistry 2022? **1**

- The Nobel Prize in Chemistry 2022 was awarded to carolyn R.Bertozzi, morten meldal, K.Barey sharpless for the development of click chemistry and bioorthogonal chemistry.

Click chemistry **2**

- The click chemistry is a functional form of chemistry, where reactions occur quickly and the unwanted by products are avoided.
- In click chemistry, molecules building blocks snap together quickly and efficiently.

Bio orthogonal chemistry **2**

- Carolyn Bertozzi has taken click chemistry to a new dimension and started utilising it in living organism.
- Developed click reactions that work inside living organisms, in order to map an elusive biomolecule on the surface of cells – glycans
- Bioorthogonal reactions take place without disrupting the normal chemistry of the cell.

- 6) Which is called as 3F Hormone? List out its functions. **2**

3F **2**

- Epinephrine is called 3F hormone and adrenal gland that produces this hormone is called 3F gland.

Functions **4**

1. Acceleration of metabolism
2. Increase in blood sugar levels.
3. Activation of RAS system, thus lead to arousal, anxiety and coarse tremors of extremities.
4. Increase blood supply to muscle
5. Dilation of pupil and relaxation of ciliary muscles.
6. Increase plasma protein concentration by movement of fluid out of circulation
7. Increases RBC count by contraction of spleen.

- 7) What is meant by Tumor immunology? **3**

- Tumor immunology has been defined as part of immunology that deals with the antigens on tumor cells and the immune response.
- Tumors or neoplasia is said to develop when the balance between cell death and renewal

is disturbed in a way that numerous clones of a single cell group are produced in an uncontrolled fashion.

Tumor antigens **3**

- Tumor cell also express unique molecules that can be classified into two groups
- I. Tumor specific antigens
- II. Tumor associated transplantation antigens.
- Tumor antigens are capable of eliciting a comprehensive immune response involving both the cellular and humoral immune responses.

8) Explain the use of physics in medical diagnosis and therapy? **2**

- Medical physics is the application of physics principles medicine or health care.
- It's basically a way of using our physics knowledge to develop tools and treatments that help human live longer and be healthier.

Physics in medical diagnosis **1.5**

- Diagnostic radiology involves the use of special equipment that utilizes principle of physics to form images of Internal body structure and tissues, and these images are then used to help diagnose specific medical conditions.
- **Ex:** X-ra, ultrasound, magnetic resonance imaging, computed tomography scans.

Nuclear medicine **1.5**

- Involves the administration of radiative substances into the body to allow health care professionals to see how the body is functioning at a cellular level.
- Using particle accelerators to defeat cancer.
- Better detection of Breast cancer
- Matter / Antimatter collision imaging
- Ensuring the safety of people who get CT scans

Radiotherapy **1**

- Radiation therapy involves the delivery of ionizing radiation inside the body to destroy and eliminate cancer cells.
- For deep-seated tumors, high-energy photons are used.
- For superficial tumors, high-energy electrons are used.

9) State that why Union Information Technology minister announce the withdrawal of the Personal Data Protection Bill - 2019 **2.5**

- The data protection Bill 2021, has been withdrawn from the Lok Sabha by Union Minister of Communications & Ministry of electronics and information technology after 4 years of deliberation.

- The Government aims to replace the personal data protection Bill with a comprehensive legal framework intended to tackle all the current and future challenges of the digital ecosystem.
- It will encompass a new telecom law, Information Technology law and user privacy law.
- The new bill will uphold the fundamental principles of the right to privacy and the IT Act of 2000 will also be revised.

Reason for withdrawal **2.5**

- The bill was referred to the JCP, which after through investigation, recommended 99 amendments in a Bill of 99 sections with 12 suggestions.
- As a result, the Govt had to withdraw the previous Bill and propose a new one.
- The JCP's report on the personal data protection Bill listed a number of concerns that were important but fell outside the purview of a modern digital privacy law.

Data protection Bill 2019 **1**

- It set the rules for how personal data should be processed and stored, and lists people's rights with respect to their personal information.
- The bill sought to establish a Data protection Authority in the country for the protection of digital privacy of individuals.

10) What is E20? Mention the benefits of E20.**E20** **3**

- E20 means blending of 20% of ethanol and gasoline
- Ethanol is a biofuel and a common by product of biomass left by agricultural feed stock such as corn, sugarcane, hemp, potato etc.
- It is produced mainly from molasses, a by product of sugar manufacture.
- Ethanol is basically alcohol of 99% plus purity, which can be used for blending with petrol.

Benefits of E20 **2**

1. Facilitates the development of E20 compliant vehicles.
2. Adoption of E20 fuel will be instrumental in cutting down vehicular emissions.
3. It will help in reducing emissions of CO₂, hydrocarbons etc.
4. It will also help in cutting down the country's oil import Bill, thereby saving foreign exchange and boosting energy security.

5. It would extend support to the agricultural sector as well as provide additional income to farmers.

Target to be achieved in this regard 1

- The country aims now to reach 10% Ethanol blending target by 2022 and 20% by 2025.
- at the inaugural ceremony of South Asian Geoscience Conference 'Geo India 2022', the minister said that the ethanol-blend percentage in petrol has increased from 0.67

per cent in 2013 to 10 per cent in May 2022, five months ahead of schedule

11) List out the Advantages and disadvantages of social media. 6

- Social media have greatly influenced people and the entire world.
- We are so reliant on technology and social media that we can't envisage a world without them.

Advantages	Disadvantages
A place for Noble causes and practices	Cyberbullying
Use of social media for promotion and advertising	Hacking on social media
People can connect through social media	Reduces face to face communicationskills.
Good source of up to date information	Fake news
Social media is beneficial Education	People's Addiction to social media.
Assists in the formation of people's communities	Spending time on social media is a waste of time.
Social media can Reach large Audiences	Social media causes sleep issues.
Government Benefits from social media	Social media cause depression and loneliness.
Entertainment with social media	Social media cause distraction.

12) What are the new Ramsar sites in India? 6

- India has added 11 more Ramsar sites that are of international importance taking the number of such sites to 75.
- A Ramsar site is a wetland of International importance under the Ramsar convention which is also known as the convention on wetlands.

Name	States	Specification
Tampara lake	Odisha	If among the most prominent freshwater lakes in odisha. Important habitat of vulnerable species (common pochard, river term)
Hirakud reservoir	Odisha	Provide's important hydrological services It is the largest earthen dam in Odisha.
Ansupa lake	Odisha	The wetland is an oxbow lake formed by River mahanadi Provide's safe habitat to threatened bird species.
Yashwant sagar	Madhya Praadesh	It is one of the two important bird areas in the indore region. The wetland is considered heaven to a large number of winter migratory birds.
Chitrangudi Bird Sanctuary	Tamilnadu	The wetland has been a protected area since 1989 and declared as Bird sanctuary, coming under the Jurisdiction of Tamilnadu forest department.
Suchindram Theroor wetland complex	Tamilnadu	It is part of the suchindrum – Theroor Manakudi conservation Reserve It is declared an Important Bird Area and lies at the southern tip of the central Asian flyway of migratory birds.

Vaduvur Bird Sanctuary	Tamilnadu	It is a large human made irrigation tank and shelter for migratory birds as it provides a suitable environment for food, shelter, and breeding ground.
Kanjirankulam Bird Sanctuary	Tamilnadu	It is notable as a nesting site for several migratory heron species that roost in the prominent growth of babul trees. The wetland exhibits rich biodiversity including many globally near threatened species.
Thane creek	Maharashtra	Tane creek is flinged by mangroves on both tanks & comprises around 20% of the total indian mangrove species.
Hygam wetland conservation Reserve	Jammu & Kashmir	It serves as an abode to many residents and migratory species. It is also recognized as an important bird area.
Shallbugh wetland conservation reserve	Jammy & Kashmir	It serves as an abode to more than four lakh resident and migratory birds of at least 21 species.

13) What are all the challenges faced by DRDO? 1

- DRDO is the R&D wing of the ministry of defence with a vision to empower India with cutting edge defence technologies.

Challenges 5

1. Inadequate Budgetary support

- The standing cimmittee on defence noted that out of the total defence budget, the share of DRDO was 5.79% in 2011 -12, which reduced to 5 – 31% in 2013 – 14.

2. Inadequate manpower

- The DRDO also suffers from inadequate manpower in critical areas to the lack of proper synergy with the armed forces.
- Big on promise and small on delivery
- In 2011 CAG put asevious question mark on DRDO's capabilities, citing the organisation has a history of its project suffering endemictime and cost overruns.

3. Obsolete equipments

- DRDO is just tinkering with world was II equipment instead of working on cutting – edge technology.
- Innovation
- Private sector participation.

4. Less Accountability

- In 2011, the Comptroller and Auditor General (CAG) put a serious question mark on DRDO's capabilities, citing the organisation has a history of its projects suffering endemic time and cost overruns.

14) State the initiatives, in Agriculture by ICAR? 6

1. Farmers innovation fund: 6

- ICAR is all set to start a system to scientifically validate, scale up and propagate the innovationsof progressive farmers.

2. The system intends to links farmers and farming with science and encourage farmers to continue their innovations.

3. Organic farming:

- ICAR has developed 45 different organic farming models suitable for different agro – climatic system to help increase farm income.

4. Nano fertilisers and nanopesticides:

- ICAR is developing nano fertilizers and nano pesticides to promote organic farming and to reduce the use of pesticides and fertilizers.

5. Attracting and retaining youth in agriculture. (Arya) :

- A programme named Arya is also being implemented to improve rural bio-economy to attract youth to agriculture.

6. Farmers science congress:

- It was inagurated in 2020 for the first time in the 107 years of history of indian science congress highlighting the importance of farmer's innovations and their scientific validity.

7. mKisan Portal

- 90 lakh farmers are being provided advisory by the KVKs

8. Automatic Weather Station (AWS):

- AWS established at 121 KVKs under National Innovations in Climate Resilient Agriculture (NICRA) Project and 100 being established with support from India Meteorological Department

15) Differentiate – Thermoplastic and thermosetting plastic. 6

Thermo plastic	Thermosetting plastic
Thermoplastic can be synthesized by the process called addition polymerization.	Thermosetting plastics are synthesized by condensation polymerization.
Thermoplastic is processed by injection moulding Extrusion process, blow moulding thermoforming process and rotational moulding.	Thermosetting plastic is processed by compression moulding, reaction injection moulding.
Thermoplastics have secondary bonds between molecules chains.	Thermosetting plastics have primary bonds between molecules chains and held together by strong cross links
Thermoplastics have low melting points and low tensile strength.	Thermosetting plastics have high melting points and tensile strength.
Thermoplastic is lower in molecular weight, compared to thermosetting plastic.	Thermosetting plastic is high in molecular weight.

16) What are the hazards and effect of tobacco and prevention methods?

Hazards and effects of Tobacco

4

- Nicotine** : narrows your veins and arteries. This can damage your heart by forcing it to work faster and harder ,slow your blood and reduce oxygen to your feet and hands.
- Carbon monoxide** deprives your heart of the oxygen it needs to pump blood around your body. Over time, your airways swell up and let less air into your lungs.
- Tar** is a sticky substance that coats your lungs like soot in a chimney.
- Phenols** paralyse and kill the hair-like cells in your airways. These cells sweep clean the lining of your airways and protect them against infections.
- Tiny particles in tobacco smoke** irritate your throat and lungs and cause 'smoker's cough'. This makes you produce more mucus and damages lung tissue.
- Ammonia and formaldehyde** irritate your eyes, nose and throat.
- Cancer**-causing chemicals make your cells grow too fast or abnormally. This can result in cancer cells

Preventions

2

- policy-level measures, such as increased taxation of tobacco products; stricter laws (and enforcement of laws) regulating who can purchase tobacco products;
- smoke-free policies in restaurants, bars, and other public places)
- Large, graphic warnings on tobacco packages
- A ban on tobacco marketing5.Prevention of tobacco industry interference.

17) Convert the following hexadecimal numbers to decimal numbers

a) $B6_{16}$

b) $CAFE_{16}$

c) $5E9_{16}$

a) $B6_{16}$

2

$$B6_{16} = B \times 16^1 + 6 \times 16^0$$

$$= 11 \times 16 + 6$$

$$= 176 + 6$$

$$= (182)_{10}$$

b) $5E9_{16}$

2

$$5E9_{16} = 5 \times 16^2 + E \times 16^1 + 9 \times 16^0$$

$$= 5 \times 256 + 14 \times 16 + 9$$

$$= 5 \times 256 + 14 \times 16 + 9$$

$$= 1280 + 224 + 9$$

$$= (1513)_{10}$$

c) $CAFE_{16}$

2

$$CAFE_{16} = c \times 16^3 + A \times 16^2 + F \times 16^1 + E \times 16^0$$

$$= 12 \times 4096 + 10 \times 256 + 15 \times 16 + 14$$

$$= 49152 + 2560 + 240 + 14$$

$$= (51966)_{10}$$

18) A jet - propelled aircraft can work only in atmospheric region.Why?

Principle behind the Reason

Newton's 3rd law

6

- In any Jet propelled aircraft, the main working theory is the 3rd law of the newton, 'Every reaction has a same amount of opposite reaction'.
- The Jet engine produces a thrust like force which is repelled by the atmospheric pressure, according to the Newton's third law.
- But in the non atmospheric pressure there will be no atmospheric pressure that will repel the thrust force.
- That's why the Jet planes only work in atmosphere.

Unit - 2

1) Explain about NISAR MISSION 2

- The name NISAR is short for NASA-ISRO-SAR.
- SAR here refers to the synthetic aperture radar that NASA will use to measure changes in the surface of the Earth.
- The NISAR mission is scheduled for launch in 2023.
- ISRO has already delivered the S-band SAR payload to NASA for NISAR [NASA-ISRO SAR] mission.

SAR(Synthetic Aperture Radar) 2

- It refers to a technique for producing high-resolution images.
- Because of the precision, the radar can penetrate clouds and darkness, which means that it can collect data day and night in any weather.

Primary Goals 2

- Tracking subtle changes in the Earth's surface,
- Spotting warning signs of imminent volcanic eruptions,
- Helping to monitor groundwater supplies, and-Tracking the rate at which ice sheets are melting.

Functions of NISAR 5

1. It will scan the globe every 12 days over the course of its three-year mission of imaging the Earth's land, ice sheets and sea ice to give an unprecedented view of the planet.
2. It will detect movements of the planet's surface as small as 0.4 inches over areas about half the size of a tennis court.
3. NISAR's data can help people worldwide better manage natural resources and hazards, as well as providing information for scientists to better understand the effects and pace of climate change.
4. The images will be detailed enough to show local changes and broad enough to measure regional trends.
5. As the mission continues for years, the data will allow for better understanding of the causes and consequences of land surface changes.
6. It will also add to our understanding of our planet's hard outer layer, called its crust.

Conclusion 1

- This mission will prove to be a boon for both ISRO and NASA in terms of their space mission and a boon to humanity and livelihood as the SAR will be able to notify any hazardous

disturbance in the Earth's surface days prior to a disaster or calamity.

2) What is CSIR? Explain about it's role in development of India's research in various fields? High in Covid – 19 pandemic? 1

- CSIR is the largest research and development (R&D) organisation in India.
- CSIR has a pan-India presence and has a dynamic network of 37 national laboratories, 39 outreach centres, 3 Innovation Complexes and 5 units.
- Established: September 1942
- Headquarters: New Delhi-CSIR is funded by the Ministry of Science and Technology and it operates as an autonomous body through the Societies Registration Act, 1860.

Role of CSIR in development of India's research in various fields 9

1. Strategic Sector

- **Drishti Transmissometer:** It is an Indigenous - Innovative – Cost-effective visibility measuring system that provides information to pilots on visibility for safe landing & take-off operations and is suitable for all airport categories.
- **Head-Up-Display (HUD):** CSIR-National Aerospace Laboratories (NAL) made a significant contribution by developing indigenous Head-Up- display(HUD) for Indian Light Combat Aircraft, Tejas.
- **Indigenous Gyrotron:** Design and development of indigenous gyrotron for nuclear fusion reactor have been accomplished. A gyrotron is a vacuum electronic device (VED) capable to generate high-power, high-frequency THz radiation.

2. Energy & Environment Sector:

- **Solar Tree:** It designed by CSIR- The Central Mechanical Engineering Research Institute (CMERI) lab in Durgapur. It occupies minimum space to produce clean power.
- **Lithium-Ion Battery:** The Central Electro chemical Research Institute (CECRI), Karaikudi in Tamil Nadu, has set up the first indigenous Li-ion fabrication facility that has applications in defence, solar-powered devices, railways and other high-end usages.

3. Agriculture Sector:

- **Medicinal and Aromatic Plants:** Enhanced cultivation of medicinal and aromatic plants in the country brought through the development of new varieties and agro-technologies.

- **Samba Mahsuri Rice Variety:** CSIR in collaboration with ICAR developed an improved bacterial blight resistant Samba Mahsuri variety.
- **Rice Cultivar (Muktashree) for Arsenic Contaminated Areas:** A rice variety has been developed which restricts assimilation of Arsenic within the permissible limit.
- **White-fly resistant Cotton variety:** Developed a transgenic cotton line which is resistant to whiteflies.

4. Healthcare:

- **JD Vaccine for Farm Animals:** Vaccine developed and commercialized for Johne's disease (JD) affecting Sheep, Goat, Cow and Buffalo so as to immunize them and increase milk & meat production.
- **Plasma Gelsolin Diagnostic Kit for Premature Births, and Sepsis-related Deaths:** It is developed to diagnose premature birth and sepsis.
- **GOMED:** A programme called GOMED (Genomics and other omics technologies for Enabling Medical Decision) has been developed by the CSIR which provides a platform of disease genomics to solve clinical problems.

5. Food & Nutrition Sector:

- **Ksheer-scanner:** It is a new technological invention by CSIR-Central Electronics Engineering Research Institute (CEERI) to detect the level of milk adulteration and adulterants in 45 seconds at the cost of 10 paise, thereby putting adulterators in the milk trade in notice.
- **Double-Fortified Salt:** Salt fortified with iodine and iron having improved properties developed and tested for addressing anaemia in people.
- **Anti-obesity DAG Oil:** Oil enriched with Diacylglycerol (DAG) instead of conventional triacylglycerol (TAG) developed.

6. Water:

- **Aquifer Mapping of Water Scarce Areas:** Heliborne transient electromagnetic and surface magnetic technique based aquifer mapping carried out in six different geological locations in Rajasthan (2), Bihar, Karnataka, Maharashtra and Tamil Nadu.
- **Understanding the Special Properties of the Ganga Water:** An assessment of water quality & sediment analysis of Ganga from different parts being done.

7. Waste to Wealth:

- **Non-toxic Radiation Shielding Material for X-ray Protection:** Non-toxic radiation shielding materials utilizing industrial waste like red mud (from aluminium industries) and fly ash (Thermal Power Plants) developed which has been accredited by Atomic Energy Regulatory Board (AERB) for application in diagnostic X-Ray rooms.
- **Waste Plastic to Fuel:** Process for conversion of waste plastics to gasoline/diesel or aromatics developed.

8. The Indelible Mark:

- The Indelible ink used to mark the fingernail of a voter during elections is a time-tested gift of CSIR to the spirit of democracy.
- Developed in 1952, it was first produced in-campus.

9. Skill development:

- CSIR is building a structured large scale Skill development Initiative using the state of the art infrastructure and human resources of CSIR.
- About 30 High Tech Skill/Training programmes are being launched for imparting skills to over 5000 candidates annually.

10. Aviation:

- The CSIR-National Aerospace Laboratories has designed a plane 'SARAS'.

11. Traditional Knowledge Digital Library:

- CSIR has established the first-ever 'Traditional Knowledge Digital Library' in the world. It is accessible in five international languages (English, German, French, Japanese and Spanish).
- CSIR successfully challenged the grant of patent in the USA for use of Haldi (turmeric) for wound healing and neem as an insecticide on the basis of traditional knowledge.

12. Genome sequencing

- CSIR has completed the sequencing of the Human Genome in 2009.

CSIR Role during Covid 19 Pandemic

2

1. The development of technologies against Sars-CoV-2, within a short time period
2. the immunotherapeutic drug, sepsivac has successfully completed Phase-2 trials on critically ill Covid-19 patients, and is now entering Phase-3 trials
3. Biosensor Development for COVID-19 Diagnosis
4. Bacteriophage recombination- and CRISPER-based combined array system and SARS-

CoV2-Spike protein-based serological assay to detect COVID-19 infection

5. Setting up of anti-Covid19 screening cell culture platform
6. Design, Development, Certification and Commercialization of BiPAP – Non Invasive Ventilator for COVID-19
7. Design and development of antimicrobial coated 3d printable face shield to protect from covid-19
8. Respiration Assistance Intervention Device: A Portable Ventilator (Respi-AID)

3) How do you reduce energy consumption by Green chemistry?

Green Chemistry

1

- Green chemistry aims to minimize the environmental impact of the chemical industry.
- This includes shifting away from oil to renewable sources where possible.
- It is defined as an area of chemistry focused on designing products and processes that eliminate or minimize the use and generation of hazardous substances.
- It provides a unique forum for the development of alternative green and sustainable technologies.

Green Chemistry as an alternative tool to reduce Energy Consumption

10

1. **Energy efficiency:** The amount of energy consumed by the process must be minimized to the maximum possible extent.
2. **Incorporation of renewable feedstock:** The use of renewable feedstock and renewable raw materials must be preferred over the use of non-renewable ones
3. **Avoiding the generation of hazardous chemicals:** Reactions and processes that involve the synthesis of certain toxic substances that pose hazards to human health must be optimised in order to prevent the generation of such substances.
4. **Cleaner air:** Less release of hazardous chemicals to air leading to less damage to lungs
5. **Cleaner water:** less release of hazardous chemical wastes to water leading to cleaner drinking and recreational water
6. **Increased safety for workers in the chemical industry:** less use of toxic materials; personal protective equipment required; less potential for accidents (e.g., fires or explosions)

7. **Safer consumer products of all types:** new, safer products will become available for purchase; some products (e.g., drugs) will be made with less waste; some products (i.e., pesticides, cleaning products) will be replacements for less safe products

8. **Safer food:** elimination of persistent toxic chemicals that can enter the food chain; safer pesticides that are toxic only to specific pests and degrade rapidly after use

9. **Reduce usage of fossil fuels:** Reduced use of petroleum products, slowing their depletion and avoiding their hazards and price fluctuations

10. **Less exposure to such toxic chemicals as endocrine disruptors :** Higher yields for chemical reactions, consuming smaller amounts of feedstock to obtain the same amount of product

11. **Fewer synthetic steps:** often allows faster manufacturing of products, increasing plant capacity, and saving energy and water

12. Reduced waste, eliminating costly remediation, hazardous waste disposal, and end-of-the-pipe treatments

13. Lower potential for global warming, ozone depletion, and smog formation

14. **Environment friendly:** Less chemical disruption of ecosystems.

Conclusion

1

- If the process operates at ambient temperature and pressure, it will use less energy.
- It will also reduce the chances of accidental discharge of your product or any manufacturing process components.
- Less energy requirement means less depletion of energy resources, and if the energy required all come from renewable sources, it would massively improve sustainability.

4) Write a short notes on oxidizing agents and reducing agent? Explain oxidation reactions in Everyday life.

Oxidizing agent

1

- An oxidizing agent (often referred to as an oxidizer or an oxidant) is a chemical species that tends to oxidize other substances, i.e. cause an increase in the oxidation state of the substance by making it lose electrons.
- It is also known as electron acceptor

Common examples of oxidizing agents:

1

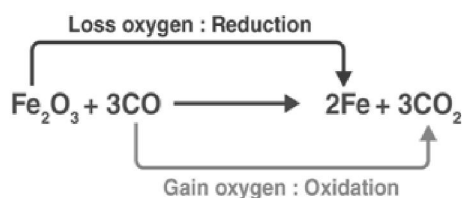
- It includes halogens (such as chlorine and fluorine), oxygen, and hydrogen peroxide (H_2O_2).

Reducing Agent 1

- A substance which loses electrons to other substances in a redox reaction and gets oxidised to a higher valency state is called a reducing agent. It is known as electron donor.

Common Examples: 1

- Earth metals, formic acid, and sulfite compounds.
- $H_2(g) + F_2(g) \rightarrow 2HF(g)$
- Hydrogen acts as a reducing agent because it donates its electrons to fluorine, which allows fluorine to be reduced.



Oxidation reactions in Everyday life

Combustion Reactions 2

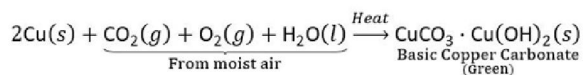
- Combustion is just oxidation combined with energy release- Kerosene, coal, charcoal, wood, etc., burn in the air and undergo combustion.
- Methane, a major constituent of natural gas, undergoes combustion in excess of oxygen upon heating. $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
- Combustion with oxygen to produce carbon dioxide and water.
- For example: $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{energy}$

Corrosion 1

- Corrosion is a slow process in which the surfaces of metallic objects are coated with oxides, hydroxide, carbonate, or sulphide of metal.
- This leads to the destruction of metal by chemical or electrochemical reactions with the environment.

Corrosion of /copper: 1

- Copper articles develop a coating of green-coloured copper carbonate when they are exposed to a humid atmosphere.



Corrosion of Iron 1

- The most common form of corrosion is rusting of iron metal. When an iron article remains exposed to moist air for a considerable time,

its surface gets covered with a brown, flaky, and non-sticky substance called rust.

- Rust is a hydrated ferric oxide ($Fe_2O_3 \cdot xH_2O$).
- It is formed due to oxygen gas and water vapour present in the air on the iron surface. It can be represented as follows : $4Fe + 3O_2 + 2xH_2O \rightarrow 2Fe_2O_3 \cdot xH_2O$

Rancidity 1

- Oxidation has a damaging effect on our food and eatables.
- Atmospheric oxidation deteriorates stored foodstuffs containing fats and oils and makes them unfit for human use.
- The foodstuffs containing fats and oils when stored for a long time develop unpleasant smells and bad tastes due to aerial oxidation of fats and oils.
- This phenomenon of slow aerial oxidation of fats and oils leading to unpleasant smells and bad tastes in them is called 'rancidity.'

Applications of Oxidation 2

1. Bleaching of fabrics.
2. Purification of water.
3. Combustion of fuel involves the use of an oxidizing agent.
4. Storage of energy in batteries.
5. Vulcanization of rubber (increasing the strength and the elasticity of rubber).
6. Oxidizing agents are also vital to many biological processes such as metabolism and photosynthesis.

5) Write about social, economic, environmental sustainability of Sustainable development and also why sustainability is important?

Sustainable Development 2

- Sustainability is most often defined as meeting the needs of the present without compromising the ability of future generations to meet theirs.
- This most widely accepted definition of Sustainable Development was given by the Brundtland Commission in its report Our Common Future (1987).
- Sustainable development (SD) calls for concerted efforts towards building an inclusive, sustainable and resilient future for people and planet.

Pillars of Sustainable development 4

1. Social Sustainability
2. Economics Sustainability
3. Environmental Sustainability

1. Social Sustainability:

- It can foster gender equality, development of people, communities and cultures to help achieve a reasonable and fairly-distributed quality of life, healthcare and education across the Globe.

2. Economic Sustainability:

- Focuses on equal economic growth that generates wealth for all, without harming the environment.
- Investment and equal distribution of economic resources.
- Eradicating poverty in all its forms and dimensions.

3. Environmental Sustainability:

- It prevents nature from being used as an inexhaustible source of resources and ensures its protection and rational use.
- Aspects such as environmental conservation, investment in renewable energy, saving water, supporting sustainable mobility, and innovation in sustainable construction and architecture, contribute to achieving environmental sustainability on several fronts.
- **Example:** aspiration to achieve net carbon zero.

Importance of Sustainability 5**1. Ensures a Future for All**

- Our present choices and actions have huge long-term impacts on future generations.
- Practicing sustainability ensures that we make ethical choices that bring a safe and livable future to everyone. If we deplete the resources of the Earth, future generations will be depleted.
- For example, if we over fish our oceans, we risk not only depleting the supply of fish, but also depleting the supply of every organism in the food chain related to that fish.

2. Reduced Energy usage

- It leads to a significant reduction in long-term energy costs.
- Some quick initiatives, like switching to energy-efficient lighting, according to production schedule, reduce long-term electrical costs. Using solar and wind energy, along with energy-efficient equipment, reduces monthly utility bills.

3. A Healthier Habitat for all

- Being committed to sustainability will reduce your carbon footprint and the amount of

toxins released into the environment, making it safe.

- When we focus on sustainability, the entire world benefits and gets to live in clean, more healthy living conditions.

4. Societal Impact

- Choosing to live a sustainable lifestyle does not mean you'll have to give things up or reduce your quality of life at all! In fact, you'll feel more fulfilled and happy knowing your contributing to a better world.
- As more and more people demand sustainable products, the market for green technology will continue to grow, which will create jobs.

5. Improves Public Health

- Sustainable practices can help improve public health by reducing pollution and conserving resources.
- In addition, sustainable practices can create jobs and stimulate the economy, which in turn helps improve public health.

6. Protects Biodiversity

- The world is currently in the midst of an unprecedented extinction crisis, with species disappearing at a rate 1,000 times faster than normal.
- The root cause of this mass extinction is human activity, which is damaging and destroying habitats at an alarming rate.
- If we want to preserve biodiversity – the incredible variety of plant and animal life on Earth – we need to urgently adopt more sustainable practices.

Conclusion 1

- To make the process of sustainable development feasible and operational, it is important to establish a common focus that can integrate the outlook and efforts of various participants in development, worldwide, realizing the diversity, in terms of geography, society, economics, level of science and technology capabilities and capacities and education standards/levels.

6) What is Xerography? Explain it. 1

- **Invented by :** Physicist Chester Carlson also known as The Father of Xerographic Printing-
Invented in year : 1938

Xerography or Electrophotography 2

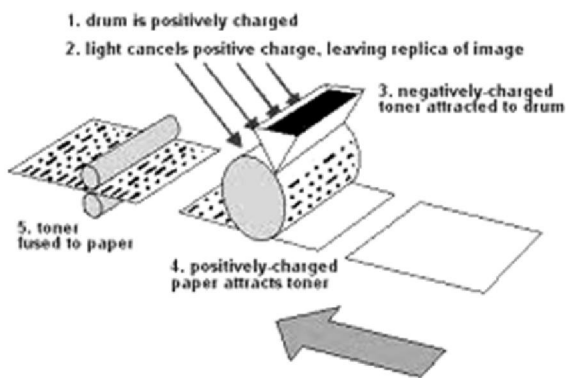
- It is a Dry Photocopying Technique.
- His invention was developed and commercialized by the Xerox Corporation.

- Xerography is widely used to produce high-quality text and graphic images on paper

Basic Phenomena used: 2

- It's based on two natural phenomena :
 1. that materials of opposite electrical charges attract and
 2. that some materials become better conductors of electricity when exposed to light.
- Carlson invented a six-step process to transfer an image from one surface to another using these phenomena.

Working Procedure 5



1. The first step in the Xerographic Process is to charge up a metal drum Photoconductor uniformly by rotating it on its surface and applying an electrostatic charge.
2. Next the document is passed over the surface of the photo sensitive drum and is illuminated by a laser, this illumination creates the latent image by only passing through sections of the document without text.
3. The image produced on the drum is then bonded with magnetically charged toner.
4. The toner particles are next transferred to a print medium by a corona device generating an electric field with the ability to surmount the magnetic field of the toner, thus attracting the toner to the medium.
5. Before the new document is ready the toner must be fused to the paper somehow. This is done by heated steel rollers which generate the necessary combination of heat, pressure, and radiant energy.

Role of Xerography in the Improvement Of Human Life 2

- Xerography made the process of documentation even more faster, thereby saving lots of effort and money.

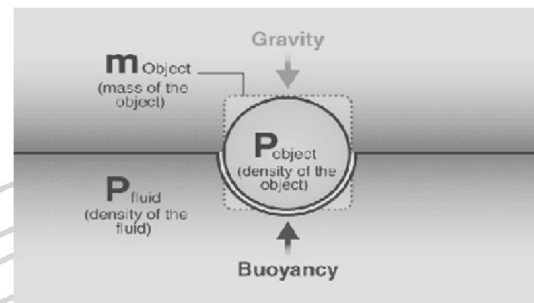
- Xerography became the foundation stone of a gigantic worldwide copying industry, including Xerox and other corporations which made and marketed copiers and duplicators, thereby earning billions.
- Photocopying started to be widely used in business, education, and government.

7) Discuss about buoyancy with suitable examples? Buoyancy 2

- Buoyancy is the tendency of an object to float in a fluid.
- All liquids and gases in the presence of gravity exert an upward force known as the buoyant force on any object immersed in them.
- Buoyancy results from the differences in pressure acting on opposite sides of an object immersed in a static fluid.

Factors that affect buoyancy 3

1. The density of the fluid
2. The volume of the fluid displaced
3. The local acceleration due to gravity



Working Principle 4

- When object is immersed in water or any other fluid, the object experiences a force from the downward direction opposite to the gravitational pull, which is responsible for the decrease in its weight.
- This upward force exerted by the fluid opposes the weight of an object immersed in a fluid.
- The pressure in a fluid column increases with depth.
- Thus, the pressure at the bottom of an object submerged in the fluid is greater than that at the top.
- The difference in this pressure results in a net upward force on the object, which is defined as buoyancy.
- **Centre of Buoyancy:** The point where the buoyant force is applied or the point on the object where the force acts is termed the centre of Buoyancy.

Examples of buoyancy 3**1. Hot Air Balloon**

- The atmosphere is filled with air that exerts buoyant force on any object.
- A hot air balloon rises and floats due to the buoyant force.
- It descends when the balloon's weight is higher than the buoyant force.
- It becomes stationary when the weight equals the buoyant force.

2. Ship

- A ship floats on the surface of the sea because the volume of water displaced by the ship is enough to have a weight equal to the weight of the ship.
- A ship is constructed in a way so that the shape is hollow to make the overall density of the ship lesser than the seawater.
- Therefore, the buoyant force acting on the ship is large enough to support its weight.

3. Fish

- A certain group of fishes uses Archimedes' principle to go up and down the water.
- To go up to the surface, the fish will fill its swim bladder (air sacs) with gases .
- The gases diffuse from their own body to the bladder and thus make the body lighter.
- This enables the fish to go into water.

8) Write a short note on Monkey Pox ?**Monkey Pox** 2

- It is a viral zoonotic disease (transmission from animals to humans) and is identified as a pox-like disease among monkeys hence it is named Monkeypox.
- It is endemic to Nigeria.
- It is caused by monkeypox virus, a member of the Orthopoxvirus genus in the family Poxviridae.

Animal Sources of Monkey Pox 1

- includes **monkeys and apes, a variety of rodents** (including rats, mice, squirrels and prairie dogs) **and rabbits**.
- African rodents are thought to be the main reservoir.

Symptoms 2

1. Infected people break out in a rash that looks a lot like chicken pox. But the fever, malaise, and headache from Monkeypox are usually more severe than in chicken pox infection
2. In the early stage of the disease, Monkeypox can be distinguished from smallpox because the lymph gland gets enlarged.

Transmission 3

1. **Primary infection:** It is through direct contact with the blood, bodily fluids, or cutaneous or mucosal lesions of an infected animal. Eating inadequately cooked meat of infected animals is also a risk factor.
2. **Human-to-human transmission :** It can result from close contact with infected respiratory tract secretions, skin lesions of an infected person or objects recently contaminated by patient fluids or lesion materials.
3. **Congenital Monkeypox:** Transmission can also occur by inoculation or via the placenta .

Treatment & vaccine 2

- There is no specific treatment or vaccine available for Monkeypox infection. In the past, the anti-smallpox vaccine was shown to be 85% effective in preventing Monkeypox.
- But the world was declared free of smallpox in 1980 so the vaccine isn't widely available anymore.
- Currently, there is no global system in place to manage the spread of Monkeypox, with each country struggling to contain any outbreak whenever it occurs.

Monkeypox Epidemic in 2022 2

- In May 2022, a number of instances and hubs of monkeypox were discovered in the United Kingdom, followed by Spain and Portugal, all of which were swiftly identified as being part of a major and still ongoing monkeypox outbreak.
- The first confirmed case, with travel linkages to Nigeria, was confirmed on May 6, 2022, but it's been speculated that infections had been spreading throughout Europe for months before that.

9) Define Stem cell. Explain about its application in Medical field and give an account of guidelines of stem cell Research in India.**Stem Cell** 2

- It is defined as the an undifferentiated cell of a multi cellular organism which is capable of giving rise to indefinitely more cells of the same type, and from which certain other kinds of cell arise by differentiation
- They have potential in the development of therapies for replacing defective or damaged cells resulting from a variety of disorders and injuries, such as Parkinson disease, heart disease, and diabetes.

Major Types of StemCells 1

1. **Embryonic stem cells :** Stem cells that are derived from the inner cell mass of a

mammalian embryo at a very early stage of development

2. **Adult stem cells(tissue stem cells):** Some tissues in the adult body, such as the epidermis of the skin, the lining of the small intestine, and bone marrow, undergo continuous cellular turnover.

Application of Stem Cells in Medical Field 4

1. **Increase understanding of how diseases occur:**

- By watching stem cells mature into cells in bones, heart muscle, nerves, and other organs and tissue, researchers may better understand how diseases and conditions develop.

2. **Generate healthy cells to replace cells affected by disease (regenerative medicine):**

- Stem cells can be guided into becoming specific cells that can be used in people to regenerate and repair tissues that have been damaged or affected by disease.
- People who might benefit from stem cell therapies include those with spinal cord injuries, type 1 diabetes, Parkinson's disease, amyotrophic lateral sclerosis, Alzheimer's disease, heart disease, stroke, burns, cancer and osteoarthritis.
- Stem cells may have the potential to be grown to become new tissue for use in transplant and regenerative medicine.

3. **Test new drugs for safety and effectiveness.**

- Before using investigational drugs in people, researchers can use some types of stem cells to test the drugs for safety and quality. This type of testing will most likely first have a direct impact on drug development for cardiac toxicity testing.
- For the testing of new drugs to be accurate, the cells must be programmed to acquire properties of the type of cells targeted by the drug. Techniques to program cells into specific cells are under study.
- For instance, nerve cells could be generated to test a new drug for a nerve disease. Tests could show whether the new drug had any effect on the cells and whether the cells were harmed.

4. **Cardiovascular Disease Treatment**

- In 2013, a team of researchers from Massachusetts General Hospital reported that they had created blood vessels in laboratory mice, using human stem cells.

- Within 2 weeks of implanting the stem cells, networks of blood-perfused vessels had formed.

- The quality of these new blood vessels was as good as the nearby natural ones which can be used to treat cardiovascular diseases

5. **Brain Disease Treatment**

- In Parkinson's, for example, damage to brain cells leads to uncontrolled muscle movements. Scientists could use stem cells to replenish the damaged brain tissue.

- This could bring back the specialized brain cells that stop the uncontrolled muscle movements.

6. **Cell Deficiency Treatment**

- people with type I diabetes could receive pancreatic cells to replace the insulin-producing cells that their own immune systems have lost or destroyed.

- The only current therapy is a pancreatic transplant, and very few pancreases are available for transplant.

7. **Blood Disease Treatment**

- Doctors now routinely use adult hematopoietic stem cells to treat diseases, such as leukemia, sickle cell anemia, and other immunodeficiency problems.

- Hematopoietic stem cells occur in blood and bone marrow and can produce all blood cell types, including red blood cells that carry oxygen and white blood cells that fight disease

Guidelines of Stem Cell Research in India 4

1. In March 2019, the Union Health Ministry had notified the 'New Drugs and Clinical Trial Rules, 2019' which state that stem-cell-derived products are to be used as "new drugs". This means that any doctor who uses stem-cell therapy needs to take permission from the government.

2. In India as well as globally, only blood stem cells from bone marrow to treat blood cancers and different blood disorders are permitted. The clinical use in any other disease or use of any stem cells other than these is still in the research stage.

3. **Central Drugs Standard Control Organization (CDSCO)** which comes under the Ministry of Health and Family Welfare is the main body which works on development of regulatory procedures and standards for drugs, cosmetics, diagnostics and devices.

4. It lays down regulatory guidance by amending acts and rules; and regulates new drug approval process.
5. Its main objective is to standardize clinical research and bring safer drugs to the Indian market.
6. The **Drug Controller General of India (DCGI)** is responsible for giving regulatory permissions for the conduct of clinical trials and is responsible for approval of marketing licenses for drugs in India.
7. As per the National Guidelines for Stem Cell Research-2013 all institutions carrying out research on human stem cells must constitute an Institutional Committee for Stem Cell Research (IC-SCR) and register with the National Apex Committee for Stem Cell Research and Therapy (NAC-SCRT).

Conclusion **1**

- Stem cells undoubtedly offer tremendous potential to treat many human diseases and to repair tissue damage resulting from injury or ageing.
- The danger lies in the mix of desperate patients, enthusiastic scientists, ambitious clinicians, and commercial pressures. Internationally agreed, and enforced, regulations are essential to protect patients from the dangers of stem cell tourism.

10) Explain about Food Quality Control and Food Control Agencies?**Food Quality Control** **2**

- The Government ensures that pure and safe food is made available to the consumers.
- In 1954, the Indian Government enacted the Food Law called **Prevention of Food Adulteration Act** and the **Prevention of Food Adulteration Rules** in the year 1955.
- **Objective:** to ensure pure and wholesome food to the consumers and to protect them from fraudulent trade practices.

The Prevention of food adulteration act 1954 **2**

1. came into force on the 1st of June 1955.
2. The act outlines the minimum standards of quality for food and strict hygienic condition for its sale.
3. The act prohibits the manufacture, sales and distribution of adulterated and contaminated foods.
4. There are standards that are specified for the pasteurized milk, milk powder, infant milk food etc.

Food Control Agencies**Food Control of India(FCI) :** **1**

- **FCII** is one of the main organizations responsible for the execution of food policies of the Government of India. FCI has a network of about 1841 depots spread across the country to manage the stock of food grains
- FCI was setup in the year 1965

Objectives of FCI **2**

1. Effective price support operations for safeguarding the interest of farmers.
2. Distributing food grains throughout the country.
3. Maintaining satisfactory levels of operational and buffer stock of food grains to ensure national security.
4. Regulate the market price to provide food grains to consumers at a reliable price.

Indian Standards Institution(ISI) **2**

- It is also known as the **Bureau of Indian Standards (BIS)**.
- ISI promotes the development of standardization and quality certification of goods.
- ISI certifies products like electrical appliances like switches, wiring cables, water heater, electric motor, kitchen appliances etc.
- **Standard Mark:** The presence of a BIS certification mark, known as Standard Mark, on a product is an assurance of conformity to the specifications.

AGMARK **1**

- Agricultural marking is abbreviated as AGMARK.
- AGMARK certifies agricultural and livestock products like cereals, essential oils, pulses, honey, butter etc.
- The AGMARK assures that they adhere to standards that are established by the Directorate of Marketing and Inspection.
- It is a mark that is approved by the Government of India for agricultural products assuring good quality along with standard

Fruit Process Order(FPO) **1**

- FPO certifies fruit products like juice, jams, sauces, canned fruits and vegetables, pickles, dehydrated fruit products, fruit extracts etc.
- It is a mandatory certification on all processed fruit products sold in India, following the Food Safety and Standards Act of 2006.
- The FPO standardized mark guarantees that the product was manufactured in a hygienic

'food-safe' environment. This ensures that the product is fit for consumption.

Food Safety Standards Authority of India(FSSAI)

1

- FSSAI is responsible for protecting and promoting public health through regulation and supervision of food safety.
- FSSAI ensures food safety and providing satisfaction to every customer.
- The organization formulates measures to eliminate the toxic and hazardous elements of the environment. It also promotes general awareness about food safety and food standards.

11) India's Falling Crude Oil & Natural Gas Production

- Substantiate?

Introduction

1

- India's crude oil production fell 3.8 per cent in July on lower output from fields operated by state-owned ONGC and private sector firms.

Production decline by ONGC

3

- Oil and Natural Gas Corporation (ONGC) produced 1.7% less oil at 1.63 million tonnes on lower output from western offshore. Fields operated by private firms saw a 12.34% decline in production
- **Production of crude oil**, which is refined to produce fuels such as petrol and diesel, fell to 2.45 million tonnes in July from 2.54 million tonnes a year back.
- The output was lower than the monthly target of 2.59 million tonnes, the data released by the Ministry of Petroleum and Natural Gas showed.
- But the oil production during the first four months of the current fiscal that began on April 1 was only marginally lower at 9.91 million tonnes as opposed to 9.96 million tonnes during April-July 2021.

Data released by Ministry of Petroleum & Natural Gas

2

- According to the ministry data, ONGC's oilfields in Gujarat and Assam produced less oil while Vedanta's Rajasthan block had a lower output.
- Natural gas output was almost unchanged at 2.88 billion cubic meters in July but was 3.4 per cent higher during April-July at 11.43 bcm
- ONGC's gas output was almost 4 per cent lower in July due to less gas production in the Daman field in Mumbai offshore.

- The country's 22 oil refineries processed 10.52 per cent more crude oil at 21.43 million tonnes as demand for fuel picked up.
- Domestically produced crude oil forms just 15 per cent of the processing at refineries, the rest being imported oil.

Reasons for the decline

2

- Fall in ONGC's production came on the back of decline in output from from Gandhar in Ankleshwar (Gujarat),
- Ceasing of high potential wells in Geleki field in Assam,
- Restriction on drilling activities due to socio-political issues in Cauvery, among others
- The fall in crude production comes at a time when oil prices remain volatile amid the Russia-Ukraine crisis and concerns of a global slowdown.

Reversal of declining trend:

2

- Oil Minister Hardeep Singh Puri on August 4 tweeted that the declining trend in crude oil production has been reversed
- It has already been able to reverse the declining trend in oil production from 2011-12 with an expected 29.7 million tonnes in 2021-22 to 30.8 million tonnes in 2022-23 & 34 million tonnes (estimated) in 2023-24

Way forward

2

- India has been making efforts to increase its domestic oil production to reduce import dependence.
- The country imports around 85% of its energy requirements.
- In March, a standing committee on petroleum and natural gas recommended that the government review its strategy to increase domestic oil production and take concrete, tangible steps for this.

12) Write about Menstrual Cycle and process of Ovulation.

Menstrual Cycle

4

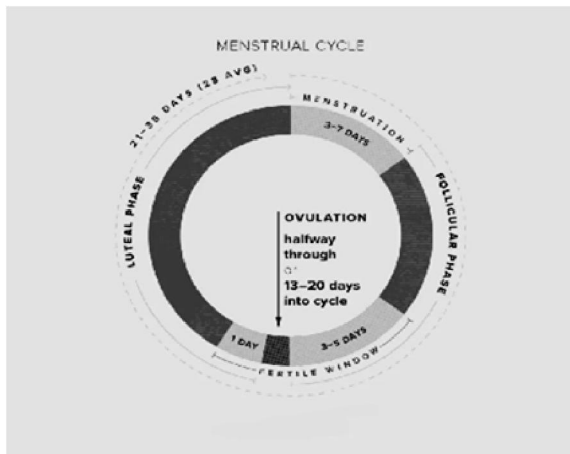
- In a life cycle, a woman's body is vulnerable to a variety of changes. The cycle of these changes occur in women every month, positively for pregnancy is called the menstrual cycle.
- **Menstruation:** When an ovum is unfertilized, the uterus lining sheds and leads to a hemorrhage, called menstruation.
- **Menarche:** In a girl, menstruation starts from the age of 10 to 15 when she attains puberty and this beginning is known as menarche.

- **Menopause:** The ending of menstruation is known as menopause which takes place at the age range of 50.
- **Duration of Menstrual Cycle:** The first day of bleeding is marked as the first day of a menstrual cycle and the period from one menstrual cycle to another can vary from 28 to 30 days.

Female Reproductive system and Organs involved in Menstrual cycle **2**

1. A pair of ovaries that store, nourish and release ova.
2. Uterus (womb), where implantation of a fertilized egg takes place and the foetus develops.
3. Pair of the fallopian tubes connecting the ovaries and uterus.

Phases of Menstrual Cycle

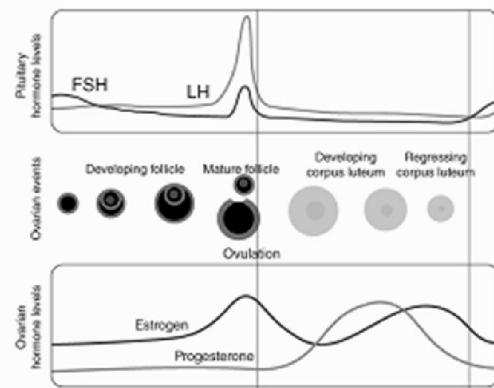


1. **Menstrual phase:** Day 1, uterus lining which is prepared for implantation starts to shed which lasts 3 to 5 days.
2. **Follicular phase:** In this phase, the primary follicle starts developing into a mature Graffian follicle. The endometrium also starts proliferating. The uterus starts preparation for another pregnancy.
3. **Ovulatory phase:** Mid-cycle phase, this is the phase in which ovulation takes place i.e., day 13-17. The end of the follicular phase along with the ovulation period defines the fertilisation period.
4. **Luteal phase:** It is the post-ovulation phase, where the fate of the corpus luteum is decided. If fertilisation occurs, pregnancy starts. If fertilisation doesn't occur, it marks the onset of another cycle.

Role of Hormones in Menstrual Cycle **2**

- Every phase of the menstrual cycle is influenced by a female hormones namely estrogen, progesterone, FSH and LH.
- Follicle-stimulating hormone (FSH) and luteinizing hormone (LH) are secreted by the anterior pituitary.
- FSH stimulates the growth of ovarian follicles that secrete estrogen.
- Progesterone is secreted by the corpus luteum.

Hormone Secretion during menstrual phases



- **During Follicular Phase:** The secretion of FSH and LH gradually increases during the follicular phase. They stimulate the development of follicles and the release of estrogen from them.
- Estrogen stimulates the proliferation of the endometrium.
- The level of LH and FSH peaks in the middle of the cycle.
- **During Ovulation:** LH induces ovulation. There is a sudden surge in LH level just before ovulation.
- **During Luteal phase:** After ovulation, the ruptured follicle develops into the corpus luteum, which secretes progesterone, hence the level of progesterone increases in the luteal phase.
- Progesterone is required for the maintenance of the endometrium for implantation.
- In the absence of fertilisation, corpus luteum regresses and progesterone level decreases. It leads to the disintegration of the endometrium and menstrual flow occurs.

Process of Ovulation **4**

- As a result of the estrogen peak, a sudden surge of LH and FSH hormones is released from the pituitary gland.

- This typically lasts for 1 to 2 days, before the follicle erupts and releases the egg from the ovary by way of the oviduct.
- The release of the egg occurs due to LH, which causes the follicle to secrete proteolytic enzymes that weaken the tissue near the blister of the follicle, eventually forming a hole called the stigma.
- **Cumulus- Oocyte Complex** : The egg surrounded by the cumulus cells, known as the cumulus-oocyte complex, then travels into the peritoneal cavity and connects to the fimbriae at the end of the fallopian tube. Pushed along the tube by cilia, the egg slowly travels towards the uterus.
- At the same time, the egg undergoes meiosis I to form two separate cells, one that contains the cytoplasmic material and one inactive polar body.
- **Meiosis II** then occurs but does not complete, as the egg remains in metaphase until fertilization.
- If it is not fertilized, the egg will degenerate within 24 hours. At this point, the uterine mucous membrane known as the functionalism is at its maximum size with endometrial glands that are still non-secretory.

Unit - 3

1) What are the research and developmental achievements in applied biotechnology? How will these achievements help to uplift the poorer sections of the society? 1

- Biotechnology is an interdisciplinary field that involves the use of live organisms or enzymes from organisms to produce products and processes useful to humans.

Achievement in Biotechnology: 7

1. Biotechnology is used to produce genetically modified crops that are resistant to pests, improve crop yield, and have higher nutritional value. For example, Bt Cotton, GM Soya bean, etc.
2. Recombinant DNA techniques are used to produce a number of medicines like Insulin, etc.
3. Biotechnology is also employed in waste management and reducing pollution. For example, Phytoremediation uses plants for the removal, degradation, or containment of contaminants in soils, groundwater, etc.
4. Biotechnology is used for the diagnosis of a number of diseases. For instance, RT-PCR is

- based on genetic amplification to detect the presence of viruses like Dengue, SARS, etc.
5. Development of RNA (mRNA) based vaccine is used to fight the COVID-19 pandemic.
 6. Biotechnology is also at forefront of Assisted Reproductive Technologies like IVF, Test tube babies, etc.
 7. Stem Cell Research: Stem cells have the ability to keep on dividing infinitely and have the capacity to distinguish into different types of body cells during the early development of an organism. Researchers can program these stem cells to differentiate into specific types of cells.
 8. Human Genome Project: It was an international scientific research project coordinated by the National Institutes of Health and the U.S. Department of Energy. Officially launched in 1990, it had the goal of determining the sequence of nucleotide base pairs that make up human DNA. It has supported researchers in identifying genes that cause diseases.
 9. Targeted Cancer Therapies: The established standard chemotherapies are toxic for healthy cells at present. Targeted cancer therapies are drugs that operate either by interfering with the function of specific molecules or by only targeting known cancerous cells in order to reduce damage to healthy cells.
 10. CRISPR: Clustered Regularly Interspersed Short Palindromic Repeats (CRISPR) is a relatively new gene-editing system that has been hailed as a groundbreaking tool in medical research. HIV research is one of its many uses.
 11. Diagnosis of HIV- Polymerase Chain Reaction(PCR) is now routinely used to detect HIV in suspected AIDS patients. It is being used to detect mutations in genes in suspected cancer patients too.PCR is a powerful technique to identify many other genetic disorders.
 12. Animals that have had their DNA manipulated to possess and express an extra (foreign) gene are known as transgenic animals. Transgenic rats, rabbits, pigs, sheep, cows and fish have been produced, although over 95 per cent of all existing transgenic animals are mice. They have numerous utilities.
- Role of Biotech in Uplifting Poor's: 7**
- Biotechnology is helping to increase the income of marginal farmers by increasing crop

yield and making them climate and pest resilient.

- The development of medicines using Biotech is reducing healthcare expenditure for the poor. E.g; the cost of Insulin has come down.
- Biotechnology is also helping in the conversion of waste into assets for the poor. E.g.; Bio-composting turns waste into valuable fertilizer.
- The poor suffer the most from pollution. Biotechnology also helps in reducing pollution and thus alleviates their suffering. E.g.; Bioremediation techniques help clean landfills around slums.
- Biotechnology also helps in increasing the shelf life of food products which in turn keeps their price in check for the poor.
- Biotechnology is a revolutionary field that has the potential to alleviate poverty and hunger. However, there is a need to equitably distribute its benefits among all strata of society
- By genome sequencing, biotechnology helps in accessing health of the people from the corners of India which ultimately proves conducive for the government in framing targeted policy initiatives.
- Addressal of micronutrient deficiencies, severe acute malnutrition, food fortification, probiotics for human health and well-being, food safety, molecular detection of GM traits in foods.
- Development of low cost foods/supplements and utilization of agricultural residues for value added products.
- The programs undertaken in agriculture such as Wheat Genome Sequencing Programme, Rice Functional Genomics, Crop Biofortification and quality improvement programme, National Plant Gene Repository programme benefits the poorer section.

2) State the objectives of ISRO. Explain the recent achievement made by ISRO.

ISRO (Indian Space Research Organisation) 1

- Founded in 1969 to develop an independent Indian space program.
- Having Head Quartered in Bangalore.

Objectives of ISRO 7

- Design and development of launching vehicles-So far ISRO developed 4 generations SLV, ASLV, PSLV, GSLV-Recently VSLV and RSLV on demo.
- Design and development of satellite

- For earth observation
- Communication, Navigations
- Eg.INSAT, IRS, GSAT
- To conduct space programs
- To encourage children involvement in space science
- To encourage private participations.
- Extraterrestrial planetary exploration
- Mission for moon – Chandrayan I, II-Mission for Maars Mom I, II-Solar mission – Aditya – L1
- To Help the National development
- For commercial purpose
- To less independent on other countries organize the administration.
- Related to space science
- Administer the organisation related to space science.
- To become top 7 on space technology-Strive to became the top list on space technology
- India – 5th nation to have own shuttle - 6th nation to have own space agency (ISRO)

Achievements of ISRO 7

- **PSLV C – 37:** Created History and world record by successfully launching 104 satellites on single mission.
- **RSLV (2016):** Reusable launch vehicle successfully demonstrate-Seen as future for low cost-NISAR: Joint venture of NASA & ISRO
- To measure the earth's surface including hazards.
- **Chandrayan – II :** Second mission for lunar exploration
- Especially to survey and explore the North side of moon.
- **VSLV :** VSSUT Satellite launching vehicle
- Most successful student satellite launched till date.
- **PSLV C54:** EOS-06 mission with Quansat -3 & 8 Nano satellite.
- **Samudayan:** Deep sea exploration mission first manned deep sea mission.
- Matsya 6000 – Vehicle for taking 3 member to 6000 m deep inside the ocean.

3) Explain the following

- a) Application of Radiochemistry
 - b) Food and Forensic Chemistry
 - a) Applications of radio chemistry 7.5
- Radiocarbon dating**

- It is a method by which the age of fossil wood or animal is determined using C-14 isotope.

Study of chemical reactions

- The nature of some of the chemical reactions can be studied by mixing a radioisotope with non-radioactive isotope of the reactants.

- The radioisotope used for this purpose is called radiotracer. For example, by photosynthesis plants synthesize carbohydrate from carbon dioxide and water as shown in the following reaction.-By using radioisotope O-18 as tracer, it was found that the evolved oxygen comes from H₂O.

Diagnosis

- Radioisotopes are found very useful to diagnose and understand many diseases.
- Iodine 131- location and detection of brain tumour, thyroid gland disorder.
- Sodium 24 - location of blood clot and circulation disorder
- Iron 59 - pregnancy disorder and anaemia
- Cobalt 60- diagnosis of cancer
- Hydrogen 3- water content in human body
- Radiotherapy: Radioactive isotopes are used in the treatment of many diseases. This kind of treatment is called radiotherapy.
- Gold 198- cancer
- Cobalt 60 - cancer

b) Food and forensic chemistry 7.5

Food chemistry : Fermentation of dairy products

- Apart from natural fermentation, to speed up the process we use microorganisms which aid the process of conversion from lactose to lactic acid.

Fat & Sugar Substitutes

- We know how fat & sugar cause different ailments, but with the help of food chemistry, chemists are coming up with substitutes which offer the same taste without the bad effects.
- In food processing and storage, chemical substances may play an important role. For example, food additives can extend the shelf life of foods; others can make food more enticing, such as colours.
- To make foods tastier, flavourings are used. Health supplements are used as energy sources.

Forensic chemistry:

- During fire investigations, forensic chemists can determine if an accelerant such as gasoline or kerosene was used; if so, this suggests that the fire was intentionally set.
- Forensic chemists can also narrow down the suspect list to people who would have access to the substance used in a crime.
- For example, in explosive investigations, the identification of RDX or C-4 would indicate a

military connection as those substances are military grade explosives.

- On the other hand, the identification of TNT would create a wider suspect list, since it is used by demolition companies as well as in the military.
- During poisoning investigations, the detection of specific poisons can give detectives an idea of what to look for when they are interviewing potential suspects.
- Forensic chemists also help to confirm or refute investigators' suspicions in drug or alcohol cases.
- The instruments used by forensic chemists can detect minute quantities, and accurate measurement can be important in crimes such as driving under the influence as there are specific blood alcohol content cutoffs where penalties begin or increase.
- In suspected overdose cases, the quantity of the drug found in the person's system can confirm or rule out overdose as the cause of death.

4) What is Monoclonal Antibody? Explain the function of Monoclonal cocktail against covid -19

Monoclonal Antibodies: 7.5

- Antibodies are proteins produced naturally by the immune system that target a specific foreign object (antigen). They are called monoclonal Antibodies (mAbs) when they are produced by clones derived from a single parent cell.
- They are man-made proteins that act like a human antibody in the immune system. They are made by cloning a unique white blood cell.
- mAbs have monovalent affinity, it binds only to the same epitope i.e. the part of an antigen that is recognized by the antibody.
- They are designed to perform many roles, like they can be used to carry drugs, toxins, or radioactive substances directly to affected cells.
- mAbs are used to treat many diseases, including some types of cancer.

mAbs and Covid-19: 7.5

- Recently, the International AIDS Vaccine Initiative (IAVI) and Serum Institute of India (SII), Pune announced an agreement with Merck, a science and technology company, to develop SARS-CoV-2 neutralising monoclonal antibodies (mAbs), which will be used to address the Covid-19 pandemic.

- Neutralising monoclonal antibodies (mAbs) against SARS-CoV-2 were co-invented by IAVI and Scripps Research.
- They are widely considered to be promising candidates for Covid-19 treatment and prevention.
- Encouraging results for Covid-19 antibody treatment have emerged from preclinical research and from initial clinical trials.
- mAbs also have the potential to play an important complementary role to Covid-19 vaccines.
- It can be used both for treatment and potentially for prevention, especially for those individuals who, due to age or medical conditions, may not benefit from vaccination.

5) What do you understand by Agro biodiversity ? How it is ready to fulfil the UN Sustainable Development goals no : 2 ?

Agro biodiversity: 3

- Agro biodiversity can be defined as the variety and variability of plant, animals and micro-organism that are used directly or indirectly for food and agriculture.
- It includes all species that are closely interwoven in an agricultural ecosystem.
- Agro biodiversity, relating to diversity of crops and varieties is crucial in food security, nutrition, health and essential in agricultural landscapes.
- India is ranked 107 in the Global Hunger Index (GHI) out of 121 countries which reflects India's hunger problem which can be tackled through agro biodiversity.

Agro biodiversity can fulfill UN sustainable development goal 2: 2

- The UN Sustainable Development Goal 2 advocates for Zero Hunger and the Aichi Biodiversity Target focuses on countries conserving genetic diversity of plants, farm livestock and wild relatives.

Issue of hunger in India 4

- Malnutrition amongst children in India is projected to remain high, despite of all the progress made in food security.
- Nearly 47 million or four out of 10 children in India do not meet their potential because of chronic under nutrition or stunting. This leads to diminished learning capacity, increased chronic diseases.
- Almost one in three Indian children under five years will still be malnourished by 2022 going by current trends.
- Access to food has not increased. Food-grain yields have risen 33% over the last two decades, but are still only half of 2030 target yields.

Agro biodiversity and solution of hunger issue: 6

- Genetic diversity of crops, livestock and their wild relatives, are fundamental to improve crop varieties and livestock breeds.
- Agro biodiversity gives crop varieties and animal breeds with the rich genetic pool that would help to provide nutrition.
- Agro biodiversity helps nutrition-sensitive farming and bio-fortified foods. For instance, moringa (drumstick) has micro nutrients and sweet potato is rich in Vitamin A.
- There are varieties of pearl millet and sorghum rich in iron and zinc.
- Hunger is affecting million of peoples and a staggering 2 million people are not consuming adequate amounts of micronutrients like iron and vitamin A.
- Agro biodiversity can enrich food basket and provide more nutrition to all.
- An increased variety of crop species can also transform the farm into a healthier ecosystem.
- For example, planting a mixture of species can increase soil nitrogen, reducing the need for inorganic fertilizers.
- Not having to use strong chemicals on farms will have a positive impact on the vegetation and will prevent toxicity in vegetation.-Agro biodiversity would help in providing tastier and healthier alternatives that can help resolving hunger issue in India.
- Agro biodiversity is important mainly to make food more cheaper, more affordable and more accessible by providing a lot of nutritional alternatives.

6) What are the three Moduli of Elasticity and its application?

Modulus of elasticity: 2

- Within proportionality limit modulus of elasticity, the ratio is stress to strain. proportional limit.
- It measures the rigidity or stiffness of a material.
- If the material is greater in the modulus, the material will be stiffer, or smaller than the elastic strain that results from the application of a given stress.
- The modulus of elasticity is the important design parameter used for computing elastic deflections.
- Elastic modulus is called modulus of elasticity.
- The modulus of elasticity is also known as Young's modulus.

A. Types of Modulus of Elasticity 8

- Depending upon the type of force applied to the body and change in deformation.
- Modulus of elasticity is divided into the following types.

1. Young's Modulus
2. Shear Modulus
3. Bulk Modulus of Elasticity

1. Young's Modulus

- Elastic modulus is explained only for one axis of the substance.
- Young's modulus of a material is an important attribute to understanding how the material will behave when applied to a force. It is represented by E.
- The Dimensional formula of E is $[M^1L^{-1}T^{-2}]$.

2. Shear Modulus

- The shear modulus of the material is the ratio of shear stress to shear strain in a body. When the shear force is increased, the value of the shear modulus also increases. It is represented by G or C.
- The Dimensional formula of G is $[M^1L^{-1}T^{-2}]$.

3. Bulk Modulus of Elasticity

- Bulk modulus is defined when uniform pressure is applied from all directions to the change in volume.
- The bulk modulus is the measure of the ability of a substance which changes in volume when under compression on all sides. It is represented by K.
- Bulk modulus of elasticity,
- $K = - P / (\Delta V/V)$
- Dimensions of K are $[M^1L^{-1}T^{-2}]$.

Applications of moduli of elasticity: 5

- Knowledge of the modulus of elasticity of materials helps us to choose the correct material, in right dimensions for the right application. The following examples will throw light on this.
- Most of us would have seen a crane used for lifting and moving heavy loads. The crane has a thick metallic rope.
- The maximum load that can be lifted by the rope must be specified. This maximum load under any circumstances should not exceed the elastic limit of the material of the rope.
- By knowing this elastic limit and the extension per unit length of the material, the area of cross section of the wire can be evaluated.
- From this the radius of the wire can be calculated.

- While designing a bridge, one has to keep in mind the following factors (1) traffic load (2) weight of bridge (3) force of winds.
- The bridge is so designed that it should neither bend too much nor break.

7) What is DART mission and explain its significant. DART MISSION 5

- "Double Asteroid Redirection Test"
- DART Mission: To protect the planet from any possible collision with alien particles
- Launched by : American space Agency -NASA
- Launched on : November 2021
- Using the Space X falcon 9 Rocket

Features: 5

- DART craft carry a high collision resolution DARCO camera to overrate
- DARCO – Didymos Reconnaissance and Asteroid Camera for optical navigation.-It is also used to send the image to the earth on Real-time
- Help in study the object with precision.
- Low cost space craft.

Need for Mission: 5

- 66 Million year go big asteroid crossed the path with Earth.
- Impact was so devastating that wiped out 70% of plant & species
- There is a chance of that big hitting the earth.

8) Describe the major outcomes of the 27th session of the cop to the UNFCCC.

COP 27 UNFCC OUTCOMES: 1

- Sharm-El-Sheikh Adaptation Agenda outlines 30 Adaptation Outcomes to build resilience for four billion people that are most vulnerable to climate, by 2030.
- Each outcome provides a global solution that can be adopted at a local level in response to local climate risks like rising climate hazards in the form of floods, heat waves, droughts, etc.

1. Food Security and Agriculture Systems: 12

- Climate-resilient, sustainable agriculture increases yields by 17% and reduces farm-level GHG emissions by 21%, without expansion of the agricultural frontier.
- Halve the share of food production lost, and per capita food waste (with respect to 2019).
- Healthy alternative proteins capture 15% of the global meat and seafood market.
- The global consumption of fruits, vegetables, seeds, nuts, and legumes increase by 1.5 times.

2. Water and Nature Systems:

- Protection of 45 million hectares (lands and inland waters), 2 billion hectares sustainable

management, and 350 million hectares restoration of land securing legal indigenous and local communities with the use of nature-based solutions to improve water security and livelihoods.

- By 2025: financial institutions contribute to halting land conversion by eliminating commodity-driven deforestation from portfolios and tap into nature-based solutions investment opportunities of USD 354 billion/year needed by 2030.
- Water systems are smart, efficient, and robust with a reduction in water loss through leakage.
- Wastewater systems maximize recycling and reuse alongside natural wetland filtration with zero environmental spillage.
- Sustainable irrigation systems are implemented across 20% of global croplands to preserve water availability whilst supporting yield growth.

3. Human Settlements Systems:

- 1 billion people have better design, construction, and access to finance to live in decent, safe homes.
- Smart and early warning systems reach 3 billion people.
- USD 1 trillion investments in nature-based solutions for communities in urban areas.
- Harden social infrastructure to ensure access to basic and essential community services.
- Increased use of waste as a secondary resource boosts the livelihoods of informal workers and reduces open waste burning by 60%, lowering pollution levels and improving the health of local communities.

4. Ocean and Coastal Systems:

- Invest USD 4 billion to secure the future of 15 million hectares of mangroves globally through collective action on halting mangrove loss, restoring half of the recent losses, doubling the protection of mangroves globally, and ensuring sustainable long-term finance for all existing mangroves.
- Halt loss, protect and restore coral reefs to support people in tropical communities.
- Halt loss, protect, and restore seagrass, marshes, and kelp forests to support people in temperate communities.
- The urban coastline is protected by grey and hybrid solutions.

5. Infrastructure Systems:

- A diverse set of energy generation sources enable affordable access to electricity for 679 million unconnected people and higher quality access for 1 billion underserved people through climate-resilient energy systems.

- 4 billion people with access to clean cooking through at least USD 10 billion/year in innovative finance for clean cooking action worldwide.
- 585 GW of battery storage capacity and extension of transmission and distribution networks enable decentralized generation and consumption.
- 2 billion people access low-cost, clean vehicles and mobility solutions through the expansion of affordable public and private transport services.
- Transport infrastructure is resilient to climate hazards through the adoption of new technology, design, and materials.

6. Planning:

- 10,000 cities and 100 regional governments have evidence-based, actionable adaptation plans.
- 2,000 of the world's largest companies develop actionable adaptation plans.
- Universal access to the tools and information required to integrate climate risks into decision-making from local to global levels.
- Operationalization of National Adaptation Plans and Locally-Led Principles, enabling adaptation in a country-driven localized, and consultative manner.

7. Finance:

- The private sector integrates physical climate risks into investment decisions and continues to innovate mechanisms for financing adaptation and resilience so as to enable the mobilization of the USD 140 to USD 300 billion that will be needed across both public and private sources.
- Public finance actors increase the provision of climate finance and allocate 50% of climate funds to adaptation and resilience.
- The global property and casualty insurance sector has an industry capabilities framework, actively supports project implementation, and institutionalizes a longer-term industry approach to climate adaptation.

Major initiatives announced in the COP 27 meeting: India's Participation in COP27: 2

- The Environment Minister of India Shri Bhupender Yadav is leading the Indian delegation to COP-27.
- India would press developed countries to fulfil their commitment to delivering \$100 billion of climate finance annually.
- It would also press for enhanced transparency and more institutional mechanisms to make these funds available to developing countries that are most vulnerable to climate change.