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**SCIENCE AND
TECHNOLOGY**

- Learning Through Maps
- Academic Vitamins
- Current Affairs
- Target Mains
- To The Point

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Reservation Not a Fundamental Right,
Russia-India-China (RIC) Grouping,
One Sun One World One Grid,
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and much more...



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THIS MAGAZINE IS A RESULT OF TEAM
COLLABORATION. WE EXPRESS OUR GRATITUDE
TO ALL OUR TEAM MEMBERS. APART FROM THE
GIVEN NAMES, SEVERAL FREELANCE WRITERS
HAVE ALSO MADE IMPORTANT CONTRIBUTIONS.

DEAR ASPIRANTS,

The Pandemic has attained its peak in some of the countries and they are witnessing a decrease in the per day count of cases. This is not the case with India. The government had imposed stringent lockdown to break the chain of spread but later, considering other necessities, it gradually eased the restrictions which is now limited only to containment zones. Nevertheless, given the length and breadth of our country and a population of around 1.3 billion, the peak seems to be elusive. Though the number of recovered cases has surpassed the number of active cases the danger still looms large and the situation demands the two-fold strategy of prepare and prevent. That is, prepare for any worst-case scenario of rise in cases and prevent the spread by incorporating the necessary precautions in the lifestyle.

The limited social interactions can result in depression and other mental issues. So, as a civil services aspirant, we also have to cope with the current situation by maintaining the rhythm of our preparation. We have to prepare for the examination with full zeal and prevent the spread of coronavirus with all the precautions needed.

UPSC has proposed to conduct the Prelims 2020 on the 4th of October which was earlier scheduled to be conducted on 31st of May. Like every black cloud has a silver lining, this extra time for the Prelims may prove to be the silver lining in the time of pandemic. This gives us ample time to get back to exam-oriented mindset and tune our daily life to exam preparation mode. Nothing is permanent in this nature and so will be this disease. We must utilize this time for efficient preparation of the examination and our strategy should be smart and full of productivity.

With this vision, we at Drishti constantly endeavour to make your days more productive and fruitful and help you attain your goal. This edition of Drishti Current Affairs Today comprises the special supplement on Science and Technology. It will be of enormous use for our readers.

Wishing you all the best in your future endeavours.
We look forward to your feedback and suggestions

With Best Wishes

(Dr. Vikas Divyakirti)

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Polity & Governance

Reservation Not a Fundamental Right: Supreme Court

Recently, the Supreme Court of India has directed that **reservation of seats** provided to certain communities is **not a fundamental right**.

Key Points

■ Background:

- All political parties from Tamil Nadu had filed a writ petition in the Supreme Court seeking direction to the Centre to implement **50% Other Backward Class (OBC) reservation** in the all-India NEET seats surrendered by the state.
- They have accused the Centre of “**violating the right of the people to have a fair education**” by neither implementing the 50% quota for OBC in Tamil Nadu nor providing 27% reservation for OBC candidates in other states for the All India Quota seats.

■ Highlights of Judgement:

- However, the Supreme Court pointed that a **writ petition** under **Article 32** of the Constitution can be filed only in case of violation of fundamental rights.
- The Court observed that the Right to Reservation is not a fundamental right.
 - ◆ Earlier, the Court had ruled that reservation in promotion is not a fundamental right.

Writ Jurisdiction

- The Supreme Court under **Article 32** and the High courts under **Article 226** of the Constitution can issue the writs of habeas corpus, mandamus, prohibition, certiorari and quo-warranto.
- The Parliament under Article 32 can also empower any other court to issue these writs. However, no such provision has been made so far.

Constitutional Background

■ Articles Involved:

- **Article 15 and 16** of the Constitution empower the State to make special provisions in education and jobs respectively for the **socially and educationally backward section** of the society and for the **economically weaker** section.

- Although these provisions are mentioned in Part III (fundamental rights) of the Constitution, their nature is like directives to the state i.e. they are **not binding on the state**.

■ Implementation:

- The quota for SCs is 15% and for STs it is 7.5%
- The quota limit for OBCs is 27%. However, various state governments have different quota limits for OBCs in their state. E.g Tamil Nadu (50% reservation for OBCs).
- The 103rd Constitution Amendment Act, 2019, empowers both Centre and the states to provide 10% reservation to the EWS category of society in government jobs and education institutions.

Secrecy of Ballot

In a recent judgement, the Supreme Court has held that **secrecy of ballot is the cornerstone** of free and fair elections.

- The choice of a voter should be free which is ensured by the secret ballot system in a democracy.

Key Points

■ Highlights of the Judgement:

- The SC held that the principle of secrecy of ballots is an important postulate of constitutional democracy and referred to **Section 94 of the Representation of People Act (RPA) 1951**.
 - ◆ The section upholds the privilege of the voters to maintain confidentiality about their choice of the vote.
- The law must protect the right of voters to the secrecy of the ballot. Even a remote or distinct possibility that a voter can be forced to disclose for whom she/he has voted would act as a positive constraint and a check on the freedom to exercise the franchise.
- However, a voter can also voluntarily waive the privilege of non-disclosure.
 - ◆ The privilege ends when the voter decides to waive it and decides voluntarily to disclose their vote.

Nation & States

Increased Stubble Burning in Punjab

Punjab has been experiencing a problem of **stubble burning** once again despite the **government's efforts to control the practice since last few years.**

Key Points

- Total **13,026 incidents** have been reported in **2020** compared to **10,476 incidents in 2019** and **11,236 in 2011.**
- The ban and action against people burning the crop residue is regulated under the **Air (Prevention and Control of Pollution) Act, 1981.**

Stubble Burning

■ Description:

- Stubble (parali) burning is the act of setting fire to crop residue to remove them from the field to sow the next crop.

■ Causes:

- The problem arises due to the **use of mechanised harvesting** which leaves several inches of stubble in the fields.
 - ◆ Earlier, this excess crop was used by farmers for cooking, as hay to keep their animals warm or even as extra insulation for homes. But, now the stubble use for such purposes has become outdated.
- In order to plant the next crop, farmers in Haryana and Punjab have to remove the stubble in a very short interval to avoid considerable losses. Therefore, burning is the cheapest and fastest way to get rid of the stubble.
 - ◆ The leftover parali in the field may pose the threat of the pest attacks to the upcoming crop.

■ Effects:

- The stubble burning emits large amounts of toxic pollutants in the atmosphere which contain harmful gases like **methane (CH₄), Carbon Monoxide (CO), Volatile organic compound (VOC) and carcinogenic polycyclic aromatic hydrocarbons.**
- The burning of wheat straw **reduces the soil fertility,** besides polluting the environment.

- Additionally, the heat generated by stubble burning penetrates into the soil, leading to the **loss of moisture and useful microbes.**

■ Alternative Use of Stubble:

- The stubble can be used for preparation of the **high-grade organic fertilizers** by mixing with cow dung and few natural enzymes.
- **The stubble can be converted to bio coal** and also can be used for **electricity generation.**

Way Forward

- An expansion of schemes like the **Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)** for harvesting and composting of stubble will help to resolve the dual problem of unemployment and stubble burning.
- The establishment of the **Farm Machinery Banks (FMB)** for custom hiring of in-situ crop residue management machinery.
- However, in the longer time span, shifting the **cropping pattern** away from paddy to maize, cotton, fruits or vegetables in Punjab, Haryana and UP will also help to resolve the issue.

Restriction on Paddy Cultivation

The **farmers from Haryana** are opposing the State Government's order under which **farmers have to diversify at least 50% of their last-year cultivated paddy (rice) area by growing alternate crops.**

Key Points

■ Government's Action:

- The restriction of cultivation is under the state government's crop diversification scheme '**Mera Pani, Meri Virasat**' for **replacement of paddy by alternative crops in 1 lakh hectare.**
 - ◆ Under the scheme, farmers **sowing alternative crops** other than paddy during the ensuing kharif season will get an **incentive of ₹7,000 per acre.**
- According to the Government, the step is aimed at **water conservation and crop diversification.**

Economic Scenario

22nd Meeting of FSDC

Recently, the **22nd meeting** of the **Financial Stability and Development Council (FSDC)** chaired by the **Finance Minister** was held through a video conference.

- The meeting reviewed issues relating to market volatility, domestic resource mobilisation and capital flows in the country in the wake of Covid-19 pandemic.

Financial Stability and Development Council

■ Establishment:

- The Financial Stability and Development Council (FSDC) is a **non-statutory apex council** under the **Ministry of Finance** constituted by the **Executive Order** in 2010.
- The **Raghuram Rajan committee (2008)** on financial sector reforms first proposed the creation of FSDC.

■ Composition:

- It is **chaired by the Finance Minister** and its members include the heads of all Financial Sector Regulators (RBI, SEBI, PFRDA & IRDA), Finance Secretary, Secretary of Department of Economic Affairs (DEA), Secretary of Department of Financial Services (DFS), and Chief Economic Adviser.

- ◆ In 2018, the government reconstituted FSDC to include the Minister of State responsible for the Department of Economic Affairs (DEA), Secretary of Department of Electronics and Information Technology, Chairperson of the Insolvency and Bankruptcy Board of India (IBBI) and the Revenue Secretary.

- FSDC sub-committee is headed by the **Governor of RBI**.

■ Functions:

- The objective of FSDC is to **strengthen and institutionalize** the mechanism for maintaining **financial stability**, enhancing inter-regulatory coordination and promoting financial sector development.
- It also intends to monitor macro-prudential supervision of the economy. It will assess the functioning of the large financial conglomerates.

Key Points

■ Covid-19 as a Threat to Global Economy:

- The Council has noted that the Covid-19 pandemic poses a **serious threat to the stability of the global financial system**, as the ultimate impact of the crisis and the **timing of recovery remains uncertain**.
- The pandemic has thrown the global economy into its **worst recession since the Great Depression in the 1930s**, and India is no exception.

■ Projected Domestic Economic Growth:

- Domestic economic growth is expected to **contract for the first time in forty years in FY21 (April 2020 to March 2021)**.
- Crisil, Goldman Sachs and Fitch Ratings have projected the Indian economy to contract 5% during the current financial year.

■ Announced Measures and its Impact:

- The Council quoted the various **short term** fiscal measures taken by the government and monetary measures taken by the Reserve Bank of India (RBI) to address the liquidity and capital requirements of the financial institutions to manage the economic scenario due to global pandemic.
- It also reviewed the **liquidity and solvency position** of the Non-Banking Financial Companies (NBFCs), housing finance companies and micro-finance institutions.
- Moratoriums on loan payments due to pandemic induced lockdowns have put a pressure on inflows of these companies while banks have turned resistant to lend them in the wake of possible defaults. NBFCs have also sought moratorium on their dues to banks.

■ Role of Government and Regulators:

- It highlighted the need for the **government and regulators to remain vigilant** on financial conditions that could expose systemic vulnerabilities in the **medium and long-term**.
- The Council stressed that the government and regulators would continue to provide **liquidity and capital support** to domestic financial institutions.

Way Forward

- The financial system resilience, fiscal support, regulatory flexibility and liquidity provision announced till date have ensured that the financial system is supportive of economic recovery but **more protracted slowdown may present new risks to the financial system**.
- There is a possibility that the current crisis **may transform from a “liquidity phase” into a “solvency phase”**. Thus, governments need to consider a range

International Relations

Mediation Between India and China

Recently, the USA President has offered **to mediate between India and China over the Indo-China border standoff**.

- The offer has come in the backdrop of the ongoing standoff between India and China along the Line of Actual Control (LAC).
- There has been a marked **increase in the number of Chinese transgressions** across the disputed India-China border in Ladakh.
 - In Ladakh, a surge of **75% have been observed in 2019 compared to 2018** and the first four months of 2020 have also witnessed an increase compared to 2019.

Background

- Currently, India and China faces standoff at least **four points** along the LAC, including **Pangong Tso lake, Demchok and Galwan Valley in Ladakh and Naku La in Sikkim**.
- The tensions between two countries **escalated along the LAC after China ordered the military to scale up battle preparedness** and asked it to resolutely defend the country's sovereignty.
 - Subsequently, India has also increased its presence on the boundary with China in North Sikkim, Uttarakhand, Arunachal Pradesh, along with Ladakh.
- So far, at least six rounds of talks have been held between Indian and Chinese military commanders in Ladakh on the ground but have **failed to achieve a breakthrough**.

Key Points

- **Offer by USA:**
 - The USA President has informed both India and China that the United States is **willing and able to mediate or arbitrate their raging border dispute**.
 - It is the **first time** that the USA made such an offer to **India and China**, referring to the LAC situation as a **"raging border dispute"**.

- ◆ In the past, the USA had offered to mediate between **India and Pakistan over Kashmir** but it was rejected by India. India had cleared its position stating that the issue can only be discussed bilaterally.
- The offer comes amid ongoing issues between the USA and China over the origin of Covid-19 and trade tensions between the two countries.
 - ◆ Also the USA's National Security Adviser had indicated that the U.S. could impose sanctions on both Beijing and Hong Kong, if **China were to go ahead and impose a national security law on Hong Kong**.



- **China's Stand:**
 - China has cleared that both countries would **resolve the standoff bilaterally**. It has also stated that the situation at the border with India is **"overall stable and controllable"**.
 - It has also stated that India and China have good **border related mechanisms and communication channels** and any issue can be resolved through dialogue and consultation.

Environment & Ecology

Heat Waves

Recently, the India Meteorological Department (IMD) has forecasted the **"heatwave to severe heatwave conditions"** over northwest, central and adjoining peninsular India along with heavy rain over northeast India.

- Many parts of coastal Andhra Pradesh, Odisha and Maharashtra have also observed increase in temperatures above 42°C, triggering heatwave conditions.
- The heat wave has been observed due to dry northwesterly winds prevailing over northwest and central India.

India Meteorological Department

- The India Meteorological Department (IMD) was established in 1875.
- It is an agency of the Ministry of Earth Sciences of the Government of India.
- It is the principal agency responsible for meteorological observations, weather forecasting and seismology.

Heat Wave

■ Description:

- A heat wave is a period of **abnormally high temperatures**, more than the normal maximum temperature that occurs during the summer season in the North-Western and South Central parts of India.
- Heat waves typically occur between **March and June**, and in some rare cases even extend till July.
- Higher daily peak temperatures and longer, more intense heat waves are **becoming increasingly frequent globally** due to climate change.

■ Impacts:

- The health impacts of Heat Waves typically involve dehydration, heat cramps, heat exhaustion and/or heat stroke. It also causes heat cramps, fatigue, weakness, dizziness, headache, nausea, vomiting, muscle cramps and sweating.
- The extreme temperatures and resultant atmospheric conditions adversely affect people living in these regions as they cause physiological stress, sometimes resulting in death.

Criteria for Heat Waves

- The heat wave is considered when the maximum temperature of a station reaches at least **40°C for Plains** and at least **30°C for Hilly regions**.
- If the normal maximum temperature of a station is **less than or equal to 40°C**, then an **increase of 5°C to 6°C** from the normal temperature is considered to be heat wave condition.
 - Further, an increase of 7°C or more from the normal temperature is considered as severe heat wave condition.
- If the normal maximum temperature of a station is **more than 40°C**, then an increase of 4°C to 5°C from the normal temperature is considered to be heat wave condition. Further, an increase of 6°C or more is considered as severe heat wave condition.
- Additionally, if the actual maximum temperature remains **45°C or more irrespective of normal maximum temperature**, a heat wave is declared.

Way Forward

- While climate change does have a strong link with the occurrence of extreme weather events, it isn't the cause for extreme weather events.
- Episodes of heat waves are growing more common as climate change intensifies. Therefore, **the intensity and frequency of heatwaves can be reduced if the global community adopts and adheres to a lower emissions scenario in the future.**

Wildfires in Uttarakhand

Recently, the state of Uttarakhand has experienced the peak of the forest fire season.

Wildfires

■ Description:

- A wildfire is an **unplanned fire** that is often caused by human activity or a natural phenomenon such as lightning, and they can happen at any time or anywhere.
- Wildfires occur in every continent **except Antarctica**.

Science & Technology

South Atlantic Anomaly

Recently, the **Swarm constellation of satellites of the European Space Agency (ESA)** has updated the development of **South Atlantic Anomaly (SAA)**.

- The South Atlantic Anomaly signifies weakening of the Earth's magnetic field between Africa and South America.
- However, it has been observed that the present dip in intensity of the Earth's magnetic field is within the normal fluctuation levels.

Swarm Constellation Mission

- Swarm is European Space Agency's first constellation of satellites for Earth observation.
- It consists of three satellites designed to identify and precisely measure the different magnetic signals that make up Earth's magnetic field.
- The mission is operated by ESA's European Space Operations Centre (ESOC), in Germany, via the primary ground station in Kiruna, Sweden.

Earth's Magnetic Field

■ Description:

- Earth's magnetic field, or the geomagnetic field, is the magnetic field that extends from the **Earth's interior** out into space exerting a force on the charged particles emanating from the Space including Sun.
- The earth's south magnetic pole is actually near the North Pole and the magnetic north pole is near the South Pole. This is why a compass magnet's north pole actually points north (Since opposite poles attract each other).

■ Reasons for Presence:

- The magnetic field of the Earth is due to the **metallic and liquid outer core** of the planet.
- The outer core of the planet is like a **giant dynamo**. The rotation of the Earth creates movements inside the liquid outer core which gives rise to the geomagnetic field.

■ Significance:

- It creates **electric currents** that generate and change our electromagnetic field.

- The **Northern Lights** in the Polar Regions are caused by the magnetic field of Earth – the energy particles emitted by the Sun are channelled by the Earth's magnetic field towards the poles, where they interact with the atmosphere to create the aurora borealis.
- The Earth's magnetic field also plays an important role in **protecting the planet from solar winds and cosmic radiation that are harmful**.

Key Points

■ Intensification of SAA (Weakening of Magnetic Field):

- Scientists have discovered that Earth's magnetic field has **lost around 9%** of its strength over the **last 200 years**.
- Further, the strength of the field has dropped from around **24,000 nanoteslas to about 22,000 nanoteslas between 1970 and 2020**.
- It has also observed an intensified weakening of magnetic fields in the **southwest of Africa**. The eastern minimum of the South Atlantic Anomaly has appeared over the last decade and has been developing vigorously. This scenario indicates that the South Atlantic Anomaly could split into two separate low points.

■ Significance of SAA:

- It has been speculated that the current weakening of the field is a sign of the **pole reversal of the earth**– in which the north and south magnetic poles may switch places.
 - ◆ Pole reversal is not an uncommon event and it takes place every 250,000 years. Last it had happened 7.8 lakh years ago.
- Additionally, the SAA is expected to help **to understand the processes in Earth's core** and future developments in the earth's interior.

■ Implications:

- At surface level, the South Atlantic Anomaly presents **no cause for alarm**. It means that people won't feel the change even if the pole shift happens.

History, Art & Culture

Founder of Ahom Kingdom: Chaolung Sukapha

Recently, there has been a controversy in Assam regarding **Chaolung Sukapha who founded the Ahom kingdom**.

- Amidst the ongoing India-China border tension, he has been repeatedly referred to as a Chinese invader.

Key Points

■ Chaolung Sukapha:

- He was a 13th century ruler who **founded the Ahom kingdom** that ruled Assam for **six centuries**. The Ahoms ruled the land till the province was annexed to British India in 1826 with the signing of the Treaty of Yandaboo.
- He and his people reached Brahmaputra valley and in 1235 AD, finally settled in Charaideo in upper Assam.
- Sukapha established his first small principality in Charaideo, sowing the seeds of further expansion of the Ahom kingdom.



■ Ahoms:

- They created a new state by suppressing the older political system of the bhuiyans (landlords).
- The Ahom state depended upon **forced labour**. Those forced to work for the state were called **paiks**.
- Ahom society was divided into **clans or khels**. A khel often controlled several villages.
- Ahoms worshipped their own tribal gods but instead of imposing their own language, religion and rituals on communities living in Assam, they **accepted the Hindu religion and the Assamese language**.
 - ◆ However, the Ahom kings did not completely give up their traditional beliefs after adopting Hinduism.

- Ahom society was very **sophisticated**. Poets and scholars were given land grants and theatre was encouraged. Important works of Sanskrit were translated into the local language.

- ◆ Historical works, known as **buranjis**, were also written, first in the Ahom language and then in Assamese.

- Most of the Sukapha's people were men who later married women from communities living in Assam. Inter-marriage also increased assimilation processes.

■ Significance:

- Sukapha successfully assimilated different communities and tribes. He developed very amiable relationships with the tribal communities of Assam especially the **Sutias, the Morans and the Kacharis**.
- He is widely referred to as the architect of '**Bor Asom**' or '**Greater Assam**' because he consolidated power, culture and religion in the region and managed to group a diverse mix of people in such a politically sensitive region crisscrossing South Asia and South-East Asia.
- Assam celebrates '**Asom Divas**' on **2nd December every year** to commemorate Sukapha and his rule.

Way Forward

- Chaolung Sukapha was the architect of greater Assam and he laid the foundation for a robust and vibrant Assam through his policy of amity, unity and harmony.
- Offensive remarks on social media and misinterpretation of historical facts can lead to a rift between different communities in an ethnically diverse state like Assam and hurt the sentiments of people which should be avoided at any cost.

Veer Savarkar Jayanti

India paid tribute to the freedom fighter, **Vinayak Damodar Savarkar (Veer Savarkar)** on his **birth anniversary (28th May)**.

- He was an Indian independence activist, politician, lawyer and writer.
- He is also known as **Swatantryaveer Savarkar**.

Social Issues

Drop in Institutional Deliveries

Recently, the data from the states of **Chhattisgarh** and **Jharkhand** has reported a **drop in the institutional deliveries**.

Key Points

■ Current Scenario in Two States:

- **Chhattisgarh:** It has recorded a **drop by 15.39 % in April** compared to the numbers recorded in March.
 - ◆ In February 2020, before the lockdown was imposed, the State had recorded 37,984 institutional deliveries . But following the lockdown, the number of institutional deliveries fell to 32,529.
 - ◆ The State has recorded an increase in the percentage of institutional deliveries from 44.9 to 70.2 between NFHS 3 (2005-06) and NFHS 4 (2015-16).
- **Jharkhand:** The state had listed 52,000 women for scheduled deliveries in May, out of these only 5.9 % of these were conducted in medical institutions by May 21.
 - ◆ The State has recorded an increase in the percentage of institutional deliveries from 40.1 % to 61.9 % between NFHS 3 (2005-06) and NFHS 4 (2015-16).

■ Reasons for Drop in Institutional Deliveries:

- The **public transport** has been majorly affected due to **nationwide lockdown imposed** to contain the spread of the **Covid-19 pandemic**. Thus reaching hospitals from villages became difficult.
- The declared Covid-19 hospitals have created a **fear of infection** and thus people are **avoiding physical contacts** with the hospitals.
- Many deliveries are **being carried out at small private nursing homes** to avoid movement and related Covid-19 spread.
- The entire health machinery is battling Covid-19, so **non-Covid health services experience a lack of medical staff**.

Institutional Deliveries in India

■ Description:

- Institutional delivery means giving birth to a child in a medical institution under the overall supervision of trained and competent health personnel.
- It also signifies an availability of amenities to handle the situation and save the life of the mother and child.

■ National Scenario:

- Over the past two decades, India has made progress in increasing the number of institutional deliveries.
 - ◆ According to the National Family Health Survey (NFHS-4), institutional deliveries have increased from 39 % in 2005-06 to 79 % in 2015-16.
 - ◆ Further, the institutional births in public institutions have increased from 18 % to 52 % in the same time period.

■ Step Taken to Increase Institutional Deliveries:

- **Janani Suraksha Yojana:** Janani Suraksha Yojana (JSY) is a 100% centrally sponsored scheme which is being implemented with the objective of reducing maternal and infant mortality by promoting institutional delivery among pregnant women.
- **Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA):** It has been launched to focus on conducting special AnteNatal Check-ups (ANC) check up on 9th of every month with the help of Medical officers to detect and treat cases of anaemia.
- **Pradhan Mantri Matru Vandana Yojana (PMMVY):** It is a maternity benefit programme being implemented in all districts of the country with effect from 1st January, 2017.
- **LaQshya Programme:** LaQshya (Labour room Quality Improvement Initiative) intended to improve the quality of care in the labour room and maternity operation theatres in public health facilities.

Way Forward

- The entire health machinery is battling Covid-19 but non-Covid health services **should not compromise** which are the **base of the health infrastructure** of the country.
- The government should ensure adequate **availability of medical staff, emergency medical services** such as ambulance, vaccinations, maternity care, etc. to the **urban as well as rural areas**.
- The **balance of the Covid and non-Covid medical services** is need of the hour and the government needs to ensure the implementation of the same in the future.

DID YOU KNOW?

Katkari Tribe

- The name Katkari is derived from a **forest-based activity** – the making and bartering or sale of **Catechu** from the **Khair tree**.
- Katkari is one of the 75 **Particularly Vulnerable Tribal Groups (PVTGs)**.
 - The British administration had classified them under the **Criminal Tribes Act, 1871**.
- Katkaris were historically **forest dwellers**.
- Katkaris are located primarily in **Raigad and in parts of Palghar, Ratnagiri and Thane districts of Maharashtra** as well as in **some places of Gujarat**.

CoAST India

- The India Observatory has come up with a Geographic Information System (GIS)-enabled dashboard called **Collaboration/Covid Action Support Group (CoAST India)** to **monitor the movements of migrants**.
 - The dashboard has been made in collaboration with Foundation for Ecological Security (FES).

India Observatory

- It is India's **first socio, economic and ecological open-source integrated Geospatial data platform**.
- It has the '**India Data Platform**' at its core, which is built on open source and brings together data on over 1,600 parameters, ranging from village to national level in the form of maps, graphs, tables and infographics.
- The dashboard aims to make such data available to governments and small local civil society groups to be used for **planning and providing assistance to migrants**.

Puntius Sanctus: New Freshwater Fish

- Recently, **Puntius Sanctus**, a **new freshwater fish**, has been found in Velankanni, Tamil Nadu. It has been found in a small waterbody.



- The fish has been identified and named by the Department of Zoology, BJM Government College in Kollam. Sanctus means holy (pilgrim town) in Latin.
- Species of Puntius are known from India mainly from the drainages of the Western and Eastern Ghats, as well as the Eastern Himalayas.

Bug Bounty Programme

- The **National Informatics Centre (NIC)** has also launched a **Bug Bounty Programme for Aarogya Setu app**.
- The programme aims to partner with security researchers and Indian developer community to **test the security effectiveness of Aarogya Setu**.
- It is aimed at encouraging the Indian developer community to find security flaws in the app and get **rewarded ₹1 lakh**.

Fungal Powder to Boost Immunity

- The **Bodoland University (BU)** of Assam has developed a fungal powder to help people boost their immunity to Covid-19 disease.
- The fungal powder is from a parasitic but rare "**super mushroom**" called **Cordyceps militaris**.
- The super mushroom was powdered through **lyophilisation** (freeze-drying) at **-80°C**.
 - Lyophilisation, also known as freeze-drying, is a dehydration method applying low temperatures and reduced ambient pressure.

ECONOMIC AND POLITICAL WEEKLY



SUMMARY OF EDITORIALS AND ARTICLES: 14, 28 MARCH, 18 APRIL

Reading Ambedkar in the Time of COVID-19

Like demonetisation earlier, this unplanned lockdown due to COVID-19 is a man-made and policy-induced crisis. The “social distancing” induced by the COVID-19 health crisis does not address the problem of deeper levels of distancing caused by “social isolation” and “social nausea,” two concepts used by B R Ambedkar.

Restructuring of Society

- Our policymakers usually tend to forget the majority of the population while making such drastic decisions. So, it becomes difficult to understand the pathological distance between classes/castes and the policy blindness towards concerns of the oppressed in India.
- Experts have pointed out that the best way to fight the present and persistent danger of COVID-19 is to maintain physical distance from and contact (“social distancing”) with other individuals.
- In the Indian context, social distancing is a sociocultural phenomenon. Corona-induced social distancing does not address the problem of deeper levels of distancing caused by “social isolation” and “social nausea”.

Separation of Interests

- Individuals are embedded in classes or social groups and, therefore, individuals only exist as socialised individuals.
- In every society, there are two broad classes - the labouring class and the leisure class. There are concrete historical, ideological and material bases for these classes to exist in the society.
- However, there is a socio-psychological element that is highly significant in explaining the persistence of this class divide and how these classes deal with modern democracy.
- The problem is that every such group is, by definition, inward-looking and only concerned with their own interests, as “social stratification” makes these groups “impervious to the interest of others”.
- Every caste maintains distance from others. But the problem lies with the process of social isolation in the oppressed castes, classes and groups.

- The only way out of this social dilemma is through, what John Dewey calls, the process of “social endosmosis” between groups and, in turn, through that the achievement of the goal of “social efficiency.”
 - Social endosmosis refers to the varied possibilities and channels of communication available in society between different classes and social groups.
 - Social efficiency is that socialisation of the mind which is actively concerned in making experiences more communicable”.
- An important implication of the process of social endosmosis in segregated and fractured societies is that it is possible for an individual born in an oppressed group to achieve social mobility and enter the ruling class.

Antagonism of Interests

- The Indian society is unique given the prevalence of endogamous castes as its building blocks.
- The caste system exists with castes characterised by graded hierarchy. Here, the social organisation in terms of social groups is fixed with respect to membership.
- According to Ambedkar, Indian society is characterised by a birth-based graded hierarchy of social groups.

Social Nausea

- In the Untouchables, Ambedkar says: “Untouchability is an aspect of social psychology. It is a sort of social nausea of one group against another group”.
- This social nausea takes the form of explicit social boycott against the Dalits if they are seen to be getting too mobile from their social stations.
- This results in the invisibility of Dalit interests or outright denial of their demands in the policy.
- The separation of interest among social groups transforms into active hostility and antagonism of class - caste interests in the case of India.
- This happens because of the feeling of social nausea in one caste against another and by every caste against the Dalits.



GIST OF MAJOR ARTICLES FROM THE JUNE 2020 ISSUE

Industry 4.0

The world is witnessing the transition which is bringing out digitisation in manufacturing. This transition is so compelling that it is being called Industry 4.0 to represent the 4th revolution that has occurred in manufacturing.

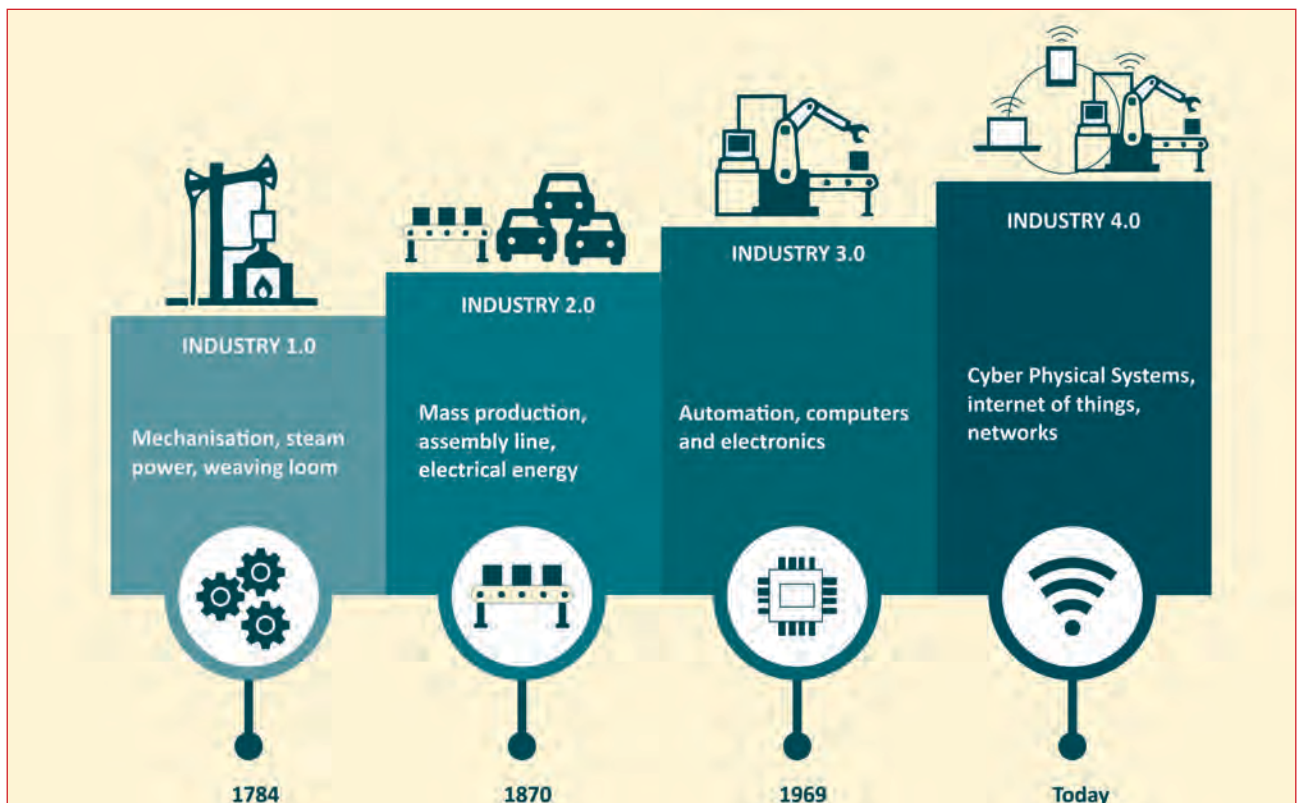
Key features

- Industry 4.0 encompasses three technological trends driving this transformation: **connectivity, intelligence and flexible automation**.
- Industrial revolutions have a huge impact on our society and they also affect the world economy.
 - The 1st industrial revolution came with the advent of mechanisation, steam power and water power.
 - The 2nd industrial revolution revolved around mass production and assembly lines using electricity.

- The 3rd industrial revolution came with electronic and IT systems and automation.
- The 4th industrial revolution is associated with cyber-physical systems.

Technologies to boost Industry 4.0

- The Internet of Things (IoT), the Industrial Internet of Things (IIoT), Cyber-physical Systems (CPS), Smart Manufacturing, Smart Factories, Cloud Computing, Additive Manufacturing, Big Data, Robotics, Cognitive Computing, Artificial Intelligence & Blockchain, etc.
- The 4th industrial revolution also relates to digital twin technologies. These digital technologies can create virtual versions of real-world installations, processes and applications that can then be robustly tested to make cost-effective decentralised decisions.





GIST OF MAJOR ARTICLES FROM THE JUNE 2020 ISSUE

Water Management: Towards Sustainable Agriculture

Sustainable water management in agriculture aims to match water availability and water needs in quantity and quality, in space and time, at a reasonable cost and with acceptable environmental impact.

What is Sustainable Agriculture?

- Sustainable agriculture is a form of agriculture aimed at meeting the needs of the present generation without endangering the resource base of future generations. Thus, a holistic and systematic approach is essential for achieving sustainability.
- Such systems aim to produce qualitative and nutritious food without harming human health and the ecosystem.
- **There are following ways to sustain agricultural productivity:**
 - Soil management through conservation agriculture, organic farming, integrated nutrient management system and on-farm residue management;
 - Efficient water resource management techniques like right method of irrigation, micro-irrigation, life-saving irrigation, use of mulches etc.;
 - Crop management includes the right time of sowing, cultivation of suitable crops and varieties in rotation, intercropping, mixed-cropping, integrated pests management, etc.
- The sustainability in agriculture i.e. for crops/cropping systems primarily depends upon the availability of water in its optimum quantity and acceptable quality.
- Especially in areas of water scarcity, the major need for the development of irrigation is to minimise water use.

Water Resources in India

- Rainwater is the primary source to meet the demand of water in Indian agriculture.

- India annually receives rainfall of 1,085 mm out of which three-fourth is through south-western monsoon activity.
- The major source for irrigation is groundwater and its amount is getting reduced at a fast pace.
- India has one of the largest net irrigated areas in the world but the productivity of irrigated areas at the national level, it is only around 3 tonnes per hectare.
- The efficiency of surface irrigation systems is around 30–40% which implies that at least 60% of the water being supplied is being lost.

Efficient Water Management Practices

- Efficient and sustainable water management practices in agriculture aim to match water availability and water needs in quantity and quality, in space and time, at a reasonable cost and with acceptable environmental impact.
- Many parameters like crop growth stage and its sensitivity to water stress, climatic conditions and water availability in the soil determine when to irrigate or the so-called irrigation frequency.
- Indian Council of Agricultural Research (ICAR) institutions and All India Coordinated Research Projects (AICRPs) have developed a plethora of technologies which are described below:
 - **Laser Land Levelling**
 - Proper land levelling is one of the management options which increases the water application efficiency which leads to higher yields as well as the rise in water use efficiency.
 - It also has a direct impact on nutrient use efficiency.
 - **Irrigation Scheduling**
 - It is the decision-making process for determining when to irrigate the crops and how much water to apply where the goal is to supply the plants with sufficient water while minimising loss to deep percolation or runoff.

DOWN TO EARTH



GIST OF MAJOR ARTICLES FROM 31 MAY AND 15 JUNE ISSUES

Distress Draft

Recently the Centre has decided to amend the power law, the Electricity Act, 2003, which could take away the power from States and give them to private firms. The Draft Electricity (Amendment) Bill 2020 makes three key proposals: abandon the existing subsidy and cross-subsidy model, allow private parties in power distribution as sub-licensee, and create an Electricity Contract Enforcement Authority (ECEA).

Problem Areas

- As per the existing subsidy and cross-subsidy model, the State government charges more from rich power consumers like industrial units and provides subsidy to weaker sections.
 - But the draft bill suggested one tariff for all. The State government may later pass on the subsidy as Direct Benefit Transfer to the beneficiaries.
 - This means, people would have to first pay up and then wait for the subsidy to reach them.
- The draft introduces the concept of “distribution sub-licensee”. This gives discoms the power to authorise another company to distribute electricity in the state without a separate licence.
 - Similarly, the existing “distribution franchisee” can distribute electricity without separate approval from the authorities. Experts say this is a gradual movement towards privatisation of distribution.
 - It may begin from a public sector company like the National Thermal Power Corporation (NTPC) and gradually move towards the private sector.
- The power to settle disputes between the generation and distribution companies would vest in ECEA, which would have the status of a civil court.
 - It would be the sole authority to adjudicate conflicts over power purchase and sale contracts. Its decisions can be challenged only at the Appellate Tribunal and, finally, at the Supreme Court.

- This means that the aggrieved party would no longer have the right to approach the High Courts for dispute settlement.

Conclusion

Past experiences with the private sector had failed in Bihar, Madhya Pradesh and Maharashtra. This put the privatisation of the power sector in a blur frame and needed to reframe the draft bill based on extant needs.

Roots of Water Scarcity

Nature-Based solutions like planting of trees and restoration of forests are often touted as the panacea for water conservation. But some studies suggested that afforestation is going to need more water to grow these plants.

Key Points

- Studies conducted in various parts of the globe, especially in semi-arid and arid regions have shown that blind afforestation does not increase water supply.
- When sparsely vegetated land is converted into forest, there is a reduction in blue water (available for human use) and increase in green water (part of water available for plant use).
- According to the **mass balance principle**, if more water is used by trees, less water will flow into rivers and lakes or recharge the groundwater that people can directly use.
- There are three aspects to be considered while planting trees for water conservation:
 - First is that of scale. In general, forest expansion of 2 sq km or more can increase the possibility of rainfall. Trees transport water to the air, and water vapour moves to another location, which can be far from the afforested area.
 - The second aspect is what kind of tree species must be planted for water conservation. Invariably, fast growing broad leaved species such as



ESSAY WRITING

COMPETITION

“A drop of ink may make a million think.”

- PAPER-I (250 Marks, UPSC CS Main Examination): “Essay: Candidates may be required to write essays on multiple topics. They will be expected to keep closely to the subject of the essay to arrange their ideas in orderly fashion and to write concisely. Credit will be given for effective and exact expression.” That is what the UPSC says about the Essay paper in the CSE notification. Through an essay, the commission wants to know if you will make the right civil servant who has balance of judgement, variety and depth of interest, logical exposition and other such bureaucratic qualities.
- Keeping this in mind, we present a forum where you are asked to practice your writing skills by writing essays on the given topics. The topics are decided keeping in view the thematic trends in CS (Mains) examination.
- If that is not all, the best essays shall be rewarded and published. We’ll judge the essay based upon four parameters viz. Structure of the essay, Content, Flow and Language.
- The prize details are as follows:

First Prize: 6 Months Subscription

Second Prize: 4 Months Subscription

Third Prize: 2 Months Subscription

Essay Writing Competition—51

Topic:

‘Politics, bureaucracy and business – the fatal triangle.’

Terms and Conditions—

1. The essay shall be of length between 1000-1200 words.
2. It should be neatly written or printed on A4 sheets.
3. Only one entry per participant is allowed.
4. Entries are to be sent by Registered/speed post only on following address: EXECUTIVE EDITOR, DRISHTI CURRENT AFFAIRS TODAY, 641, FIRST FLOOR, DR. MUKHERJEE NAGAR, DELHI-110009. Please mention ‘For Essay Competition’ in capital letters on the envelope.
5. Remember to submit your personal details on the form printed on this page after neatly tearing it off the marked pointers. Submissions without this form shall not be entertained.
6. Your essay must reach the given address before **20th July, 2020**. Entries reaching us after the given date will not be accepted.
7. Essays should be original and not plagiarized or copied except for properly quoted references. Prior published or awarded essays will not be accepted.
8. All rights related to the results of the competition are secure with ‘Drishti Current Affairs Today’. The winners shall be announced in the subsequent issue of the magazine and the winners shall be contacted by email and telephone.
9. Copyrights of the rewarded essays will lie with the magazine which may be used in any way by ‘Drishti Publications’.



Form for Essay Competition-51

(Kindly cut and attach this form along with your essay. Use original form and not photocopy.)

Name of participant: Mobile no.

Address:

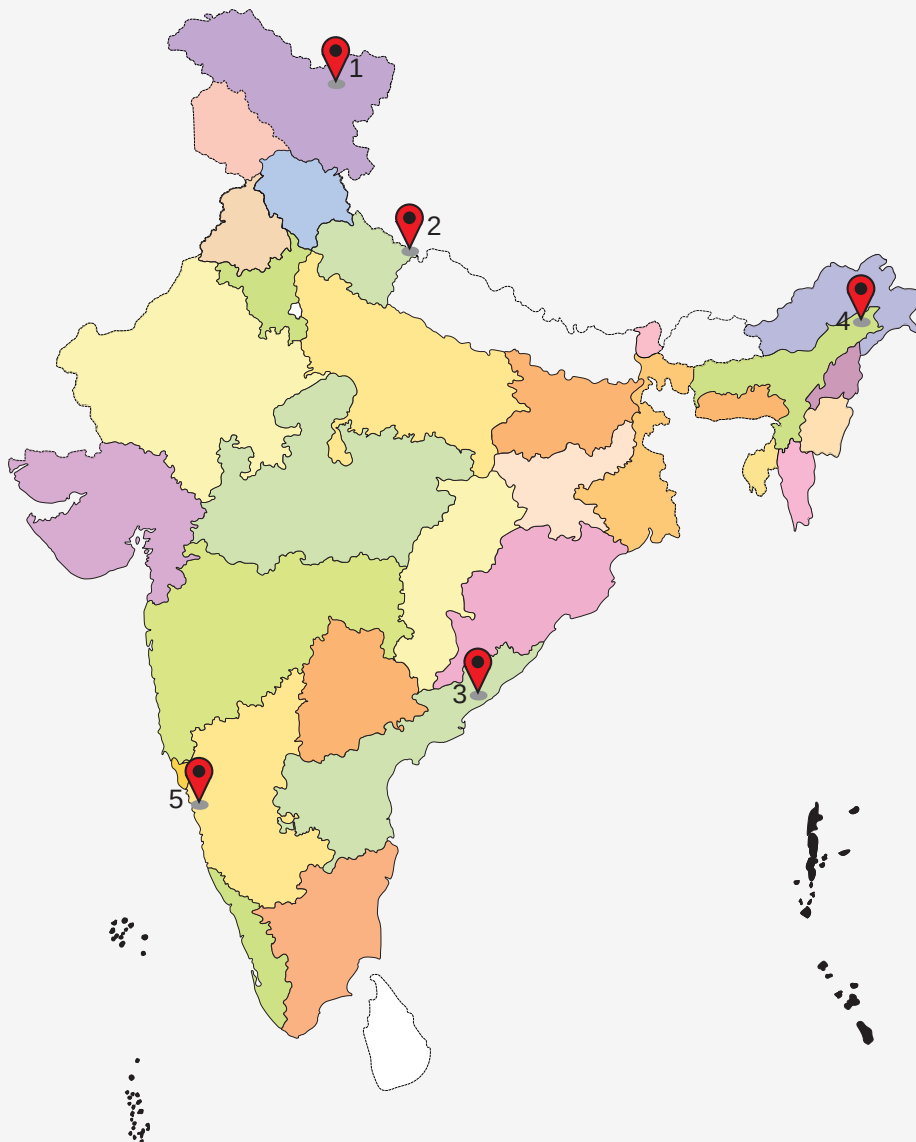
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Pin code: Email ID:



LEARNING

MAP-1

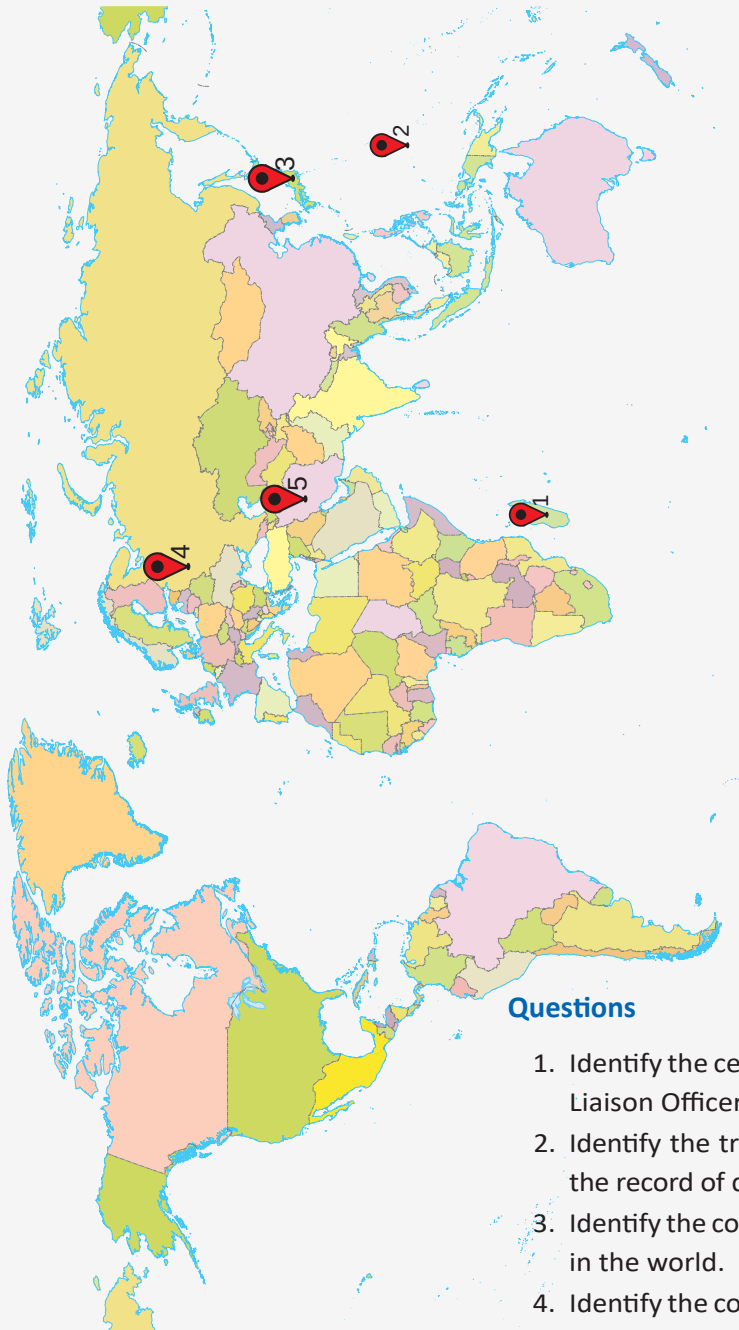


Questions

1. Identify the river valley where India and China standoff took place recently.
2. Identify the pass which is at the tri-junction of India, Nepal and China and the metalled road was recently laid down till there.
3. Identify the Naval base on which Missile Park is going to be set up.
4. Identify the region where a natural gas well exploded recently.
5. Identify the region where a monkey park is planned to be set up.

(Answers : Refer to Page No. 162)

THROUGH MAPS



Questions

1. Identify the centre where India is looking to post a Navy Liaison Officer.
2. Identify the trench where an American explorer broke the record of deepest dive.
3. Identify the country whose supercomputer is the fastest in the world.
4. Identify the country which observes Victory Day Parade every year.
5. Identify the region in the Middle East where a huge explosion took place recently.

(Answers : Refer to Page No. 162)



TO THE POINT

Designed to hit the bull's eye: Point wise, short, crisp material in an easy-to-understand format.

Labour Laws

As the economy struggles with the lockdown and thousands of firms and workers stare at an uncertain future, some states have made significant changes in the labour laws. Labour comes under the concurrent list of the Indian Constitution.

Changes in Labour Laws by the States

- The Madhya Pradesh government has disabled the applicability of a majority of provisions of the Industrial Disputes Act, 1947 for new manufacturing units.
- Uttar Pradesh has defunct the labour laws for the next three years to provide a cushion to the sagging businesses and factories in the state.
- Rajasthan has amended the Industrial Disputes Act to increase the threshold for lay-offs and retrenchment to 300 from 100 earlier.
- In Maharashtra, all the shops and factories were asked to submit consolidated annual returns instead of multiple returns under various labour laws.
- Kerala would facilitate new industrial licence within a week after the application is filed.
- Punjab, Himachal Pradesh and Gujarat have also amended their Factories Acts to increase the work time to 12 hours.

Pre-COVID Amendments in Labour Laws

- Under the Payment of Bonus Amendment Act, eligibility limit for payment of bonus enhanced from ₹10000/- to ₹21000/- per month and the calculation of ceiling from ₹3500/- to ₹7000/- or the minimum wages.
- Payment of Wages (Amendment) Act, 2017 enabling payment of wages to employees by cash or cheque or crediting it to their bank account.
- Child Labour (Prohibition and Regulation) Amendment Act, 2016 provides for a complete ban on employment of children below 14 years in any occupation or process.
- Maternity Benefit (Amendment) Act, 2017, increases the paid maternity leave from 12 weeks to 26 weeks.
- The Payment of Gratuity (Amendment) Act, 2018, provides flexibility to the Central Government to increase the ceiling limit of gratuity.

Negative Impacts of Changes

- The changes in labour laws will not only strip the labour of its basic rights but also drive down wages. For instance, what stops a firm from firing all existing employees and hiring them again at lower wages.
- Far from pushing for a greater formalisation of the workforce, this move will in one go turn the existing formal workers into informal workers as they would not get any social security and seek grievance redressal.
- 'No work, no pay' cannot be enforced anymore. The code of conduct as per the approved standing orders will not exist.

Positive Impacts of Changes

- Output and employment growth in labour-intensive industries was slower in states with more rigid labour laws as compared to others.
- Organisations will have an easier time adjusting to market conditions leading to growth and better benefits for workers.
- The move by the state governments may help bring about some procedural relief for businesses. For instance, in Madhya Pradesh, factories falling in the non-hazardous category and employing less than 50 workers will be exempt from the inspection processes.

Relevance of Labour Laws

- **International uniformity:** In attaining international uniformity, International Labour Organization (ILO) aims at securing a minimum standard on a uniform basis in respect of all labour matters.
- **National economy:** National economy is another guiding principle of labour legislation. It increases the efficiency of workers and satisfies their needs.
- **Social equality/welfare:** They help the employees to improve their social status i.e. material and morale of the workers by providing adequate wages and safety measures, ensuring appropriate working hours and health facilities.

D C A T

TARGET MAINS

PAPER-I

Question 1. *The Khudai Khidmatgar Movement holds its own importance in the Indian Freedom Struggle. Give a brief account of this Movement and discuss its significance.*

Answer: In 1929, the Khudai Khidmatgar ("Servants of God") movement, led by Khan Abdul Ghaffar Khan, nonviolently mobilized to oppose the British in India's Northwest Frontier Province.

About the movement

- Members of the movement were known as **Red Shirts** because of the red uniforms they wore.
- Inspired by the dissidence of the INC and the charismatic spiritual-political leadership of Mahatma Gandhi, the Red Shirts blossomed during the Civil Disobedience movement.
- The British responded to their mobilization by putting the Northwest Frontier Province under Martial Law from August 1930.

Significance

- Ghaffar Khan and the Khudai Khidmatgar movement inspired thousands of Pashtuns (also called Pathans), who were known as fierce warriors, and others to lay down their arms and use civil resistance to challenge British rule.
- The movement waned after its involvement in electoral politics but became a benchmark for contemporary Muslims organizing nonviolent resistance rooted in the Islamic tradition.
- Initially, they set to work for organizing village projects and opening schools, but soon they became part of the broader Indian Independence movement, accepting without retaliation some of the most fierce British repression—mass firings on unarmed crowds, torture, personal humiliation, setting homes and fields on fire, and even the destruction of entire villages.
- The movement achieved many of its political goals such as increased Pashtun autonomy and concessions to Pashtun identity (such as teaching Pashto in the schools).

Although Ghaffar Khan's initial reform efforts predated his involvement with Gandhi and the Indian National Congress (INC), he later formed a formal alliance with them and became a formidable force during and following the INC's Civil Disobedience campaign of 1930-1931, helping the INC win provincial elections in 1937.

Question 2. *The Global Report on Internal Displacement, 2020 revealed that 50.8 million people were displaced internally across the world at the end of 2019. Enumerate the impacts of such displacement and suggest measures to ameliorate the situation.*

Answer: The Global Report on Internal Displacement (GRID 2020) released by the Internal Displacement Monitoring Centre (IDMC) has highlighted the internal displacement across the world meaning that on a large scale, people are forced to leave their land due to reasons like climate, conflict or better job and life.

Impact of displacement:

- **Population pressure:** The number of persons in certain areas will increase and in turn, density will increase.
- **Job loss:** Due to a large number of people, demand for jobs will ultimately give rise to the crisis of jobs and employment.
- **Resources:** Resources like food and shelter will be limited as beyond the carrying capacity of the Earth resource can not be generated.
- **Land pressure:** A displacement is mainly oriented towards good lands like better agriculture or industrial land. So, such displacement is likely to encroach upon land available for only a few.
- **Political pressure:** State has to look after these people and equality to access could be compromised. Like, India has recently changed labour laws to deal with the crisis of mass exodus of migrant workers.

Measures needed:

- **Political commitment:** Willingness of decision-makers and service providers to recognise and invest in addressing internal displacement is much required.
- **Strengthened capacity:** Finding solutions to internal displacement ability of individuals and organisations to reduce internal displacement. Like skill development, jobs at the local level, rural development etc.

- Moreover, there is a provision of collateral-free MSME loans. The government is planning to give ₹20,000 crores to MSMEs. This would, in turn, help 2 lakh MSMEs.
- 'Make in India' campaign is bound to be a success story. As more people will get engaged in self-reliant business stories.
- There is a ₹1 lakh crore Agri-infrastructure fund that includes various provisions for cold chain supply and management, apart from post-harvest measures.

Promotion of self-reliance rather than anti-globalisation

- It will reduce the dependency on other countries. Therefore, India would have the upper hand in deciding its own course. Other developed nations will not be able to utilize the loopholes and gain on that front.
- Make in India products will decrease the demand from outside in turn reduce the import from other countries.
- Exchange of goods and services between countries is the core of globalisation. It would be hampered due to this scheme as more local products will be manufactured.

Amid all this, Atmanirbhar Bharat can't be called as against globalisation as in worldwide lockdown it is necessary for the country to have self-sufficiency in at least some basic and fundamental products for the purpose of minimum survival..

Question 9. *The current ongoing crisis owing to COVID-19 has brought up the issue of revenue loss of the Indian States. Enumerate the sources of revenue for the State governments and suggest measures to augment the same.*

Answer: According to credit agency India Ratings & Research the COVID-19 pandemic and the subsequent lockdown has severely hit the economy, with 21 major states losing ₹971 billion in revenue.

Sources of revenue

States own revenue mainly comes from seven heads-

1. Tax revenue

- Goods and Services Tax (SGST),
- VAT (mainly on petroleum items),
- Excise (mainly on liquor),
- Stamps and registration fees,
- Tax on vehicles,
- Tax and duty on electricity.

- 2. Non-tax revenue** constitutes 10% of the total revenue.
- 3. Other:** Interest Receipts, Dividends and Profits from State Public Sector Enterprises as well as returns from user charges on general, social and economic services.
- 4. Union:** The total Union Transfers consist of those determined by the Finance Commission (i.e. States' share in Central taxes and Finance Commission Grants, if any), the Non-Plan Grants and Plan Grants (which include the funds for Centrally Sponsored Schemes).

Measures:

- **Tax augmentation:** Liquor sales with a higher excise duty along with an increase in Value Added Tax (VAT) on petrol and diesel.
- **Union's share:** Central Government may raise fund allocation to the worst-hit states.
- **MPLAD and MLALAD funds:** It is believed that these funds are not utilised for local area development so these funds can be used to reduce the State's expenditure especially in health and sanitation.

Though share to States has been increased by the central government a steady decline in the state's revenue is still going on. Government has to come up with a policy to avoid the ripple effect of these changes as liquor sales are opposed by many women.

PAPER-IV

Question 10. *What does the following quote mean to you?*

"Your lack of dedication is an insult to those who believe in you".

Answer: The quote means that every work requires dedication whether it is administrative or career-oriented. It is usually believed that a person gets motivated by their close ones. Our parents or siblings show trust in us and also allow us to pursue our goals. But if we lack dedication and hard work then getting that work completed would be difficult and there will also be a break of the trust of those who believed in us.

In Indian freedom struggle, masses believed in Gandhiji to free India from the Britishers and which fructified by independence on 15th August 1947. So, in this way Gandhiji had dedication and masses had trust in him.

D C A T



SCIENCE

AND

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Section - 1 (BIOLOGY)

CELL

The Cell

- It is the basic structural, functional, and biological unit of all living organisms.
- Cells are the smallest unit of life which are also called the building blocks of life.
- The term cell was coined by Robert Hooke.
- The smallest known cells are a group of tiny bacteria called mycoplasmas.
- As an individual unit, the cell is capable of metabolizing its own nutrients, synthesizing many types of molecules, providing its own energy, and replicating itself in order to produce succeeding generations.
- In a multicellular organism, cells become specialized to perform different functions through the process of differentiation.

Cell Theory

- M. Schleiden and Theodore Schwann in 1839, formulated the "Cell Theory". According to this theory:
 - The cell is the fundamental unit of structure and function in living things.
 - All organisms are made up of one or more cells.
 - Cells arise from other cells through cellular division.
- The expanded version of the cell theory can also include:
 - Cells carry genetic material passed to daughter cells during cellular division.
 - All cells are essentially the same in chemical composition.
 - Energy flow (metabolism and biochemistry) occurs within cells.

Types of cells

Prokaryotic cells

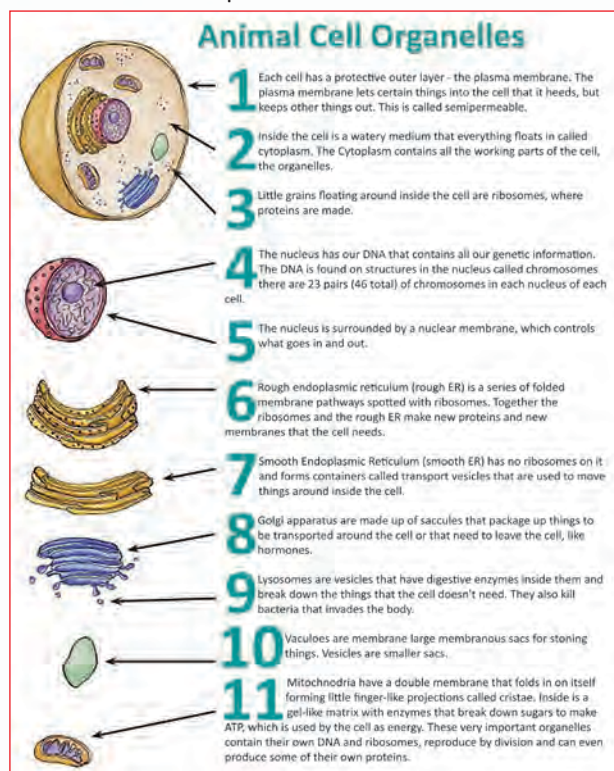
- These are the cells that lack a cell nucleus or any membrane-enclosed organelles.
- This means the genetic material DNA in prokaryotes is not bound within a nucleus. All bacteria and bacteria-like Archaea are prokaryotic organisms.

Eukaryotic cells

- These are the cells that possess a membrane-bound nucleus (that holds DNA in the form of chromosomes) as well as membrane-bound organelles.
- Eukaryotic organisms may be multicellular or single-celled organisms. Most of the living things that we are typically familiar with are composed of eukaryotic cells; animals, plants, fungi and protists.

Cellular Organelles

- Organelles are living parts of the cell that have definite shape, structure and functions.
- There are various cell organelles, out of which, some are common in most types of cells like cell membranes, nucleus, and cytoplasm. However, some organelles are specific to one particular type of cell-like plastids and cell walls in plant cells.



Cell Division

Cell division is the process by which a parent cell divides into two or more daughter cells. Cell division usually occurs as part of a larger cell cycle.

- Blood carries oxygen and nutrients to living cells and takes away their waste products.
- It also delivers immune cells to fight infections and contains platelets that can form a plug in a damaged blood vessel to prevent blood loss.

Composition of Blood

- Plasma forms about 60% of blood and the rest 40% are white blood cells (WBCs), platelets, and the red blood cells (RBCs).
- All of the cells found in the blood come from bone marrow. They begin their life as stem cells, and they mature into three main types of cells— RBCs, WBCs, and platelets.

Plasma

- Plasma is mainly water, but it also contains many important substances such as proteins (albumin, clotting factors, antibodies, enzymes, and hormones), sugars (glucose), and fat particles.
- Cells also put their waste products into the plasma. The plasma then helps remove this waste from the body.

Red Blood Cells

- Also known as erythrocytes, RBCs are the most common type of cell found in the blood, with each cubic millimetre of blood containing 4-6 million cells.
- They circulate around the body for up to 120 days, at which point the old or damaged RBCs are removed from the circulation by specialized cells (macrophages) in the spleen and liver.

White Blood Cells

- WBCs have many different shapes and sizes. Some cells have nuclei with multiple lobes, whereas others contain one large, round nucleus. Some contain packets of granules in their cytoplasm and so are known as granulocytes.
- There are three types of WBC—lymphocytes, monocytes, and granulocytes—and three main types of granulocytes (neutrophils, eosinophils, and basophils).
- Despite their differences in appearance, all of the various types of WBCs have a role to play in the immune response. They circulate in the blood until they receive a signal that a part of the body is damaged.

- Individuals who have low levels of WBCs may have more and worse infections.

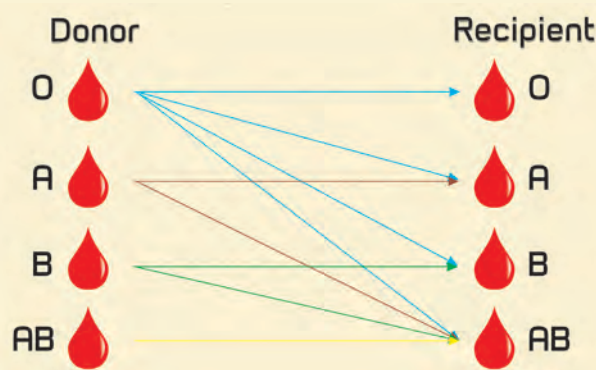
Platelets

- Platelets are irregularly shaped fragments of cells that circulate in the blood until they are either activated to form a blood clot or are removed by the spleen.
- Thrombocytopenia is a condition of low levels of platelets and carries an increased risk of bleeding.
- Conversely, a high level of platelets (thrombocythemia) carries an increased risk of forming inappropriate blood clots.

Blood Group

- Karl Landsteiner discovered blood groups in human beings (1900) known as ABO blood groups system.
- **Blood Groups:** A, B, AB or O on the basis of carbohydrate molecules present on the surface of red blood cells which serve as antigens.
- There are several other blood antigens present on the surface of RBCs viz. MN antigens, Rh Factor (named so, because it was first found in rhesus monkeys), etc.

Blood Transfusion Among Blood Groups



NOTE: Hh, or the Bombay blood group, is a rare blood type. This blood phenotype was first discovered in Bombay, now known as Mumbai, in India, by Dr Y. M. Bhende in 1952. It is mostly found in Indian sub-continent (India, Bangladesh, Pakistan) and parts of the Middle East such as Iran.

Stem Cell Culture

Stem cells have the unique ability to self-renew or to differentiate into various cell types (**totipotency**) in response to appropriate signals. These properties provide stem cells with unique capabilities for tissue repair, replacement, and regeneration.

Pollination

- The transfer of pollen from the anther to the stigma of a flower is called pollination.
- If the pollen lands on the stigma of the same flower or another flower of the same plant, it is called self-pollination.
- When the pollen of a flower lands on the stigma of a flower of a different plant of the same kind, it is called cross-pollination.

Fertilization

- The fusion of male and female gametes is called fertilisation. Plants undergo double fertilization.
- A fertilised egg is called a zygote. The zygote develops into an embryo.
- The fruit is the mature ovary whereas ovule develops into a seed, which contains the developing embryo.

Seed Dispersal

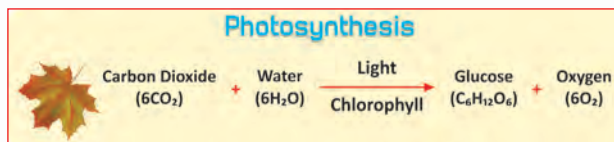
- Seed dispersal is aided by the wind, water and animals.
- Seed dispersal helps the plants to
 - prevent overcrowding,
 - avoid competition for sunlight, water and minerals and
 - invade new habitats.

PHOTOSYNTHESIS

- Photosynthesis is the process used by plants, algae and certain bacteria to harness energy from sunlight and turn it into chemical energy.
- Glucose is formed by this process and transformed into different compounds like cellulose and starch which is stored in different plant parts.
- The organisms which make their own food are known as autotrophic organisms.
- **Following are the important examples of autotrophs:**
 - Plants
 - Algae - Green algae and red algae
 - Bacteria such as cyanobacteria
- Photosynthesis takes place in the chloroplast of the plant cell.

- Different parts of the plant play different roles to complete the photosynthesis:

- **Leaves:** They are the food factories of the plant.
- **Roots:** They absorb minerals and water from the soil and carry it to different parts of the plant.
- **Stomata:** It is present in the lower epidermis of the leaf which uses carbon dioxide from the air.



NOTE: Some rare autotrophs produce food through a process called chemosynthesis, rather than through photosynthesis. Autotrophs that perform chemosynthesis do not use energy from the sun to produce food. Instead, they make food using energy from chemical reactions, often combining hydrogen sulfide or methane with oxygen.

Some Other Forms of Plant Nutrition

- **Chemoautotrophic nutrition**
 - The organisms that make their own food with the help of chemical energy and they do not need sunlight.
 - For example, Nitrosomonas, cyanobacteria and other nitrogen-fixing bacteria, etc.
- **Photoheterotrophs**
 - Some varieties of bacteria use light to create their own food, just like organisms that use photosynthesis.
 - However, these bacteria are not autotrophs, because they must rely on chemicals besides carbon dioxide for carbon. These strange bacteria are called photoheterotrophs.
- **Radiotrophs**
 - Some fungi use gamma radiation and a natural pigment called melanin to create energy for growth.
 - Gamma radiation is a high-frequency band of light that is invisible to people and can cause damage to human tissues when encountered in large doses. These strange, rare fungi are called radiotrophs.
 - They are found inside and around the abandoned Chernobyl Nuclear Power Plant in Ukraine.

Section - 2 (PHYSICS)

ATOMIC PHYSICS

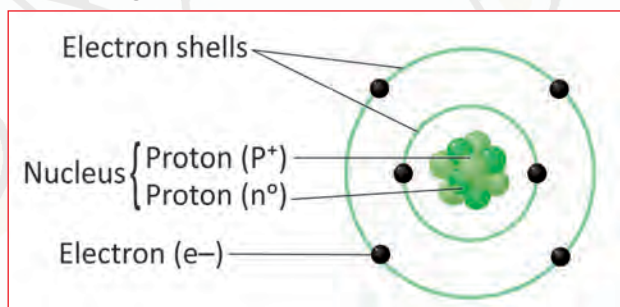
Atomic physics deals with the study of the atom. The constituent particles of an atom include the proton, neutron and electron.

Particle	Mass (kg)	Charge
Proton	1.672×10^{-27}	$+1.6 \times 10^{-19}$
Neutron	1.675×10^{-27}	Neutral or 0
Electron	9.108×10^{-31}	-1.6×10^{-19}

Thus a proton and a neutron have almost the same mass, which is nearly 1836 times that of an electron. Protons and electrons have equal but opposite charges.

Atomic Structure

- According to the atomic model given by **Niels Bohr**, an atom consists of a central nucleus with electrons revolving around it in circular orbits.



- The nucleus consists of closely packed protons and neutrons and contains almost all the mass of the atom. In a neutral atom, the number of electrons is equal to that of protons.
- The **hydrogen atom is the lightest atom** with only one electron revolving around a single proton. The heaviest natural atom is that of uranium with 92 electrons.
- In a normal atom, the electrons revolve in specified paths known as orbits and occupy their lowest energy levels.
- If the atom is supplied with extra energy, by strong heating or by bombardment with some fast-moving particle, one or more electrons may jump from one energy level to a higher one. The atom is then said to be in an excited state.

- The electrons fall back to their lower energy levels by emitting the surplus energy in the form of electromagnetic wave pulses called photons.
- Depending on the differences between the energy levels, the emitted radiation may be of different frequencies, lying in the infrared, visible, ultraviolet and even X-ray regions.

Emission of Radiation

Fluorescence

- Besides heating or bombarding with fast-moving particles, an atom can also be excited by the absorption of photons of light.
- Many substances undergo excitation when illuminated with photons of ultraviolet light and then emit visible light upon de-excitation. Such substances are called fluorescent substances and the phenomenon is called fluorescence.

Incandescence

- The emission of light from a substance whose atoms are excited by high temperature is called incandescence.
- The light from the heated tungsten filament of an incandescent bulb (the common electric bulb) consists of many frequencies and therefore appears white. The sun is also an incandescent source.

X-Ray Emission

- X-rays are produced in an evacuated X-ray tube, which has a source of electrons (a heated filament) and a tungsten target.
- Due to the high potential difference (around 50,000 to 100,000 V), electrons are accelerated towards the tungsten target and strike it with very high speeds.
- The atoms of tungsten are excited and then emit X-rays in the process of de-excitation.

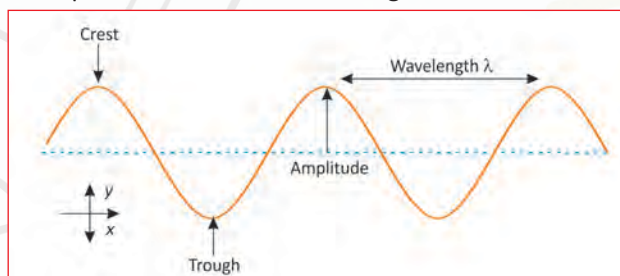
SPACE SCIENCE

The universe is the entirety of space, matter and antimatter and astronomy is the scientific study of the universe and the nature and motion of celestial bodies.

- The specific latent heat of **vaporization** of a substance is the heat required to change a unit mass of the substance from liquid to the vapour state without change of temperature.

WAVE MOTION

- Wave motion can be defined as the transfer of energy without the net transfer of matter.
- A point of maximum positive displacement in a wave is called the crest, and a point of maximum negative displacement is called the trough.



- The wavelength (λ) of a wave is the distance between adjacent crests (or troughs) in the case of transverse waves, or between adjacent compressions (or rarefactions), in the case of longitudinal waves.
- The frequency (n) of a wave is the number of waves that pass a given point per second. The unit of frequency is vibrations/second or Hertz (Hz).

Types of Waves

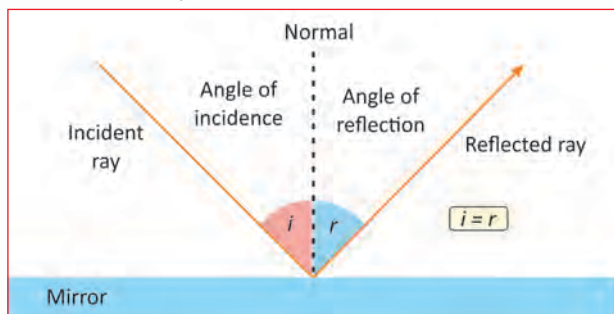
- Mechanical waves require a material medium to travel (air, water, ropes). These waves are divided into three different types.
 - Transverse waves cause the medium to move perpendicular to the direction of the wave.
 - Longitudinal waves cause the medium to move parallel to the direction of the wave.
 - Surface waves are both transverse waves and longitudinal waves mixed in one medium.
- Electromagnetic waves do not require a medium to travel (light, radio).
- Matter waves are produced by electrons and particles.
- Electromagnetic waves include an enormous range of frequencies from radio waves with frequencies less than 10^5 Hz to gamma rays having frequencies greater than 10^{20} Hz.

LIGHT

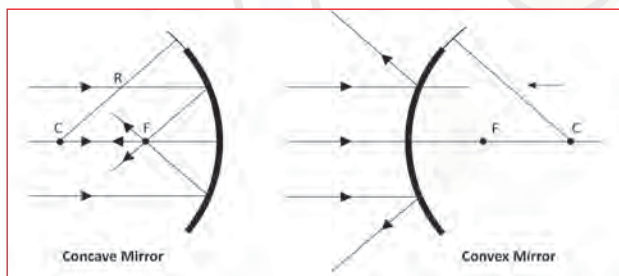
- Light is the form of energy which causes the sensation of vision. Self-luminous objects, such as the sun and the stars, are sources of light.
- Any medium through which light can travel is an optical medium.
- The media through which light cannot pass, are called opaque media.
- The direction of the path taken by light is called a ray. A number of rays constitute a beam of light which may be converging, diverging or parallel.

Reflection

- The laws of reflection state that the angle of incidence (angle i) is equal to the angle of reflection (angle r) and Incident ray, reflected ray and the normal drawn at the point of incidence to the reflecting surface, lie in the same plane.



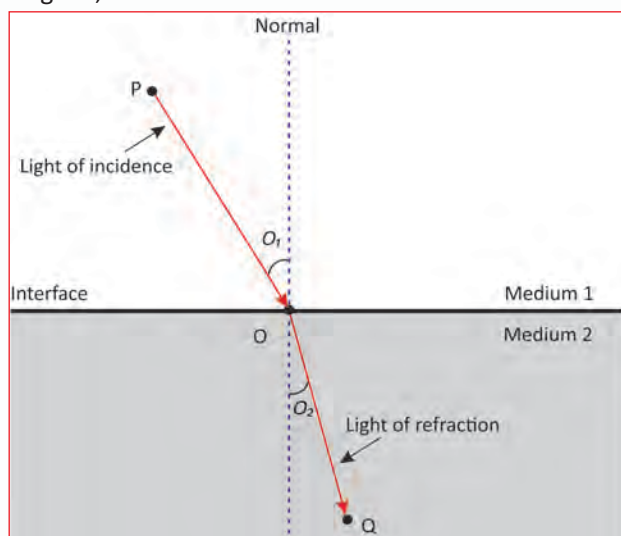
- An image which can be obtained on a screen is called a real image. An image which cannot be obtained on a screen is called a virtual image.
- The image formed by a plane mirror is erect. It is virtual and is of the same size as the object. The image is at the same distance behind the mirror as the object is in front of it.
- The reflecting surface of a **spherical mirror** may be curved inwards or outwards.
 - A spherical mirror, whose reflecting surface is curved inwards, that is, faces towards the centre of the sphere, is called a concave mirror.
 - A spherical mirror whose reflecting surface is curved outwards is called a convex mirror.
 - Concave mirrors are commonly used in torches, search-lights and vehicle headlights to get powerful parallel beams of light.



- Convex mirrors are commonly used as rear-view (wing) mirrors in vehicles. These mirrors are fitted on the sides of the vehicle, enabling the driver to see traffic behind him/her to facilitate safe driving.

Refraction

- Light bends when it passes obliquely from one medium to another. This is called refraction of light.
- When a ray passes from one medium to another optically denser medium, e.g., from air to water or glass, it bends towards the normal.



- Conversely, a ray passing from water or glass into the air is bent away from the normal.

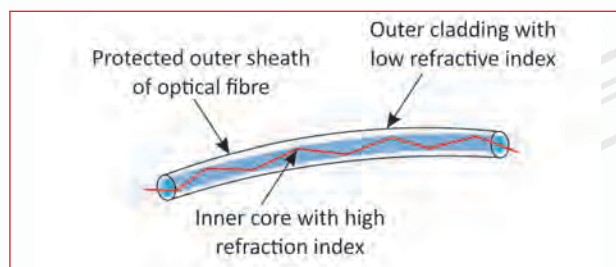
Atmospheric Refraction

- The density of the atmosphere surrounding the earth decreases with increasing altitude.
- Thus if light enters the atmosphere from outside, it encounters layers of air of increasing density and, therefore, bends gradually producing a curved path.
- It is due to refraction, produced by the earth's atmosphere, that the sun is visible for several minutes after it has set below the horizon.

- The twinkling of stars can also be partly attributed to atmospheric refraction.

Total Internal Reflection

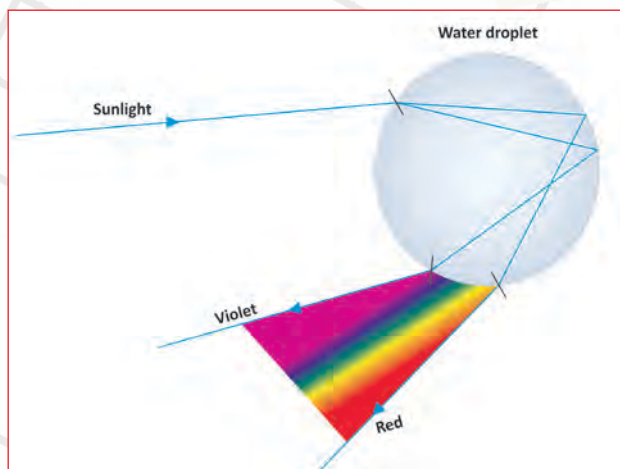
- Light can always pass from one medium to an optically denser medium but it cannot always pass into a rarer medium.
- If the angle of incidence of light in the denser medium is greater than a particular angle (known as the critical angle for that medium), the light is not at all refracted into the rarer medium but is totally reflected and is known as total internal reflection.



- Interesting use of the total internal reflection is in optical fibres, which are fine strands of high-quality glass.
- Light is piped down some of the fibres to illuminate the inside of the stomach and is reflected back along some other fibres. This procedure is called **endoscopy**.

Dispersion

- White light consists of seven colours i.e. violet, indigo, blue, green, yellow, orange and red called as its spectrum.
- Minimum wavelength (or maximum frequency) is of violet colour and the red has the maximum wavelength (or minimum frequency).
- All the colours travel at the same speed in a vacuum but in a transparent medium, they travel at different speeds.
- Due to different speeds, the colours are refracted through different angles and, therefore, when a narrow beam of white light passes through a glass prism, it is split up into its constituent colours and the process is known as dispersion.
- The rainbow is an example of dispersion, as the sun rays pass through the water droplets in the air after the rain, the light disperses into its constituent colours.

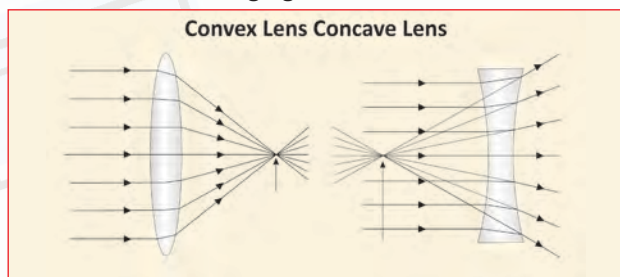


Diffraction of Light

- When a beam of light passes through a narrow slit or an aperture, it spreads out to a certain extent into the region of the geometrical shadow is diffraction.
- If one uses monochromatic light for diffraction, bright and dark bands are observed in the region of the geometrical shadow.
- With white light, coloured bands are observed. Diffraction is a particular case of interference and is due to the wave nature of light.
- A diffraction grating is a device used to disperse a beam of light for producing its spectrum.

Lenses

- Lenses are used in various optical instruments that produce images, for example, cameras, projectors, telescopes, microscopes, etc.
- **There are mainly two kinds of lenses:**
 - Convex - converging lens
 - Concave - diverging lens



- The converging lens serves as a magnifying glass. When the object is outside the principal focus of a converging lens, it forms a real image.

- For all the positions of the object, the images formed by diverging lenses are virtual, erect and diminished.

Defects of Vision

A normal eye should be able to have a clear vision of objects from infinity (the far point) down to about 25 cm (the near point).

Myopia or Near-sightedness

- Myopia occurs when the eyeball is too long, relative to the focusing power of the cornea and lens of the eye.
- This causes light rays to focus at a point in front of the retina, rather than directly on its surface. If you're nearsighted, the first number ("sphere") on your eyeglasses prescription will be preceded by a minus sign (-).

Hypermetropia or Farsightedness

- Hypermetropia or long-sightedness is a defect of an eye where a person cannot see nearby objects clearly.
- This defect of the eye is caused due to low converging power of the lens of the eyeball being too short.

Presbyopia

- This defect of vision usually happens in old age when ciliary muscles become weak and can no longer adjust the eye-lens. The muscles become inflexible in this condition and cannot see nearby objects clearly.
- Another point to be noted is that a person can have both myopia and hypermetropia. In such a condition, spectacles having bifocal lenses are worn.

Astigmatism

- Astigmatism usually causes vision to be blurred or distorted to some degree at all distances.
- Instead of the cornea having a symmetrically round shape (like a tennis ball), it is shaped more like a rugby ball.

LASER (Light Amplification by Stimulated Emission of Radiation)

- A laser is an optical device that produces an intense beam of coherent monochromatic light.
- A laser is not a source of energy and is simply a converter of energy taking advantage of stimulating emission to concentrate a certain fraction of energy (commonly 1%) into radiation of a single frequency, moving in a single direction.

- In an aircraft flying at high altitude, normal atmospheric pressure is maintained by the use of air pumps.

Upthrust

- If a block of wood is held below the surface of the water and then released, it immediately rises to the surface. The block rises because it experiences an upward force or upthrust (or buoyant force) due to water.
- Like liquids, gases also exert upthrust on objects inside them.
- If the upthrust is greater than the weight of the immersed object it will float to the surface.

Archimedes' Principle

- It states that when a body is wholly or partially immersed in a fluid, it experiences an upthrust equal to the weight of the fluid displaced.
- For **example**, a ship that is launched sinks into the ocean until the weight of the water it displaces is just equal to its own weight. As the ship is loaded, it sinks deeper, displacing more water, and so the magnitude of the buoyant force continuously matches the weight of the ship and its cargo
- An angler pulling a fish out of water experiences a sudden increase in the weight of the fish as soon as it is out of water.

UNITS AND MEASUREMENT

- Laws of physics are expressed in terms of physical quantities such as time, force, temperature, density and numerous others.
- **Physical quantities may, in general, be divided in two classes:**

- Scalar quantities have only magnitude
- Vector quantities have both magnitude and direction.
- Certain physical quantities have been chosen as fundamental or base quantities (such as length, mass, time, electric current, thermodynamic temperature, amount of substance, and luminous intensity).
- The units for the fundamental or base quantities are called fundamental or base units.
- The SI units have well defined and internationally accepted unit symbols (such as m for metre, kg for kilogram, s for second, A for ampere, N for newton, etc.).

The International System of Unites (SI)

Base Unit	Symbol	Defining Constants	Symbol	Value
kilogram	kg	Planck constant	h	$6.626\ 070\ 15 \times 10^{-34}\ \text{J s}$
metre	m	Speed of light in vacuum	c	$299\ 792\ 458\ \text{m/s}$
second	s	hyperfine transition frequency of caesium atom	ν_{Cs}	$9\ 192\ 631\ 770\ \text{Hz}$
ampere	A	elementary charge	e	$1.602\ 176\ 634 \times 10^{-19}\ \text{C}$
kelvin	K	Boltzmann constant	k	$1.380\ 649 \times 10^{-23}\ \text{J/K}$
mole	mol	Avogadro constant	N_A	$6.022\ 140\ 76 \times 10^{23}\ \text{/mol}$
candela	cd	luminous efficacy of monochromatic radiation of frequency 540THz	k	$683\ \text{lm/W}$

Section - 3 (Chemistry)

MATTER AND ITS BUILDING BLOCKS

The matter is anything that has mass and occupies space. Mass refers to the amount of matter present in a sample. Matter exists in three physical states: Solid, Liquid and Gas.

Properties of Matter

Physical properties

- These are those characteristics that can be observed without changing the basic identity of the substance.

- For example, colour, odour, hardness, melting point, boiling point, and density.

Chemical Properties

- These describe the way a substance may change or react to form other substances.
- **Examples of chemical properties:** Iron metal rusts in a moist atmosphere, nickel dissolves in acid to give a green solution, magnesium burns in presence of oxygen.

- For example, K_2O , Al_2O_3 , $6 SiO_2$. Feldspars are the most abundant rock forming silicates in the earth's crust.
- Nearly pure alumina and zirconia are now used as bases for ceramic materials, which are excellent electrical or thermal insulators.
- **Magnetic ceramics**, which contain iron compounds, are used as memory elements in computers.

Zeolites

- Zeolites are aluminosilicates which are used as catalysts in petrochemical industries for cracking of hydrocarbons.
- They are used to convert alcohols into gasoline. Hydrated zeolites, called permutit, are used as ion exchangers in softening of hard water.

Uses of Halogens and Noble Gases

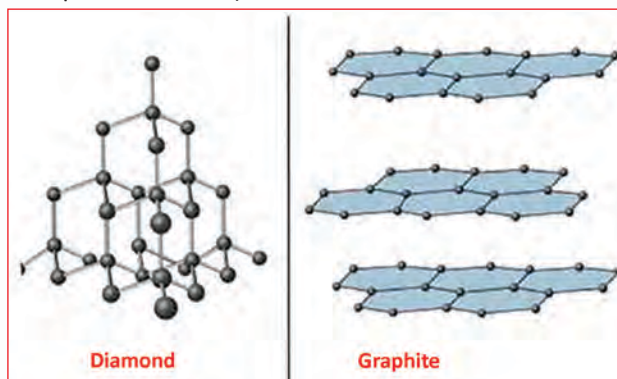
- Halogen acids are corrosive. Hydrogen Fluoride (HF) attacks glass and is, therefore, used for etching glass and manufacture of glass shells for television tubes. Due to its high reactivity and special properties, fluorine is called a super halogen.
- Chlorine is a powerful bleaching agent. It is also used to make bleaching powder.
- It is used to sterilise drinking water. It is used in the manufacture of DDT, refrigerants (CCl_2F_2 , Freon), and in the preparation of poisonous gases like tear gas (CCl_3NO_2), mustard gas, and phosgene.
- Helium is used to fill balloons which are employed for meteorological observations. Oxygen-helium mixture is used for artificial respiration in deep-sea diving. Helium has the unusual property of diffusing through materials like rubber, glass, or plastics.
- Neon is used in beacon light as a safety signal for air navigators. It is used in fluorescent lamps and discharge tubes for advertising purposes.
- Argon is used to provide an inert atmosphere, to fill incandescent and fluorescent lamps, and also in neon signs for obtaining lights of different colours.
- Krypton and xenon are used in gas-filled lamps. Their mixture is used for high-speed photography.
- Being radioactive, radon is used in the treatment of cancer and X-Ray photography for the detection of flaws in metals and other solids.

CARBON AND ITS COMPOUNDS

- Carbon is a nonmetal. Earth's crust contains only 0.02% carbon in the form of minerals like coal, petroleum, carbonates, etc.
- The atmosphere has only 0.03% of carbon dioxide gas. All living things (plants and animals) are made up of compounds of carbon called organic compounds.
- The atomic number of carbon is 6 (electronic configuration: 2,4). Carbon is tetravalent, i.e., its valency is 4.
- It forms covalent bonds by sharing electrons. Carbon has the unique property of self combination (known as catenation) to form long chains, which gives rise to an extremely large number of carbon compounds (organic compounds).

Allotropes of Carbon

- Allotrope are the various physical forms in which an element can exist.
- In the free state, carbon occurs mainly in two forms in nature i.e. diamond and graphite.
- Another naturally occurring form of carbon, called buckminsterfullerene has also been known.
- Diamond is hard whereas graphite is soft.
- Diamond is a non-conductor of electricity whereas graphite is a good conductor of electricity.
- Both diamond and graphite produce CO_2 on burning in the presence of oxygen.
- It is the difference in the arrangement of carbons in both graphite and diamond that the physical properties differ a lot.
- **The structure of Diamond and Graphite** (Black dots represent carbon)



Some Common Pesticides In News	
Carbaryl	Insecticide used in paddy, cotton, sorghum, ladyfinger, cabbage, cauliflower etc.
Diazinon	Household pest control
Fenarimol	Fungicide used on apples
Fenthion and Unuron	Herbicides used for weed control in pea crop
Trifluralin	Herbicide used for weed control in cotton and soyabean
Tridemorph	Fungicide used on groundnut, mango, vegetable and roses
Thiometon	Used on brinjals
Sodium cyanide	Used to fumigate cotton
Methyl parathion	Used on paddy, cotton, black gram, mustard, wheat etc.
Methoxy ethyl mercury chloride	Fungicide used for sugarcane and potato seeds

Biopesticides

- These are pesticides derived from animals, plants, bacteria, and certain minerals. For example, canola oil and baking soda are biopesticides.
- Microbial Pesticides consist of a micro-organism (Examples: A bacterium, fungus, virus or protozoan) as the active ingredient.
- Plant Incorporated Protectants (PIPs) are pesticidal substances that plants produce from genetic material that has been added to the plant.
- Biochemical Pesticides are naturally occurring substances that control pests by non-toxic mechanisms.

Electrochemistry

- It is that branch of chemistry which deals with the relationship between electrical energy and chemical changes taking place in redox reactions.
- It includes the study of the formation and behaviour of ions (cations and anions) in solution.
- Substances, which in the molten state or in the form of a solution, allow electricity to pass through are called electrolytes. For example, molten NaCl in water.
- Substances which do not allow electricity to pass through are called non-electrolytes. For example, naphthalene, glucose, oil, etc.
- Electrolysis is the process of decomposition of an electrolyte by the passage of electricity through its aqueous solution or molten state.

Commercial Cells

- **Primary Cells**
 - They become dead after some time.
 - Dry Cell, used in transistors and clocks, consists of a zinc container which acts as the anode. A graphite rod acts as the cathode, which is surrounded by powdered manganese dioxide and carbon. This

mixture is, in turn, surrounded by a paste of ammonium chloride and zinc chloride.

- **Mercury Cell**, used in hearing aids and watches, consists of a zinc container as the anode, a carbon rod as the cathode, and a paste of mercuric oxide mixed with potassium hydroxide as the electrolyte.
- **Secondary cells**
 - These cells can be recharged by passing an electric current through them and can, therefore, be used again.
 - **Lead Storage Battery** is used in automobiles and inverters.
 - **Nickel-Cadmium Storage Cell** (or Nicad Cell) is used in calculators.
- **Fuel Cells**
 - These devices convert the energy produced during the combustion of fuels like hydrogen, methane, etc., directly into electrical energy.
 - Unlike thermal plants which burn fossil fuels, fuel cells do not cause any pollution problem. These cells never become dead and have a very high efficiency.

CHEMISTRY IN EVERYDAY LIFE

Pharmaceutical Drugs

- It is defined as a chemical substance used in the medical diagnosis, treatment, or prevention of disease.
- They are classified on the basis of their therapeutic action:
 - **Chemotherapeutic agents**
 - These drugs are used in the treatment of infectious diseases. They destroy the parasites without damaging the host tissues.
 - For example, Mechlorethamine, Chlorambucil, Melphalan.
 - **Pharmacodynamic agents**
 - These drugs alter or regulate the biochemistry of the body. They act selectively on any system of the body, like the central nervous system (CNS), cardiovascular system, etc.
 - These drugs mimic or inhibit normal physiological/biochemical processes or inhibit pathological processes in animals.
 - These drugs inhibit vital processes of endo- or ectoparasites and microbial organisms.

- A thermoplastic polymer is one which softens on heating and becomes rigid again on cooling. For example, Nylon, polythene, and polystyrene.
- A thermosetting polymer is one which becomes hard on heating. It cannot be softened by heating. For example, Bakelite, Araldite, Spandex, etc.
- **Natural and Synthetic Rubbers**
 - Natural rubber is polyisoprene (obtained from the monomer isoprene). It is soft and elastic.
 - A synthetic rubber is any artificial elastomer. These are mainly polymers synthesized from petroleum byproducts.
- In contrast with a dye, a pigment is generally insoluble in water.
- Both dyes and pigments appear to be coloured because they absorb some wavelengths of light more than others.
- Based on the salt used, they could be aluminium lake, calcium lake, or barium lake pigments.
- **Examples of natural dyes:**
 - Obtained from plants: Alizarin, Catechu, Indigo, and Logwood.
 - Obtained from animals: Cochineal, Kermes, and Tyrian Purple.
 - Obtained from certain naturally occurring materials: Ochre and Prussian Blue.

Dyes

- Dyes are substances, natural or synthetic, used to colour various materials, especially textiles, leather, and foods.

Section- 4 (Technology)

BIOTECHNOLOGY

- Biotechnology deals with techniques of using live organisms or enzymes from them to produce products and processes useful for humans.
- With the development of genetic engineering in the 1970s, research in biotechnology (and other related areas such as medicine, biology etc.) developed rapidly because of the new possibility to make changes in the organisms' genetic material (DNA).

Genetic Engineering

- Genetic engineering, sometimes called genetic modification, is the process of altering the DNA in an organism's genome.
- This may mean changing one base pair (A-T or C-G), deleting a whole region of DNA, or introducing an additional copy of a gene.
- It may also mean extracting DNA from another organism's genome and combining it with the DNA of that individual.
- Genetic engineering is used by scientists to enhance or modify the characteristics of an individual organism.
- Genetic engineering can be applied to any organism, from a virus to a sheep.

- For example, genetic engineering can be used to produce plants that have a higher nutritional value or can tolerate exposure to herbicides.
- Plants, bacteria, fungi and animals whose genes have been altered by manipulation are called Genetically Modified Organisms (GMO).
- **Genetic modification has:**
 - made crops more tolerant to abiotic stresses (cold, drought, salt, heat).
 - reduced reliance on chemical pesticides (pest-resistant crops).
 - helped to reduce post-harvest losses.
 - increased efficiency of mineral usage by plants (this prevents early exhaustion of fertility of soil).
 - enhanced nutritional value of food, e.g., Vitamin 'A' enriched rice.

Transgenic Crops

- Plants can be transformed using a plasmid from a bacterium found in soil called *Agrobacterium tumefaciens*.
- Plants may be susceptible to infection, and this allows foreign DNA from the bacterium to be integrated into the plant genome.
- This method can be used to produce transgenic crops, such as the examples given below:

- Golden rice production
- Insect-resistant crop
- Herbs resistant crop
- *Bacillus thuringiensis* or Bt cotton is genetically modified cotton plant resistant to boll worm, a type of insect.

Transgenic Animals

- RNA viruses called Retroviruses are often used as vectors to introduce foreign DNA into animal cells.
- Retroviruses work by using Reverse Transcriptase enzymes to make a double-stranded DNA copy of their RNA.
- The virus infects the target cells, and they retain the DNA copy, producing cells that have recombinant retroviral DNA permanently inserted into their genome. This can result in an animal with an altered genotype.
- Transformation of the germline in mammals can also be carried out using embryonic stem cells.
- **Examples of transgenic animals include:**
 - Mice used as disease models to know the pathophysiology of Cystic Fibrosis, in turn, treat this disease in Humans.
 - Giant Salmon with engineered Growth Hormone

Gene Therapy

- Gene therapy is a collection of methods that allows correction of a gene defect that has been diagnosed in a child/embryo.
- Gene therapy uses sections of DNA (usually genes) to treat or prevent disease.
- The DNA is carefully selected to correct the effect of a mutated gene that is causing disease.
- Gene therapy may be a promising treatment option for some genetic diseases, including muscular dystrophy and cystic fibrosis.
- There are two different types of gene therapy depending on which types of cells are treated:
 - **Somatic gene therapy:** transfer of a section of DNA to any cell of the body that doesn't produce sperm or eggs. Effects of gene therapy will not be passed onto the patient's children.
 - **Germline gene therapy:** transfer of a section of DNA to cells that produce eggs or sperm. Effects of gene therapy will be passed onto the patient's children and subsequent generations.

Ethical Issues

- The manipulation of living organisms by the human race cannot go on any further, without regulation.
- Some ethical standards are required to evaluate the morality of all human activities that might help or harm living organisms.
- Going beyond the morality of such issues, the biological significance of such things is also important.
- Genetic modification of organisms can have unpredictable results when such organisms are introduced into the ecosystem.
- Therefore, the Indian Government has set up organisations such as Genetic Engineering Approval Committee (GEAC), which will make decisions regarding the validity of GM research and the safety of introducing GM-organisms for public services.

NOTE: Genetic Engineering Approval Committee (GEAC) is a statutory body under the Environment Protection Act, 1986.

Biopiracy

- Biopiracy is the term used to refer to the use of bio-resources by multinational companies and other organisations without proper authorisation from the countries and people concerned without compensatory payment.
- Most of the industrialised nations are rich financially but poor in biodiversity and traditional knowledge. In contrast, the developing and the underdeveloped world is rich in biodiversity and traditional knowledge related to bio-resources.
- Indian basmati rice was pirated by a US company which outraged the discontent among Indian farmers who have been planting basmati rice since ages.

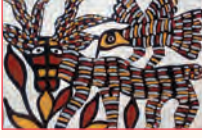
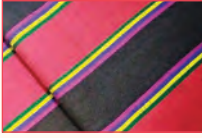
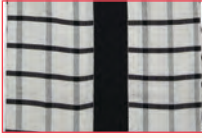
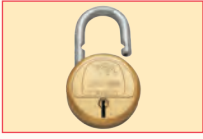
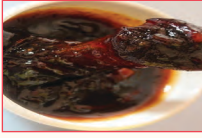
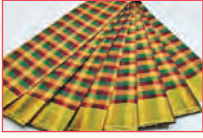
New Innovations in Biotechnology

Targeted Cancer Therapies

Targeted cancer therapies are drugs that work either by interfering with the function of specific molecules or by only targeting known cancerous cells, in order to minimize damage to healthy cells.

HPV vaccine

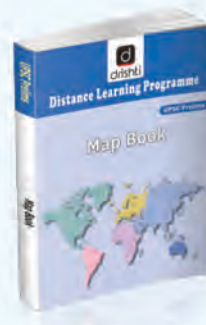
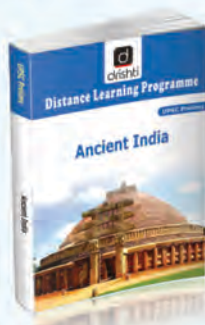
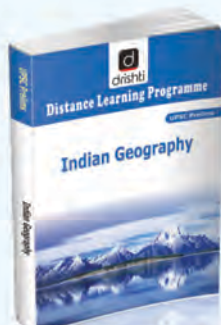
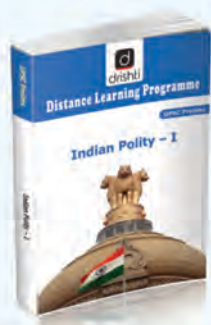
- Human Papillomavirus (HPV) is one of the causative agents of cervical cancer. It is the second most lethal cancer in women, second only to breast cancer.

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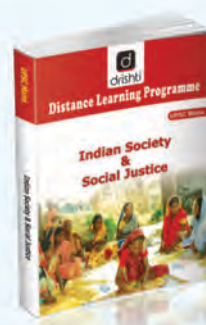
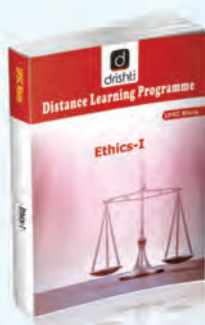
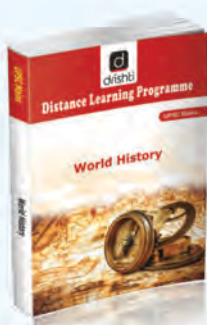
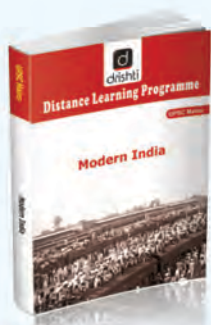


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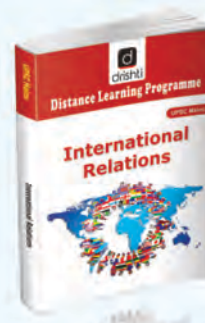
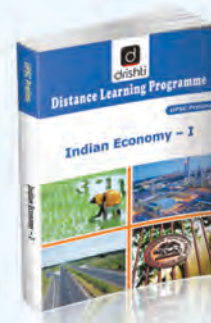


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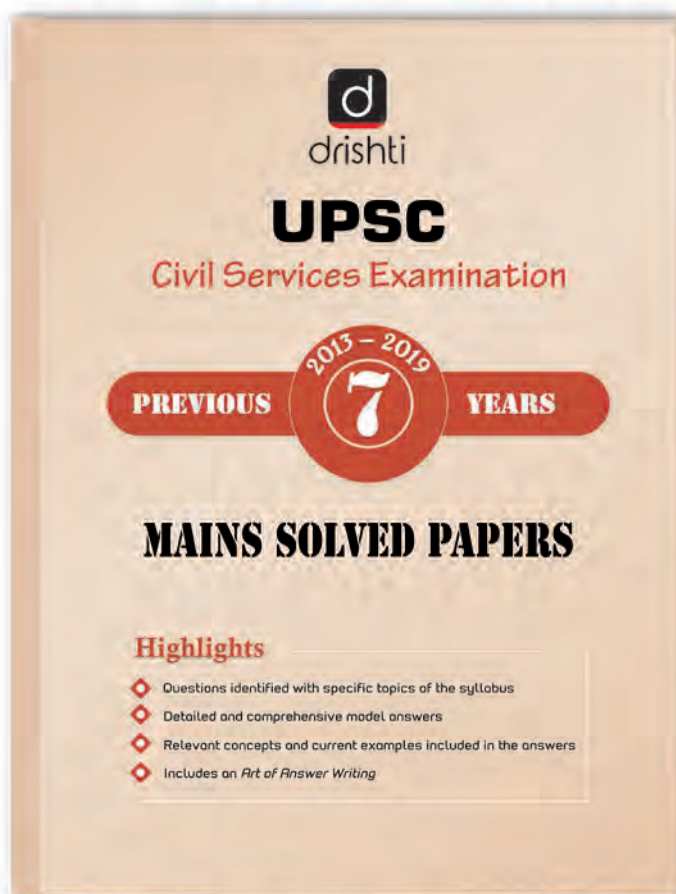
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