

# All-Inclusive Current Affairs for Prelims 2022

## Science Class-8

2022 Science classes 1-7 (pages 1-80) are same as 2021 classes:

- ❑ **Videos:** Link to see videos has been provided to 2022 course subscribers
  - **Mobile app users:** Open Chat → Open PT365 chat → see links to videos
  - **Web portal users:** See description of video for links
- ❑ **PDFs:** downloaded from <https://www.allinclusiveias.com/prelims2021>

### Nuclease, Ligase

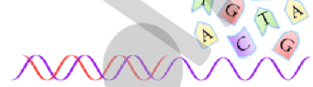
#### Nuclease:

- ❑ Enzymes that **degrades nucleic acids**
- ❑ In living organisms, they are **essential** for DNA repair
- ❑ Types:
  - ❑ **Ribonucleases (RNases)** that attack RNA
  - ❑ **Deoxyribonucleases (DNases)** that attack DNA
  - ❑ **Exonuclease** remove nucleotides from ends
  - ❑ **Endonuclease** makes cut on specific position

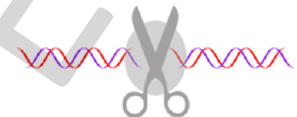


**Ligase:** enzyme that catalyses joining of two molecules by forming new chemical bond.

Polymerase



Nuclease



Ligase



**Polymerase** → makes long chain  
**Nuclease** → cuts  
**Ligase** → joins

#### Prelims 2001

**Assertion (A):** Scientists can **cut** apart and **paste** together DNA molecules at will, **regardless of source** of molecules.  
**Reason (R):** DNA fragments can be manipulated using restriction **endonucleases** and DNA **ligases**.  
**Answer:** Both A & R are true and R is **correct explanation** of A

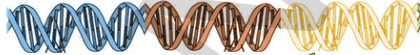
#### 2020 Chemistry Nobel Prize:

- for CRISPR-Cas9
- to Emmanuelle Charpentier & Jennifer Doudna

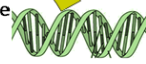
#### To carry genes, vector can be:

- **Viral vector** – virus
- **Non-viral vector** – only DNA
- **Microbial vector** – bacteria

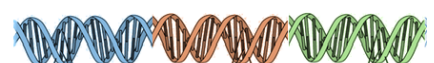
DNA of virus



Insert desirable gene

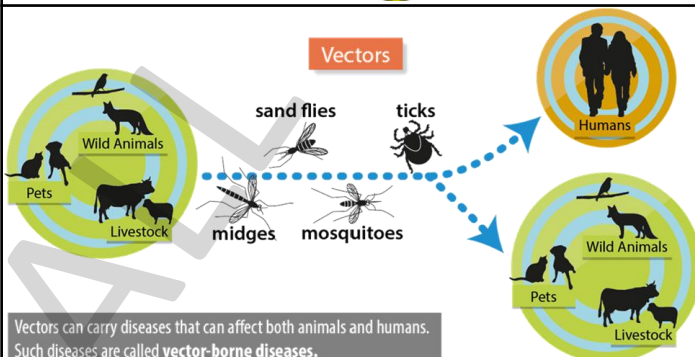


Recombinant DNA of virus



Remove harmful gene

#### Vectors



#### Prelims 2021

With reference to recent developments regarding '**Recombinant Vector Vaccine**', consider the following statements:

1. Genetic engineering is applied in the development of these vaccines.
  2. Bacteria and viruses are used as vectors.
- Which of the above statements are correct?  
 (a) 1 only                      (b) 2 only  
 (c) Both 1 and 2              (d) Neither 1 nor 2

I read I forget, I see I remember

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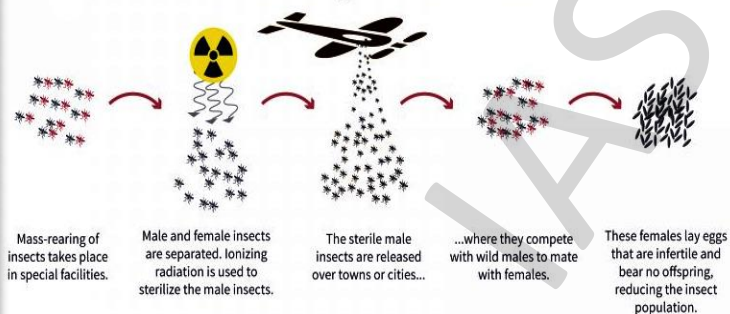
## New research: Tech based on CRISPR to control growth of mosquitoes

By: Express News Service | New Delhi |  
Updated: September 14, 2021 8:57:33 am

The “precision-guided sterile insect technique” (pgSIT), alters genes linked to male fertility—creating sterile offspring—and female flight in *Aedes aegypti*, the mosquito species responsible for spreading diseases including dengue fever, chikungunya and Zika, the University of California, San Diego said in a press release. Details of the pgSIT have been described in Nature Communications. The pgSIT uses CRISPR to sterilise male mosquitoes and render female mosquitoes (which spread disease) flightless. The system is self-limiting and is not predicted to persist or spread in the environment, two safety features that should enable acceptance for this technology, the release said.

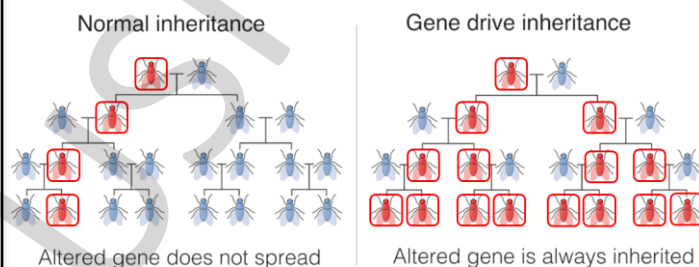
## Sterile Insect Technique

A method of biological insect control



## Gene drive

- ❑ It is a genetic engineering technique
- ❑ It modifies rules of heredity
- ❑ It alters the probability that a specific allele will be transmitted to offspring  
(An allele is a variant form of a gene)



## Genome Sequencing

**Human Genome Project:** (see pg-2 of 2021 pdf)

**2003:**

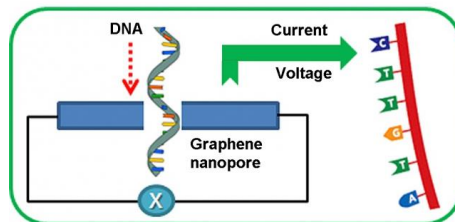
- ❑ Human Genome Project ended
- ❑ But only **92%** of our genome could be decoded
- ❑ Reason: Technology not so much developed

**2022:**

- ❑ T2T consortium has now decoded the **8% gap**
- ❑ **Telomere-to-Telomere** is a global team of scientists led by some US universities

## Nanopore Sequencing

- ❑ Monitors changes to electric current as DNA/RNA pass through a protein nanopore
- ❑ Enables real time, fast, cheap gene sequencing



## Non-coding DNA

- ❑ Only 1-2% of human genome codes for proteins
- ❑ **98-99%** of human DNA is non-coding DNA. It does not provide instructions for making proteins.

## Biological dark matter

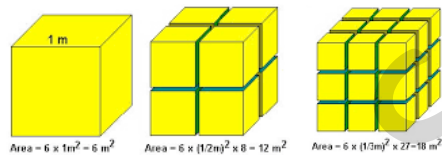
(Novel Open Reading Frames or n-ORFs)

- ❑ Unclassified or **poorly understood** genetic material
- ❑ It can help in diagnosing / treating complex diseases
- ❑ **Dark matter RNA:** RNA produced from regions of genome without known function

## Nanotech

### Why nanomaterials have different property?

- Large surface area increases reactivity
- Quantum effects govern properties of material



### Nano Urea Liquid:

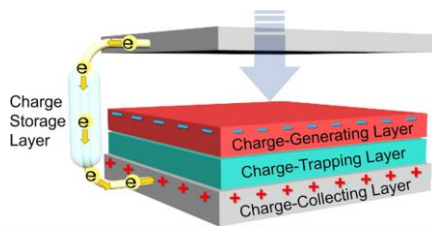
- ❑ Its small size (20-50 nm) increases availability to crop by 80%.
- ❑ 500 ml bottle equivalent to one bag of urea granules.
- ❑ Launched by IFFCO (Indian Farmers Fertiliser Cooperative Ltd)



Introducing World's First Nano Urea for Farmers

- Reduces Input Cost
- Increases Farmers' Income
- Environment-friendly
- Enhances Crop Productivity
- Improves Nutritional Value
- Cheaper than Conventional Urea

82% of the total nitrogenous fertilizers consumed in India is Urea; 20% of Urea is imported



### Nanogenerators:

- ❑ converts mechanical/thermal energy from small physical change into electricity
- ❑ e.g. piezoelectric and triboelectric nanogenerators

## IT related news

### IndiaChain: initiative of NITI

- ❑ Common blockchain infra for various govt departments

### Presidio principles: initiative of WEF

- ❑ aka Blockchain Bill of Rights
- ❑ 16 principles to protect rights of participants of Blockchain

### APPS



### DAPPS



### Decentralised apps: DApps

- ❑ Instead of a single server, they run on peer-to-peer (P2P) networks / blockchain.
- ❑ They are outside the control of a single authority.
- ❑ They need higher computing power.
- ❑ People can interact with one another without third parties.

## Deepfake



Person A Person B



- Put some videos of Person A and B in an AI software.
- Software will learn their facial movements, voice tone, etc.
- Whatever Person A says, software will make it look like Person B said it.
- Problem? Deepfakes are not normal cut copy paste job.
- They are synthesized by AI so well that its extremely difficult to say if it's a fake video.

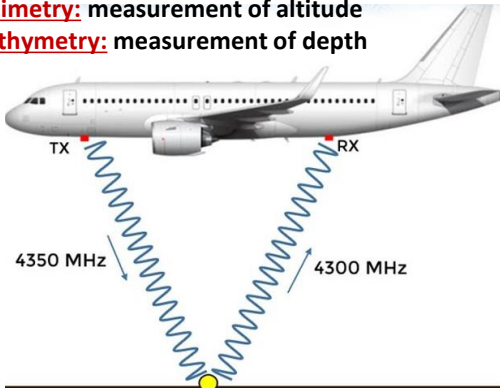
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# 5G

**Altimetry:** measurement of altitude  
**Bathymetry:** measurement of depth



**Barometric altimeter:**

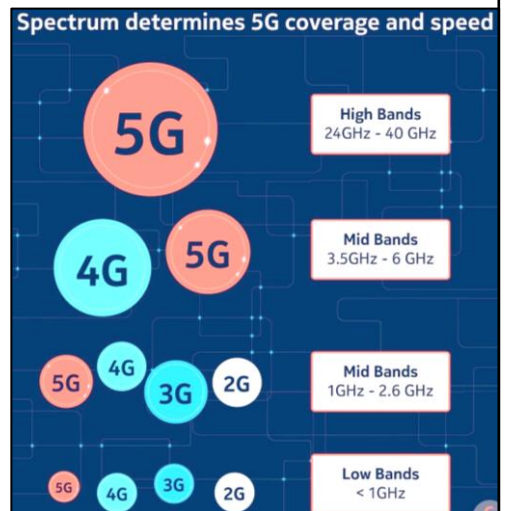
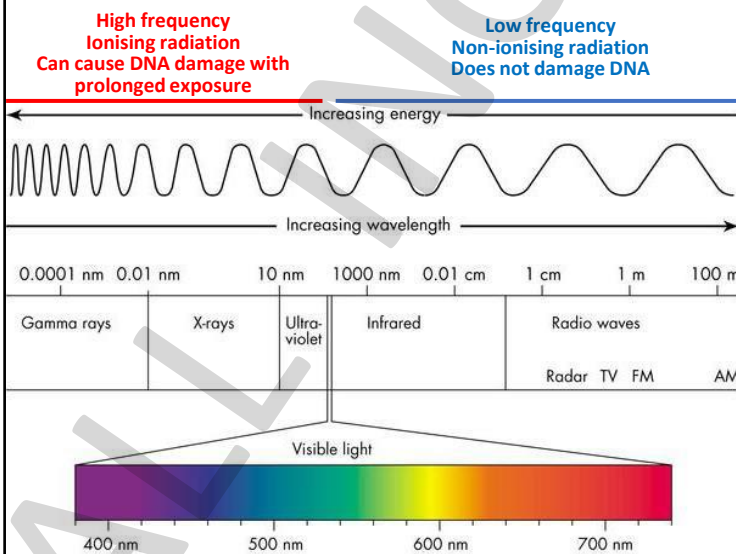
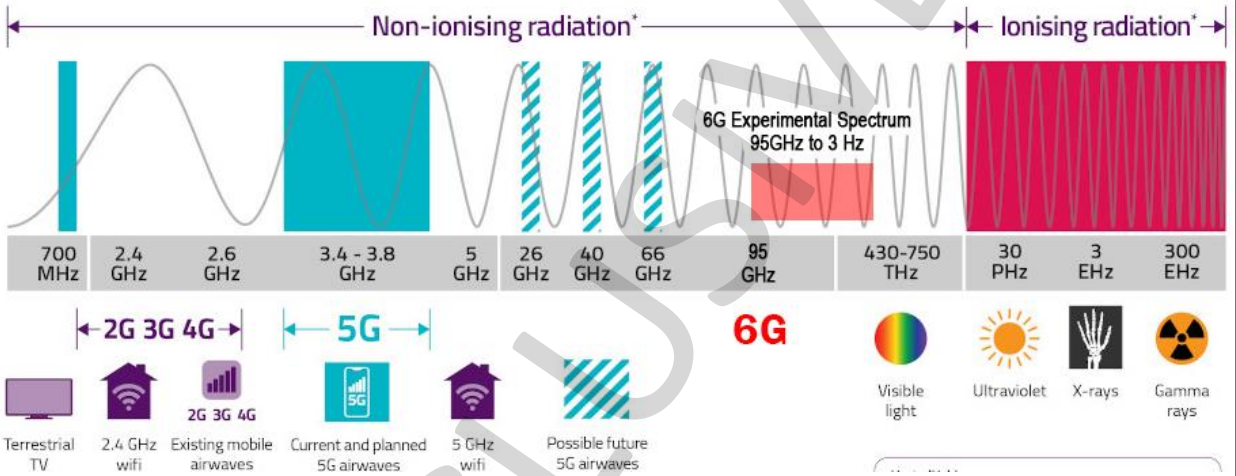
- Measures atmospheric pressure

**Radar altimeter:**

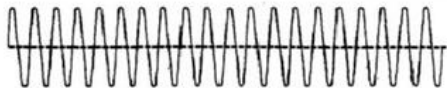
- Measures frequency of reflected radio pulses
- Indicates actual height above ground.
- Usually operate in range 4.2-4.4 GHz
- 5G C-band is near to this range
- Hence, can interfere with landing etc.

**5G in India:** 3.3-3.6 GHz

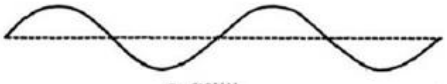
- Demand by Telcos is for 26-28 GHz
- mm Wave refers to 10mm 30GHz - 1mm 300GHz



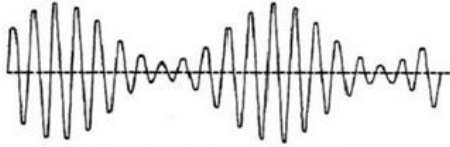
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A CARRIER



B SIGNAL



C AMPLITUDE MODULATED WAVE

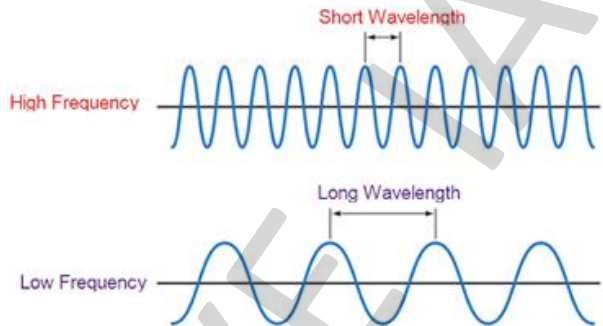


D FREQUENCY MODULATED WAVE

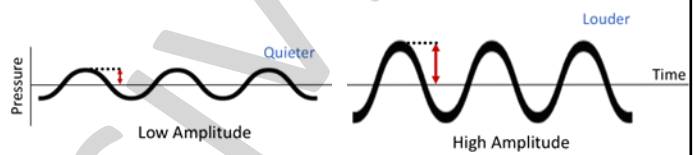
**Prasar Bharti:**

- ❑ **Statutory** autonomous body; Prasar Bharati **Act 1990**.
- ❑ Est. 1997; HQ Delhi; Two constituents: AIR and DD

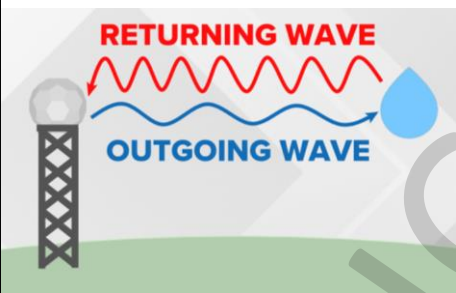
In 2019, Prasar Bharti asked AIR to phase out short wave transmitters. But MEA opposed the move as it will impact India's outreach to more than 100 countries.



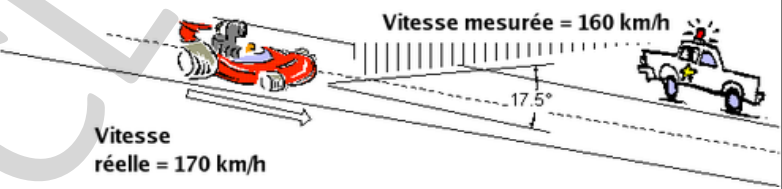
Amplitude modulation (AM)	Frequency modulation (FM)
Developed in 1870s	Developed in 1930s
Frequency 500 – 1700 KHz	Frequency 88 to 108 MHz
Consumes less power	Consumes more power
More noise, less quality	Less noise, better quality



**Doppler radar**



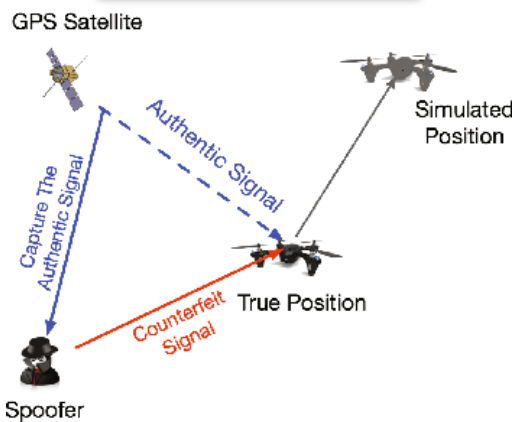
- uses Doppler effect to produce velocity data about distant objects
- by analysing how motion has altered frequency of returned signal



**TaxiBot**



**GPS spoofing**

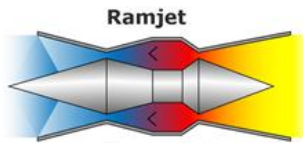
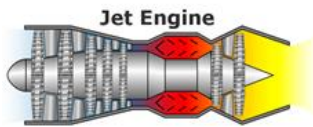


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## Air-breathing engine

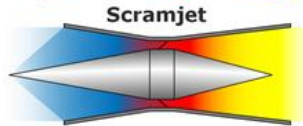
✓ Turbojet ✓ Turbofan ✓ Ramjet ✓ Scramjet

- ❑ **DRDO** recently tested Hypersonic technology demonstration vehicle.
- ❑ It used **ISRO's** Advanced Technology Vehicle. It is based on **scramjet** engine technology.



### Ramjet engine:

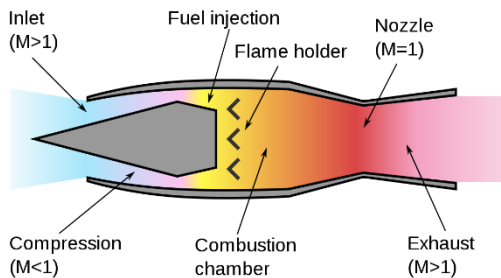
- It does not have rotating compressor.
- It uses forward motion to compress incoming air.



### Scramjet engine:

- supersonic-combustion ramjet
- airflow remains supersonic throughout the engine

Compression    Combustion    Expansion



### Working:

- Incoming air is compressed due to forward motion of engine.
- Fuel is mixed with hot compressed air
- Ignition produces thrust.

### Benefits of Ramjet:

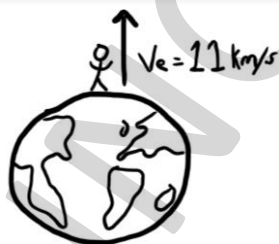
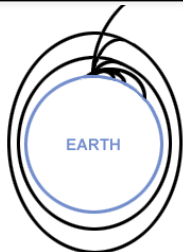
- No need to carry **oxidizer** (70% of propellant weight)
- Vehicle becomes **lighter, faster, long range.**

### Applications:

- India uses ramjet engine in **BrahMos** and **Akash** missiles.
- **BrahMos-II** will use scramjet engine.

### Limitation:

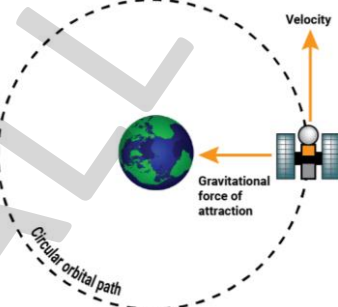
- Does not work when vehicle is **stationary**
- Needs **additional** propulsion system, i.e. assisted take-off
- Can't work at higher **altitudes** where oxygen level drops.
- Efficiency drops after **Mach 6.**



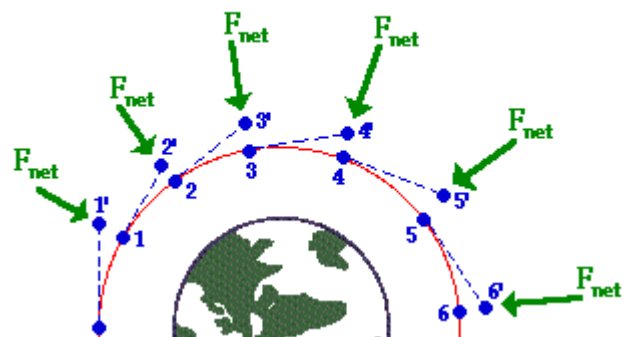
## Escape Velocity

- ❑ Minimum speed needed for a non-propelled object to escape gravitational influence of a body
- ❑ Earth 11.2 km/s
- ❑ Moon 2.4 km/s

**Why satellites remain in orbit, and don't fall?**  
Gravity + satellite's momentum from its launch



**An Orbiting Satellite Requires a Centripetal Force**

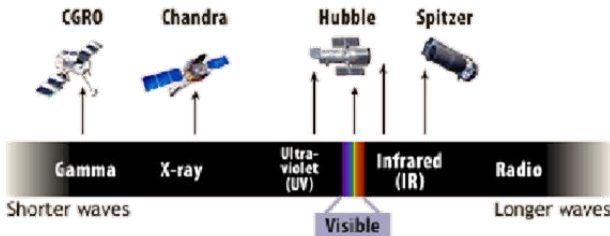
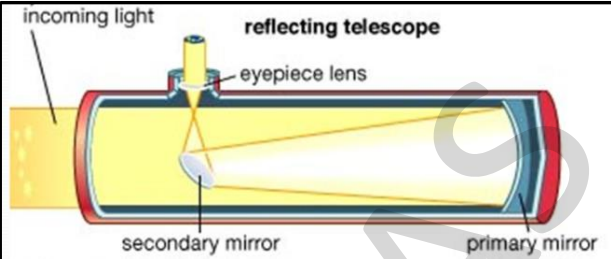
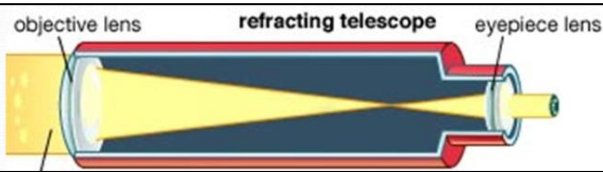


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## Telescopes



### ← Great Observatories program: (NASA)

Four powerful space-based telescopes

- 1990 Hubble Space Telescope
- 1991 Compton Gamma Ray Observatory
- 1999 Chandra X-ray Observatory
- 2003 Spitzer Space Telescope

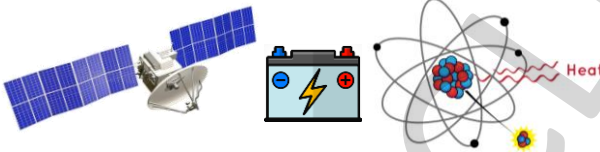


Hubble	James Webb
1990	2021
LEO, 570 km	L 2, 15 lakh km
Visible light	Infrared
2.4m mirror	6.5m mirror
Both are reflecting telescopes	
First space observatory? No	Replacement of Hubble? No



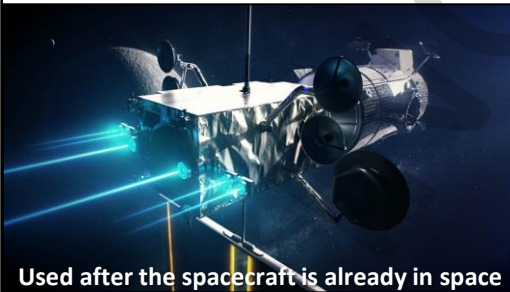
## Power for spacecraft

Sun, Battery, Unstable atoms



### Radioisotope/Radionuclide: (radioactive isotope)

- Has **unstable** combination of neutrons & protons
- Has **excess energy** in nucleus
- Provides **heat** to the spacecraft (space is cold!)
- Provides heat to generate **electricity**



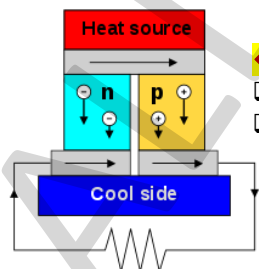
### Nuclear Thermal Propulsion:

- Transfers **heat** from reactor to a **liquid** propellant.
- Heat converts liquid to **gas**, which expands through nozzle.
- More efficient** than chemical rockets.

### Ion propulsion:

- Uses electrical power and gas (e.g. Xenon)
- Separates electrons in gas atoms to create positively charged ions, which are discharged from thruster at high speed

## Miscellaneous

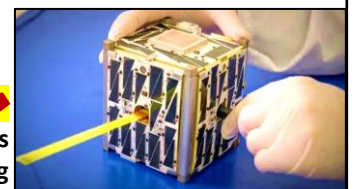


### ← Thermoelectric effect / Seebeck effect:

- Converts temperature difference into electricity
- Device: Thermocouple / Thermoelectric Generator

### CubeSat →

- It is a class of research nanosatellites
- Usually 10cm x 10cm x 10cm, weight < 1.33 kg



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### Sagittarius A\*

- Near constellations Sagittarius and Scorpius
- Milky Way's central supermassive **Black hole** (40 lakh solar masses)
- Bright and very compact astronomical radio source at centre of Milky Way
- 2020 Physics Nobel Prize:**
  - to Reinhard Genzel and Andrea Ghez
  - for discovery that Sgr A\* is a supermassive Black hole

## Tuberculosis

### DownToEarth

#### Union agriculture ministry prohibits use of TB antibiotics on crops

The draft order prohibits import, manufacture or formulation of Streptomycin and Tetracycline for use in agriculture from February 1, 2022; enforces complete ban from Jan 1, 2024

By **Deepak Bhati**  
Published: Tuesday 21 December 2021

### Bacillus Calmette–Guérin (BCG) vaccine

- Introduced 18 July, **1921** to combat TB
- It is currently the **only** licensed vaccine for TB
- It gives **moderate protection** against severe forms of TB in **infants and young children**
- It is preferably given **soon after birth**.
- Single dose gives **lifetime immunity**.  
Booster doses not recommended by WHO.
- There is **no vaccine** that is **effective** in preventing TB disease in **adults**.
- BCG can also used as vaccine/medicine in some other disease? Yes!
- Some TB vaccines undergoing trials:  
MTBVAC, IMMUVAC, VPM 1002, Mycobacterium indicus pranii

## Covax

### COVAX No-Fault Compensation Program

- It is for 92 low and middle income countries (Advance Market Commitment economies)
- It is world's **first and only** international vaccine injury compensation mechanism
- Compensation to those who suffer **serious adverse events** from COVAX vaccines
- It gets funds from levy on each dose distributed through COVAX
- No fee is charged to apply for compensation under the Program.

## Miscellaneous

### National Anti-Doping Bill 2021:

(Ministry of Youth Affairs and Sports)

- To make NADA a statutory body
- To make NDTL as principle dope testing lab

### National Anti-Doping Agency:

- Society under MoYA&S; Implements anti-doping rules

**National Dope Testing Laboratory:** (1990, New Delhi)

- Lost WADA accreditation in 2019; regained in 2021



### Oxidation:

chemical reaction, produce free radicals, may damage cells.

### Anti-oxidants:

neutralize free radicals by giving up some of their electrons.

### Some antioxidants:

Beta-carotene; Lutein; Lycopene; Selenium; Vitamin A, C, E

*Vegetables and fruits are rich sources of antioxidants.*

Deficiency	Disease
Vitamin A	Night blindness
Vitamin B1	Beriberi (weakness)
Vitamin C	Scurvy (bleeding gums)
Vitamin D	Rickets (bones are weak & bent)
Calcium	Weak bones, tooth decay
Iodine	Goiter (enlarged thyroid gland)
Iron	Anemia (low hemoglobin, RBCs)

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## Food Fortification

Ministry of Consumer Affairs, Food & Public Distribution

**In a first, Centre issues uniform specifications for Fortified Rice Kernels (FRK) for grade A & Common Rice**

Posted On: 20 SEP 2021 5:45PM by PIB Delhi

Department of Food and Public Distribution (DFPD) under Ministry of Consumer Affairs, Food and Public Distribution for the first time issued uniform specifications for Fortified Rice Kernels (FRK) for grade A & Common Rice have in case of procurement of Fortified Rice Stocks, of which 1% of FRK (w/w) should be blended with normal rice stock.

**FSSAI norms: 1 kg fortified rice will contain**

- Iron** (28 mg-42.5 mg),
- Folic acid** (75-125 microgram)
- Vitamin B-12** (0.75-1.25 microgram).

In addition, rice may also be fortified with zinc and vitamins A B1 B2 B3 B6

Fortified rice is to be distributed under various schemes like PDS and midday meals by 2024.

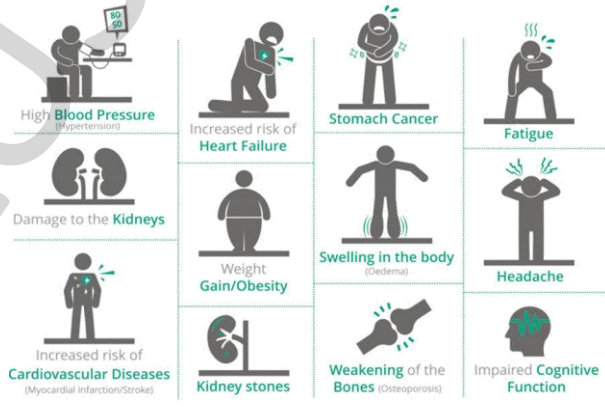
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Vitamin A	Night blindness
Vitamin B1	Beriberi (weakness)
Vitamin C	Scurvy (bleeding gums)
Vitamin D	Rickets (bones are weak & bent)
Calcium	Weak bones, tooth decay
Iodine	Goiter (enlarged thyroid gland)
Iron	Anemia (low hemoglobin, RBCs)

### Sodium:

- WHO has set benchmark in different food categories
  - WHO recommends salt intake < 5gm/day for adults
- Naturally in meat/dairy, most in processed foods*

### Adverse Health Effects Associated With Excess Salt Consumption

#### Health Benefits of Sodium



## Sodium



Sodium Sulphur batteries normally work only above 300°C. But new tech is making them feasible at room temperature.

### Sodium (Na 11):

- It is a metal.
- It **floats** on water (All metals except Lithium, Sodium, Potassium)
- It can be **easily cut** with a knife.
- It is a **good conductor** of electricity and heat.
- Even trace amounts of sodium are toxic for humans? No
- In fact, sodium is essential element for all animals and some plants.

## Microbial Fuel Cell

**Engine** → fuel is burnt

**Cell** → redox reaction

**Fuel cell** → redox reaction of fuel

**Microbial fuel cell** → microbes drive redox reaction

7. Microbial fuel cells are considered a source of sustainable energy. Why ?

- ✓ 1. They use living organisms as catalysts to generate electricity from certain substrates.
- ✗ 2. They use a variety of inorganic materials as substrates.
- ✓ 3. They can be installed in waste water treatment plants to cleanse water and produce electricity.

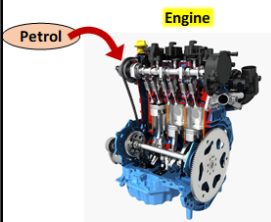
Prelims 2011

95. With reference to 'fuel cells' in which hydrogen-rich fuel and oxygen are used to generate electricity, consider the following statements :

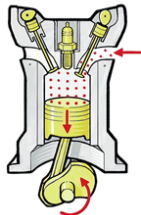
- ✓ 1. If pure hydrogen is used as a fuel, the fuel cell emits heat and water as by-products.
- ✗ 2. Fuel cells can be used for powering buildings and not for small devices like laptop computers.
- ✗ 3. Fuel cells produce electricity in the form of Alternating Current (AC).

Prelims 2015

- Limited supply of petrol/diesel
- Creates pollution



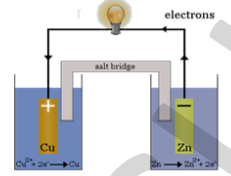
Engine



Combustion creates force

- No pollution, but needs repeated recharge, eg electric cars

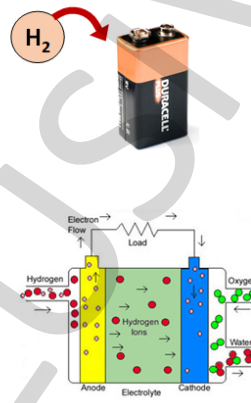
Cell



Redox reaction creates electricity

- Use Hydrogen (unlimited supply)
- No Pollution (creates only water)
- No need to recharge (runs on fuel)

Fuel cell

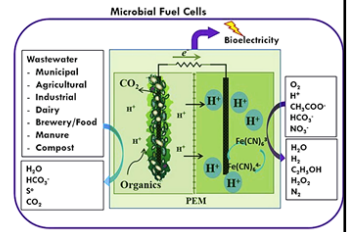


Fuel is refilled again and again, to continue redox reaction

- Uses microbes
- Can run small sensors in remote areas
- Can treat waste water

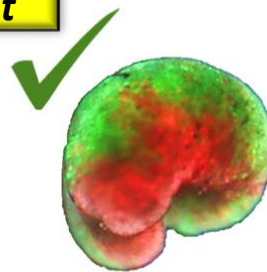


Microbial Fuel cell



Using microorganisms to drive redox reaction

## Xenobot



- They are made of just two things: frog **skin** cells (green) and frog **heart** cells (red)
- Skin cells provide rigid support, Heart cells give push to move
- Supercomputer did simulation: **how to arrange these cells** so that they move themselves straight, round, etc.
- In future, they may be made to do more types of work
- Currently, main aim is to study **how cells cooperate to make complex bodies**