Science and Technology Class 07

3rd August, 2023 at 9:00 AM

NUCLEAR TECHNOLOGY IN SPACE (09:08 AM)

- **Radioisotope Thermoelectric generators-**
- To explore deep space solar energy can not be relied upon.
- In such cases, space agencies may use a **Radioisotope Thermoelectric generator** that uses radioisotope such as Plutonium 238 which emits alpha particles and energy.
- This energy is absorbed as thermal energy which can also be converted into electrical energy.
- **Nuclear Propulsion**- Having a rocket powered by nuclear energy. This remains in experimental status.

NANOTECHNOLOGY (09:47 AM)

- It is science and engineering occurring at the nanoscale (1-100nm).
- At this scale, materials exhibit amazing properties.
- In fact, the physical, chemical, and even biological properties change at such a small scale such as better electric conductors, greater chemical reactivity etc compared to their larger-scale counterparts.
- Scientists can use this to fine-tune a material's property of interest.
- QLED has quantum dots.
- **Uniqueness about nanotechnology**
- 1) At the nanoscale, quantum effects rule the behaviour and properties of the material.
- 2) Nanomaterials have a large surface area than similar volumes of large-scale materials. A greater amount of material can come into contact with the surrounding thus affecting chemical reactivity.
- Because of this nanomaterials have applications in catalysis. (Smaller object -more surface area - more chemical reactivity).
- Most of the biology occurs at the nanoscale for e.g. haemoglobin has a 5-nanometer diameter, and a strand of DNA has a 2-nm diameter. Many medical researchers are working on tools, treatments and therapies that are more precise using nanotech.

APPLICATIONS OF NANOTECHNOLOGY (11:00 AM)

- **1. In Daily life-**
- Nanoscale films on eyeglasses, computers, and camera displays can make them water and residue-repellant, antifog, and scratch resistant among others.
- In fabric, the addition of nanomaterials can lead to interesting properties such as anti-wrinkling,anti-staining, or even inhibited bacterial growth.
- Nanomaterials can also be used in many cosmetics, such as sunscreen lotions, lipsticks and in cleaning products.
- **2. In Electronics:-**
- In Transistors, the basic switch that enables all modern computing has gotten smaller and smaller through nanotechnology.
- Ultra high-definition displays are enabled by Quantum dots (a type of nanomaterial).
- Flexible, foldable displays are possible with the help of nanotechnology.
- In post-Moore electronics, nanotech has played a significant role (the law no longer is valid). Moore's law was a prediction that the number of transistors in an integrated circuit is going to double every 2 years.
- In quantum computers, scientists are using quantum dots and other nanomaterials to design Qubit.
- In batteries such as Lithium-ion batteries, fuel cells, and solar cells many nanomaterials have applications.
- **3. In Healthcare:**
- **Cancer treatment**- Gold nanoparticles are being investigated as a potential treatment for cancer and other diseases.
- **Targeted drug delivery:** A nanoparticle can incapsulate or otherwise help to deliver medication directly to cancerous cells.
- **Gene editing**: With the help of nanoparticles, many gene editing tools such as CRISPR- Cas9 become more efficient in precise gene editing.
- In **diagnosis of the diseases**, nanotechnology is helping in making better imaging and diagnostic tools which leads to early diagnosis and better treatment.
- **Gene editing and Gene sequencing-** Nanoparticles can be engineered to deliver components to target cells or tissues allowing for precise gene editing.
- For rapid and accurate DNA sequencing, nanotech is used.
- In tissue engineering, we can make nanomaterials that can, mimic human bones, dental cells, etc.
- Some Nanomaterials such as Quantum dots have proven to kill superbugs (drug-resistant bacteria).
- **4. In Environmental Remediation:**
- In water purification, nano-membranes can be very helpful.
- Similarly for air filtration i.e. removing pollutants from the air, nano filters are used. Nanomaterials can be used to break down pollutants in the air.
- **Environmental monitoring-** Nano-sensors can be used to detect air pollutants, and monitor water quality, soil conditions etc.
- In both solar energy and wind energy production, nanotech has applications. For e.g. Quantum dots in solar panels can increase efficiency. Similarly, the addition of nanoparticles to wind turbines can make them stronger yet lighter.
- Light weighting of vehicles, aeroplanes enabled by nanotechnology makes them more energy efficient without compromising on material strength.

TOPIC OF NEXT CLASS- INFORMATION AND COMMUNICATION TECHNOLOGY