

SOLAR ENERGY

Solar energy is the energy received from SUN. Sun is the major source of energy. Over the history there are many examples of using the sun as a source of energy. There were old cultures that used solar energy to ignite wood. In the early 1900's the steam engine had it's power from the Solar energy.

Recently, solar energy has emerged as an alternative energy. It's being used for different purposes like lighting, mechanical power and for generating electricity and so on. But before supplying the solar energy, it has to be captured and collected first.

The common method for collecting the sun light is through flat-plate collectors or mirrors. Solar energy is majorly used in the production of electricity. There are two ways of generating electricity through solar energy. They are solar thermal plants and the photovoltaic cells.

Solar Thermal plants:

- They have solar panels that are made of these mirrors.
- These mirrors let the sun light hit their surfaces all the time.
- These panels absorb energy from sun and send the heat to the tubes filled with liquid.
- This liquid boils the water to create steam.
- The steam spins the turbine that is connected to a generator which generates electricity.
- The steam cools and condenses back to water that is recycled. Reheated and converted to heat again.

Photovoltaic Cells:

- Sun light hits the surface of these photovoltaic cells.
- A material called semi-conductor converts sunlight directly into electricity.

Major disadvantages of solar energy:

- Solar panels use expensive semi-conductors.
- Giant solar farms are built away from the cities. To bring the power to cities expensive transmission lines are to be built.
- Maintenance is a drawback. They are to be kept clean always.

- The cooling of the steam generated is also a problem
- The major problem is the energy can be produced only when the sunlight is available.

Questions and answers for Solar energy:

1. Where is the solar power plant located?

A: The solar plant is located outside Seville in Spain.

2. Why was this region selected?

A: This region was selected because, this part of southern Spain is known for its abundant sunlight and scarce rainfall. Also, it provides an ideal landscape for a solar thermal power.

3. What could the drivers see as they neared the solar power plant?

A. The drivers could see white rays emanating from a tower, piercing the dry air and alighting upon the upturned faces of the tilted mirrors below.

4. Why are the mirrors used in the plant?

A. The mirrors are used to track the sun and radiating its energy on to a blindingly white square at top of the tower.

5. What are the reasons given for the raise in popularity of this plant?

A. The following are the reasons for the increase in solar energy:

- Gas costs are rising.
- The world is focussing on global warming.
- Governments are interested to invest in alternative energy.

6. What is the function of the heliostats?

A. The tower uses curved mirrors called heliostats. The function of these heliostats is to shift position with a slight mechanical groan every few seconds.

7. What is challenge faced by the developers of the solar plant?

A. A significant challenge face by the developers of concentrating solar power is the cost of maintenance.

8. What are the various steps involved in power generation?

A. The following are the steps involved in power generation through solar energy:

- Huge curved mirrors collect the sun's energy.
- They heat the liquid in the tubes.
- This heated liquid is used to convert water into steam.
- The steam is used to rotate the turbines.
- The rotation of the turbines creates or generates electricity.
- The steam cools and condenses back to water and re-cycled.

NANOTECHNOLOGY

Ans 1:

Nanotechnology can be vaguely defined as the study and control of phenomena and materials at nano scale. Most of its applications include evolutionary developments of existing technologies.

Mostly nanotechnology is used in the field of medicine. Researchers are developing customized nanoparticles the size of molecules that can deliver drugs directly to the diseased cells in a patient's body. This method greatly reduces damage treatment such as chemotherapy does to patient's healthy cells. Future applications may include the usage of nanocrystalline zirconium oxide as medical implant as it is hard, wear-resistant and also bio compatible. Nanotechnology also finds usage in sunscreens and other cosmetics. Nano-sized titanium dioxide and zinc oxide absorb and reflect UV rays and yet are transparent to visible light which makes them apt for manufacturing sunscreens. Other present day applications include carbon fibers and multi walled Carbon Nanotubes which are used in polymers to enhance conductivity and hence find application in antistatic packaging. Cutting tools can also be strengthened and hardened using nanocrystalline materials such as tungsten carbide which are more wear and erosion-resistant and last longer than their conventional counterparts.

As already said, the full potential of nanotechnology is yet to be uncovered and extensive research is going on around the globe over its possible future applications. Some of them being usage in data storage whereby the area required to record one piece of information can be shrunk using nanotechnology. Nanotechnology also finds application in military battle suits, nano-engineered membranes for water purification, fibers and fabrics, CNT

ceramics with extreme properties &c. Hence, nanotechnology is not a lone field in itself but has various applications in every other branch of science. Nanotechnology is the future of mankind.

Ans 2:

Bulkier particles of zinc oxide and titanium dioxide have been used in sunscreens for decades to reflect or absorb cancer-causing ultraviolet light. The reason traditional sunscreens look white when applied on the skin is because particles of this size reflect visible light. But when these sunscreen ingredients are manufactured into nanoparticles at the sizes of 25 – 50 nm, they behave differently and allow the visible light to pass through them making them completely transparent. In comparison to conventional sunscreens, they are more stable, thus requiring less reapplication making them more durable and efficient. They are also less irritant and less allergen which makes them more preferable compared to other sunscreens.

Ans 3:

There are many long term applications of nanotechnology and some of them being used in data storage, CNTs, medical implants, machinable ceramics, water purification, military suits, nanomedicine &c.

Carbon nanotubes have exceptional mechanical properties, particularly high tensile strength and light weight which makes them suitable for nanotube reinforced composites with performance better than current carbon-fiber composites. Nanoscale fabricated magnetic materials have applications in data storage as we are in an era when the Hard Disk needs to be tightly packed with smallest recording unit so as to expand its total capacity keeping the size of the Hard disk almost same. The devices on computer chips which currently operate using flows of electrons could use the magnetic spin property in the near future which has wide range of advantages.

Other future applications include usage in military battle suits where enhanced nanomaterials can be the basis for energy-absorbing materials which can withstand blast waves. Military equipment can further be enhanced and modernized by fabricating sensors which can respond to chemical and biological weapons through nanopores. Usage of nanotechnology in ceramics can greatly improve their plasticity, ductility with three times the expansion of traditional ceramic. Nanotechnology is going to play a key role in the field of medicine in treating incurable diseases such as cancer, AIDS &c. Nanobots can

be designed and made to carry drugs or equipment to kill dangerous cancer cells without affecting healthy ones. Nanotechnology is the future of mankind.

Ans 4:

Medicine is going to be one big industry where nanotechnology will find its major application. Conventionally medical implants such as orthopedic implants and heart valves are made of titanium and stainless steel alloys as they are biocompatible. But they deteriorate in quality within the patient's lifetime. This drawback can be overcome by Zirconium oxide also known as Zirconia which is hard, wear-resistant, bio-corrosion resistant and bio compatible. Hence it appeals to be the best alternative for medical implants in the near future.

Ans 5:

Nanomaterials can be enhanced to an extent that battle suits can be developed which can withstand blast waves in war zones such as the one being developed by the Institute of Soldier Nanotechnologies at MIT. These play a crucial role in saving manpower of belligerents and further save many civilian lives in hostile environments such as war-torn countries and colonies. A long-term application of nanotechnology in battle suits field can be equipping the suit with sensors to detect and also respond to chemical and biological weapons such as Mustard agent, Phosgene gas, Sarin. Nanotechnology can also be applied to make battle uniforms which can track physiology of the soldier and treat him/her accordingly in battlefield.

Ans 6:

Carbon nanotubes have outstanding mechanical, thermal, and electrical properties. Thus, by placing nanotubes into appropriate matrices, it is postulated that the resulting composites will have enhanced properties. The new ceramic material reinforced with carbon nanotubes has been made by materials scientists at University of California. The new material is far tougher than conventional ceramics. Unlike the conventional ceramic, the CNT reinforced ceramic conducts electricity. It can also conduct heat and act as a thermal barrier depending on the orientation of the nanotubes. Due to their hardness and resistance to chemical attack, ceramics find use coating turbine blades and with this latest technology, its scope can further be extended.

Ans 7:

Technologies like Reverse Osmosis and Ultra Violet filtration have seeped into this industry which can purify water from many disease-causing bacteria. These technologies have their own limitations and one being the inefficiency in

treating miniscule bacteria. This limitation can be overcome by CNT based water filtration devices and it has been reported that these filters can not only block the smallest particles but also kill most bacteria. Such water purifiers are already in the market for use.

CLOUD COMPUTING

Cloud computing is one of the fastest emerging technologies these days. The cloud is the delivery of on-demand computing resources everything from applications to data centres etc; It is a third party service. The business owners outsource their computing needs to a third party and use their services when needed by accessing their resources through the internet.

The reasons for the increase of the cloud computing:

- The cloud computing services are provided at cheaper rates than of maintaining the individual servers.
- Reduces the cost of hiring a highly skilled maintenance team.
- One of the main reasons for the use of cloud computing is that it reducing the cost of infrastructure.
- The users need not worry about the software, installations and back-ups.

Types of cloud computing:

There are basically three types of cloud computing. They are:

A) Public cloud: This is the most popular type of cloud computing. In this type the third party provides both the disk space and computing power.

Eg: Google and Amazon.

B) Private Cloud: These are used by the users who have a data that needs to be secured and protected. In this type the user sets up his own data center and the maintenance. It provides more security to the data but is more expensive than the public cloud.

Eg: Banking people generally go for a private cloud as they need to protect the data of their customers.

C) Hybrid Cloud: It is a combination of both the public and private cloud. These are generally used by users who want some of their data to be visible and some of their data to be protected.

Cloud Computing Architecture:

Cloud computing mainly provides the following three services. They are:

I) IAS- Infrastructure As a Service: The service provider or the third party bears all the cost of servers, networking equipment, storage and back-up. The user has to just pay for the service.

II) PAS- Platform As a Service: The service provider provides the platform and the solutions for the users.

III) SAS- Software As a Service: The service provider will give the user the service of using their software of any applications based on their need.

But, the main drawback of the cloud computing is that there is always a worry of data security and as it is an emerging technology it still needs to be developed a lot. On the whole it is a major emerging technology.

HOTSPOT: Biodiversity hotspot is a bio geographic region with a significant reservoir of biodiversity that is under threat from humans.

(Geology) the places are volcanic regions thought to be fed by underlying mantle that is anomalously hot compared with the surrounding mantle.

GEOGRAPHIC AREA: An area of land that can be considered as a unit for the purposes of some geographical classification.

SHOT IN THE ARM:

A boost or act of encouragement.

Something that boosts one's spirit.

Something that has some sudden positive effect on something, providing encouragement and new activity.

RAIN FED POTHOLE:

A deep circular hole in a riverbed formed by the erosion of the rock.

A depression or hollow in a road surface caused by wear or subsidence.

BEAR THE BURNT:

To withstand the worst part or the strongest part of something, such as an attack.

Put up with the worst of some bad circumstances.

IDEAL CHOICE:

(an act/ instance of choice, a wise choice)

A choice that is regarded perfect. Something that is existing only in imagination desirable or perfect but not likely to become a reality.

NAGGING PROBLEM: A problem which doesn't have a solution.

PAINSTAKING: It requires a lot of care, effort or hard work.

GREEN CHEMISTRY also called sustainable chemistry is an area of chemistry and chemical engineering focussed on the minimize the use and generation of hazardous substances. It focuses on technological approaches to preventing pollution and reducing consumption of non renewable resources.