Geology Lo.10

Qena Student Club

Solar energy

- **Solar energy** is the light and heat that the sun provides to Earth. This kind of energy is a resource that is renewable.

- Solar energy comes in various forms. These consist of wind, photovoltaic, biomass, and both direct and indirect sun radiation.

- One source of tidal energy is the sun. Nonetheless, the Earth-moon system is primarily responsible for producing tidal energy. Furthermore, keep in mind that wind power comes from the sun's heat since wind energy is found in the temperature differential between air segments.

- Solar energy sources include: • Direct solar thermal and photovoltaic power, Indirect solar wind power.

- Solar energy is generated at the Sun's extremely hot core. This happens as a result of nuclear fusion.

- In this process, very little mass is transformed into energy. The Sun remains hot due to the continuous nuclear fusion process occurring inside it.

Solar energy

- Surface emits electromagnetic radiation in every direction. primarily consists of light in the visible spectrum

- The electromagnetic spectrum is divided into two wavelength groups: ultraviolet (UV) at shorter wavelengths (10 nm to 380 nm) and infrared (IR) at longer wavelengths (750 nm to 1 mm).

- The radiation moves at the speed of light. It takes almost eight minutes to reach Earth

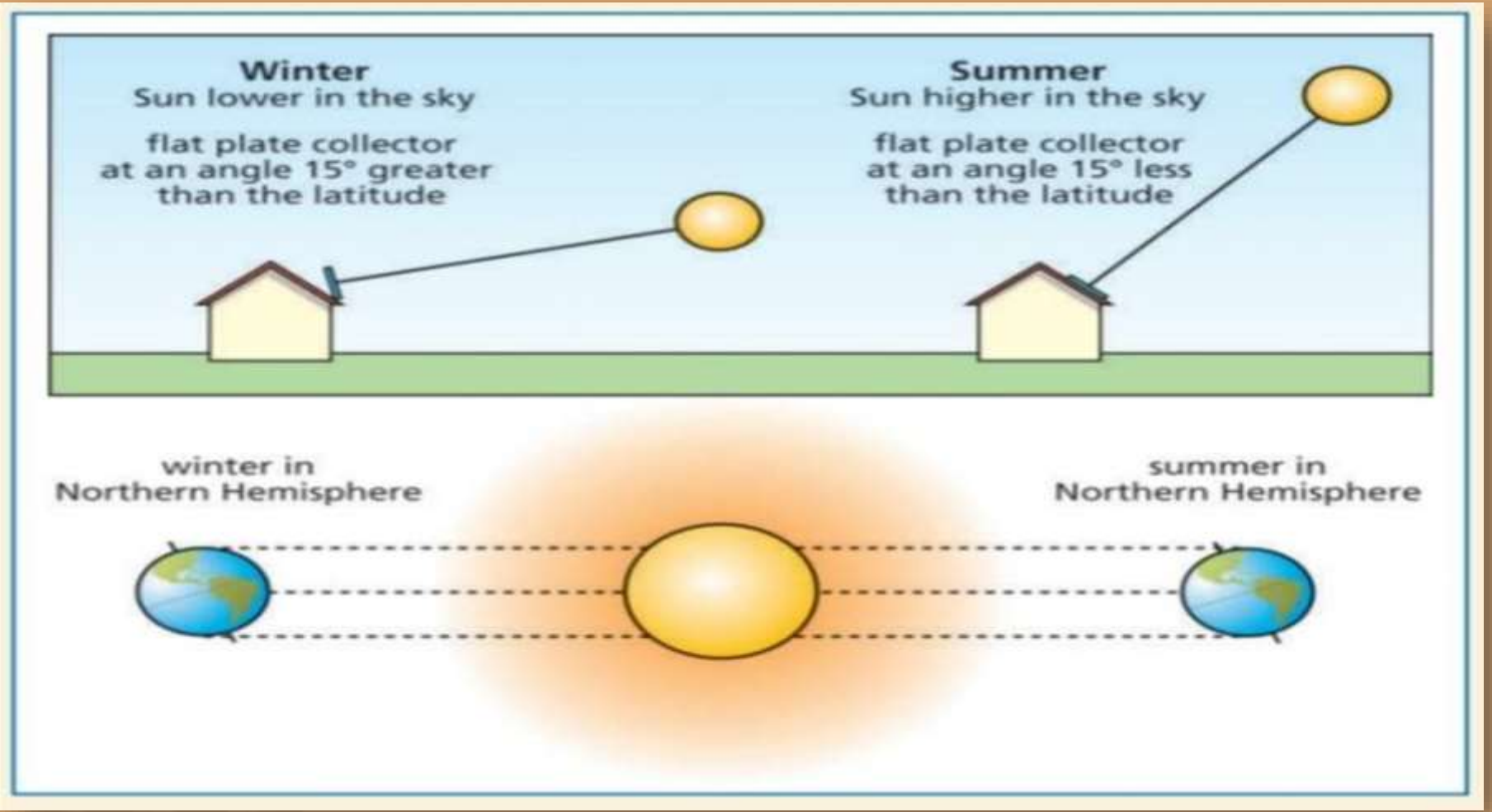
- Insolation: The rate at which sunlight reaches a particular piece of land.

- Latitude, season, time of day, air clarity, aridity of the sky, and land surface slope are all factors that affect insolation.

- summer and winter orientation of solar cells:-
  The sun is lower in the sky during winter, and the flat plate collector is angled 15 degrees greater than the altitude.

- The Sun is higher in the sky during the summer, with a flat plate at an angle of 15 less than the altitude.

Solar energy



This figure shows how the Earth's axis tilts in the summer and winter.

Solar Heating

Home heating: is one of the main uses of solar energy.
There are two kinds of it
1-Active: needs special equipment in the form of solar collector
2-Passive: Don't rely on mechanical equipment, but they are not as effective as active systems
3-Water heating: another major use of solar energy, have two main parts.
-They include solar collectors and storage tanks.

Solar Heating can be also used for:

- Solar energy is produced in the externally hot core of the sun, This occurs through the nuclear fuse.
- Insolation: It's the rate at which a given area of land receives solar energy. It depends on latitude, season, time of day, cloudiness of the sky, clearness of the air, and the slope of the land surface. It decreases when a surface is not perpendicular to the sun's rays.
- If the Sun is directly overhead and the sky is clear, the rate of solar radiation on a horizontal surface at sea level is about 1000 W/m2 (watts per square meter). This is the highest value insolation can have on Earth's surface.
- When the rays from the Sun are not direct, there is more atmosphere between the Sun and the surface. Some of the radiation is absorbed before it reaches Earth's surface.

Solar Heating

There’re two basic types of solar heating:

In active systems a solar collector is used to collect and distribute solar energy.

In passive systems, the building is Designed to let in large amounts of sunlight and the heat produced from the Sunlight is trapped inside.

Solar heating home heating is one of man’s uses of solar energy.

Active system: special equipment like a solar collector. Storage tank, solar energy is collected within the; flat; rectangular box with a transparent cover.

The water heating bottom of the collector box is plate-counted black on the upper surface and insulated on the lower surface

“Solar energy” trikes black surface is converted to heat, cool water circulated through pipes from hot collector box to storage tank, water is warmed, provide us in the pool or homes not expensive

- **air heating**
- **Many buildings use solar collectors to provide more than just hot water**
- **Buildings may use passive solar heating**

Solar Heating

- **In winter, the sun, homes Directly through large windows heating building**

- **In summer, the sun is blocked by over hag from shining into buildings Materials absorb, store sun heat and can be built into sunlit floors, walls then they heat up during the day. Al right they slowly release the heat. Many designs for passive solar heating also provide delighting simply the use of natural sunlight to brighten up a building.**

Star beating reduces the use of fossil fuels
• 90 percent efficient water heating
• 60 percent efficient water heating
• 30 to 40 percent efficiency of electricity produced from fossil fuels

▪ Photovoltaic PV cells (direct source)
To generate electricity from solar energy in power toys, calculators' roadside telephones, call boxes
They convert light into electric energy Some are simple calculations of wristwatches.
- **PV is the cheapest form of electricity; efficiency is not high but increasing In crystalline silicon.**

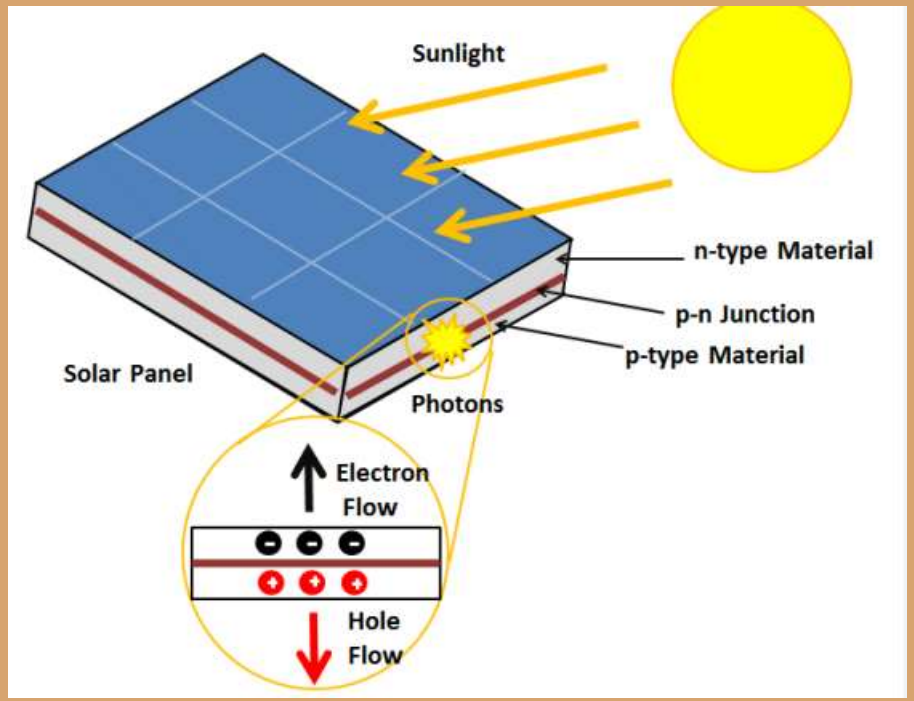
Photovoltaic Energy

It’s used to generate electricity. Photovoltaic (PV) devices generate electricity directly from sunlight via an electronic process that occurs naturally in certain types of material, called semiconductors.

Electrons in these materials are freed by solar energy and can be induced to travel through an electrical circuit, powering electrical devices or sending electricity to the grid.

They’re also known as “Solar cells”.

Their efficiency isn’t high, but it’s increasing as technology is progressing.



How does PV work?

Photons strike and ionize semiconductor material on the solar panel, causing outer electrons to break free of their atomic bonds.

Due to the semiconductor structure, the electrons are forced in one direction creating a flow of electrical current. Solar cells are not 100% efficient in crystalline silicon solar cells, in part because only certain light within the spectrum can be absorbed. Some of the light spectra are reflected, some are too weak to create electricity (infrared) and some (ultraviolet) creates heat energy instead of electricity.

Wind Power

- People have been using wind power for hundreds of years to pump water from wells.

➢ Yet, it has only been in the past 35 years that communities have started to use wind power to produce electricity

This figure shows wind turbines from an electricity-generating wind farm near Palm Springs, California.

- Wind turbines. (In 2010, it had a wind-power capacity of 9727 MW [megawatts] with several tens of thousands of wind turbines.)
- Other areas in the country have a high potential for wind power as well.

- These areas include the Rocky Mountains, the flat Midwest states, Alaska, and many more.
- Commercial wind turbines can have blades with a diameter as large as 60 m

Wind Power

- Wind is moving air, so it has mechanical energy that can do work. People have been using wind for energy for thousands of years
- The old-fashioned windmill in that figure one way that wind energy can be used.
- The wind turbines in the opening photo above are a much newer way of using wind energy.
- They change the kinetic energy of the wind to electrical energy.
- However, only certain areas of the world get enough steady wind to produce much electricity.
- Many people also think that wind turbines are noisy, dangerous to birds, and unattractive in the landscape.

Wind Power Use

- Wind is the source of energy for wind power.
- Wind has been used for power for centuries.
- For example, windmills were used to grind grain and pump water.
- Sailing ships traveled by wind power long before ships were powered by fossil fuels.
- Wind can be used to generate electricity, as the moving air spins a turbine to create electricity

Consequences of Wind Power

- Wind power has many advantages. It does not burn, so it does not release pollution or carbon dioxide.
- Also, wind is plentiful in many places. Wind, however, does not blow all of the time, even though power is needed all of the time.
- Just as with solar power, engineers are working on technologies that can store wind power for later use.
- Windmills are expensive and wear out quickly. A lot of windmills are needed to power a region, so nearby residents may complain about the loss of a nice view if a wind farm is built.
- Coastlines typically receive a lot of wind, but wind farms built near beaches may cause unhappiness for local residents and tourists.
- The Cape Wind project off of Cape Cod, Massachusetts has been approved but is generating much controversy.
- Opponents are in favor of green power but not at that location.
- Proponents say that clean energy is needed and the project would supply 75% of the electricity needed for Cape Cod and nearby islands
- California was an early adopter of wind power. Windmills are found in mountain passes, where the cooler Pacific Ocean air is sucked through on its way to warmer inland valleys

Test Bank

1- On a given day, which factors have the most effect on the amount of insolation received at a location on the Earth's surface?
A. Latitude and elevation
B. Longitude and time of day
C. Longitude and elevation
D. Latitude and time of day
ANS: D

2. Earth received heat from the sun is known as:
A. Thermal radiation
B. Insolation
C. Infrared heat
D. Solar radiation
ANS: B

3. The radiant energy emitted from the Sun is termed:
A. Long wave radiation
B. Convection
C. Insolation
D. Transmission ANS: C

Test Bank

4. The proportion of solar energy reflected from the Earth back into space is the Earth's:
A. Reflection ratio
B. Albedo
C. Energy loss
D. Energy balance
ANS:B

5. Cairo at latitude 30 degree, we must adjust angle of a PANEL CELL in summer at:
A. 15 degree
B. 45 degree
C. 90 degree
D. 60 degree
ANS: A

6. The average solar power incident on the Earth's surface is about:
A. 1000 mW cm
B. 1 kW m
C. 100 W cm
D. 1000 W cm-2
ANS: B

Test Bank

7. The capacity factor of a solar PV farm is approximately:
A. 5-10%
B. 10-20%
C. 20-30%
D. 40- 60 %
E. ANS: C

8. The following is indirect method of Solar energy utilization:
A. Wind energy
B. Biomass energy
C. Wave energy
D. All of the above
ANS: D

9. If the grid of a solar panel is 20 time 100, we give _____ VOLT from it:
A. 10 V
B. 200 v
C. 1000 v
D. 6000 v
ANS: C

Test Bank

10. An instrument used for measuring solar radiation is :
A. hygrometer
B. pyranometer
C. anemometer
D. Pyrheliometer
Ans: B

11-The output of a solar cell is of the order of:
A. 1w
B. 5w
C. 10w
D. 20w
Ans: A

12-The operating temperature of a central receiver power tower of solar plant is
A-500-1000 C
B-100-200 C
C-5000-10000 C
D-1000-5000 C Ans: A

Test Bank

13- Solar cells use the sun's light not its heat to make electricity – India has the largest solar cooker program
A:First is true, second is false
B: First is false , second is true
C: both are true
D:both are false
Ans: C

14-. The Zenith Angle complement is _____
A. Surface Azimuth Angle
B. Slope
C. Solar Altitude
D. Angle Solar Azimuth Angle
Ans: C

15-Which Meter is used to measure the Beam Radiations _____
A. Pyrheliometer
B. Sunshine Recorder
C. Anemometer
D. All of the above
Ans: A

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