

PART – II
(SECTION – A)

- Q. 2. (a) Differentiate between a star and a planet. What is the magnitude of a star and how the color of stars is correlated with their temperatures? (5)
- (b) “Semiconductors are the Brains of Modern Electronics”. Explain in detail what this quotation means. (5)
- (c) Briefly describe the most popular and accepted theory about the origin of the Universe. (5)
- (d) What are the advantages and limitations of renewable energy resources? Briefly explain the prospects of non-conventional energy resources in Pakistan. (5)(20)

General Science and Ability 2021, Part II

Q2. a) Star

Stars are huge gaseous bodies that generate their own light through the energy released from nuclear fusion.

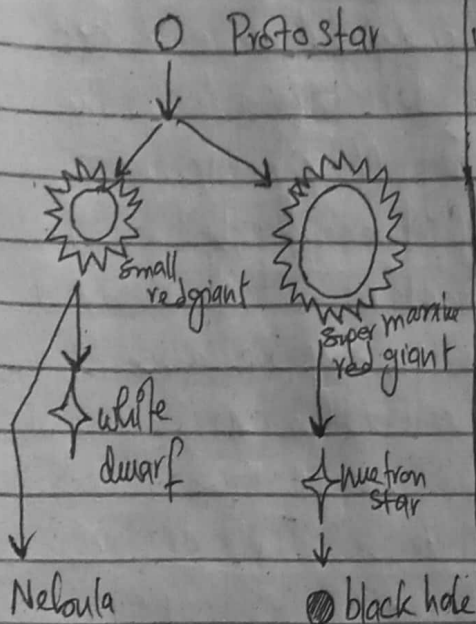
Answer

Planet

- A planet is a spherical body made up of rocks, and because of the gravitational force generated by the core they trap gas around them. They cannot generate light.

Stars

- Stars have a life cycle. A basic outline of the life cycle of a star has been illustrated below



- Stars from millions of light years away can be seen with a naked eye

Example of stars are Sun, Betelgeuse, Bellatrix, Sirius

Planets

- A planet has no life cycle. Unlike the star, it has no end but its existence will only cease if the star it's orbiting blows up by collapsing under its own gravity.

- Planets from millions of light years away can't be seen because they are small and don't generate their own light.

Examples of planets are Earth, Mars, Jupiter etc

b) Semiconductor

Definition

Semiconductors are materials whose conductivity varies with different temperatures. For most semiconductors, they are good conductors at high temperatures because their electrons are more mobile at high temperatures while

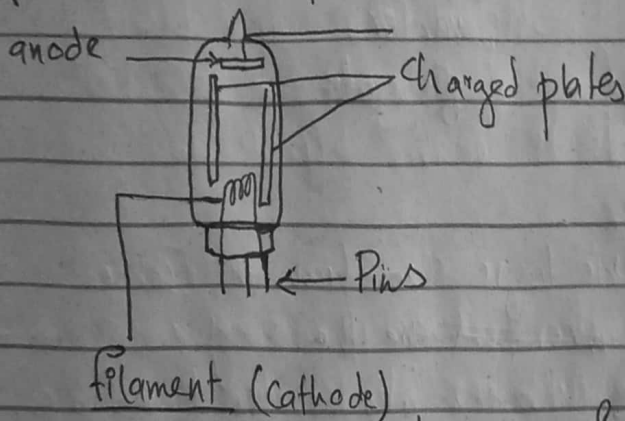
not seen while at cold temperatures the electrons lack mobility so they act as insulators.

Examples

Two examples of semiconductors are Silicon and Germanium.

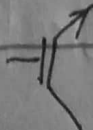
Brains of Modern Electronics

Initially Vacuum Valves were used for amplification in analogue electronic circuits. Power amplifiers were also designed from Vacuum Valves. The Vacuum Valves were made from glass and operated as follows




- The filament emits electrons because of thermionic emissions. The charged plates accelerate the electrons and the anode captures the electrons and makes them flow in the circuit.


Vacuum valves were expensive to manufacture. Engineers soon discovered semiconductor and from Semiconductors they manufactured Transistors. The first transistor they made was a BJT (Binary Junction Transistor). A Binary Junction Transistor is drawn in a circuit diagram as follows




Soon, with technological advancement, the scientists used semiconductors to manufacture MOSFETs.

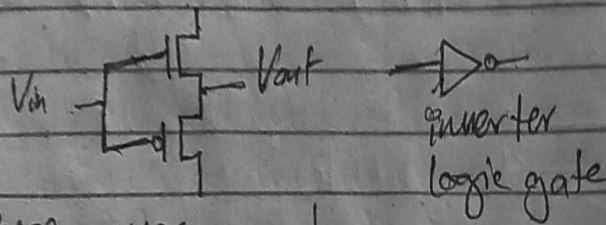
There are three types of MOSFETs.

i) NMOS \rightarrow 

ii) PMOS \rightarrow 

iii) CMOS \rightarrow 

The transistors were then arranged and connected in different form to create logic gates.



PMOS & NMOS arranged to form an inverter

Logic gates perform basic logic operations in electronic circuits and are also ~~important~~ are the major components of digital electronics. Logic gates operations are similar to neurological functions of the brain. A logic gate is made from transistors and transistors are made from semiconductors.

c) The universe is 4.5×10^{15} years old and has been expanding ever since its creation. The widely accepted and most popular theory for the creation of the universe is the Big Bang Theory.

The Big Bang Theory

The big bang theory suggests that in its initial

stage before space, time existed, the universe was an infinitely small yet very massive and hence dense singularity. Soon the singularity started to expand and has been expanding ever since.

Subatomic particles came into existence when the primal universe was expanding. The sub-atomic particles being quark and leptons. The sub-atomic particles formed protons, neutrons and electrons and eventually became complete atoms. These atoms merged to form stars and planets. The universe continued to expand and the galaxies drifted further apart from each other.

Evidence Supporting Big Bang Theory

i) Doppler Effect

Red Shift: When something moves away from us their wavelengths appear to increase while the frequencies appear to decrease relative to the observer.

Blue Shift: Relative to the observer, when things move closer, their wave lengths appear to decrease while frequency appears to increase.

According to astrophysicists through detecting spectrums of different galaxies in different stars and planets, they have noticed a shift indicating that the planets and distant galaxies are moving away from us. With this discovery they have concluded

that initially all these galaxies were really close together and are now moving far apart from each other.

d) Renewable Energy Resources

Definition

Renewable Energy Resources can be regenerated naturally and can not be depleted and they pose no risk to the natural environment.

Types of Renewable Energy Resources

i) Solar

The lights made up of small particles called photons according to the dual nature of light. The photons are used for their photo electric effect to generate electricity.

ii) Hydropower

The fast movement of water in dams is used to spin the turbines. The kinetic energy generated by the movement of turbines is converted to electrical energy.

iii) Geothermal

Due to the high temperature below the earth's crust, the water is converted to steam and exits at high pressure. The fast movement of steam is used to spin turbines to generate electricity.

iv) ~~Fast~~ Wind

The ~~fast~~ movement of wind is used to spin turbines to generate electricity.

Advantages

- They can never be depleted
- They are economical and budget friendly
- There's no need to mine them
- They are easy to install
- They are more energy efficient

Limitations

- Solar: Ineffective during night & cloudy days
- Hydropower: Construction of dams is expensive and is difficult to relocate people
- Wind: Ineffective on days when there is no wind

Perspects in Pakistan

• Due to higher prices of electricity in Pakistan because of the use of non-renewable energy resources, which are mostly imported, it will be feasible to implement use of renewable energy resources by harnessing the naturally available renewable energy resources in Pakistan.

Wind farms can be constructed in Sindh, close to sea where wind constantly blows. Solar farms can be built in large empty fields to harness energy from the sun during daytime. Dams can also exist in Pakistan and more can be constructed.