

SECTION-I

Q2 Differentiate between star and a planet.
Briefly explain the life cycle of star
from a Nebula to a Black hole.

Ans:- The Differences between star and planet are following

Star

Planet

- | | |
|--|---|
| (1) A star is a massive sphere of hot gases | Planet is a round body which is smaller than star |
| (2) Star produces its own light by nuclear fusion | Planet doesn't have its own light |
| (3) Star orbits around the centre of galaxy | Planet revolves around a star |
| (4) Objects revolve around a star are called Planets, dwarf planet, asteroids, etc. | Objects revolve around a planet are called satellites (moon) |
| (5) Star has very high temperature like sun, with surface temperature is $5500-6000^{\circ}\text{C}$ | Planet's temp temperature depends on its distance from sun. The one nearer to sun is more hotter |
| (7) The example of star is sun | The example of planet is earth. |
| (8) Star is shiny | Planet is not shiny |

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Life Cycle of Star from Nebula to Black Hole:

- The life cycle of a star starts from nebula which is a vast cloud of gas and dust
- The gravity pulls the material together. Causes the star to collapse and form a protostar.
- The protostar undergoes nuclear fusion in its core leading to the formation of main sequence star like sun. This is the longest stage of star.
- Over time, it exhausts its energy.
- If it is low-medium mass star, it evolves into Red Giant
- If it is high mass star, it evolves into Supergiant
- High mass star undergoes core collapse once iron accumulates in the core. Its outer layer is expelled in a ~~into~~ supernova explosion.
- If remaining core exceeds (2-3 solar masses), gravity overwhelms all the forces, forming a 'black hole', an object with gravitational field so strong that nothing, not even light, can escape from it.

Q- What are Semiconductors ...

Semiconductors :

A semiconductor is a material that conducts the current, but partly. It is neither a pure conductor, nor a pure insulator. It is somewhere between conductor and insulator. Common materials used in semiconductors or the common elements found in semiconductors are Silicon, Germanium, Gallium arsenide, etc.,

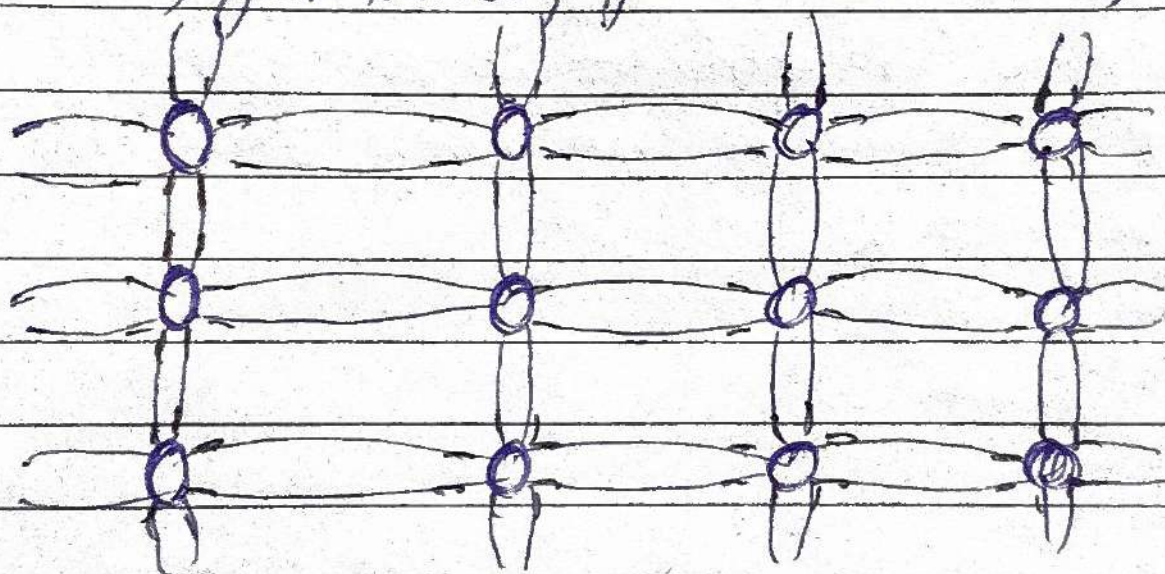


Figure: Arrangement of electron in Semiconductor
Semiconductors have 4 electrons in their valence shell. When all neighbouring elements are same, it forms a crystal. Semiconductors are made out of such crystals.

Types of Semiconductor:

1. N-Type Semiconductor :

N-type Semiconductors are formed when dopant has 5 electrons in its valence shell. Phosphorus is

Commonly used as dopant in N-type. The phosphorus atom joins the Silicon Crystal, each atom of phosphorus is bonded with four adjacent Silicon atoms. As phosphorus has five electrons in valence shell and only four of them are bonded with Silicon, as a result the extra electron starts to behave as a single electron (valence) in a regular conductor like Copper. It is called N-type because it has extra electron.

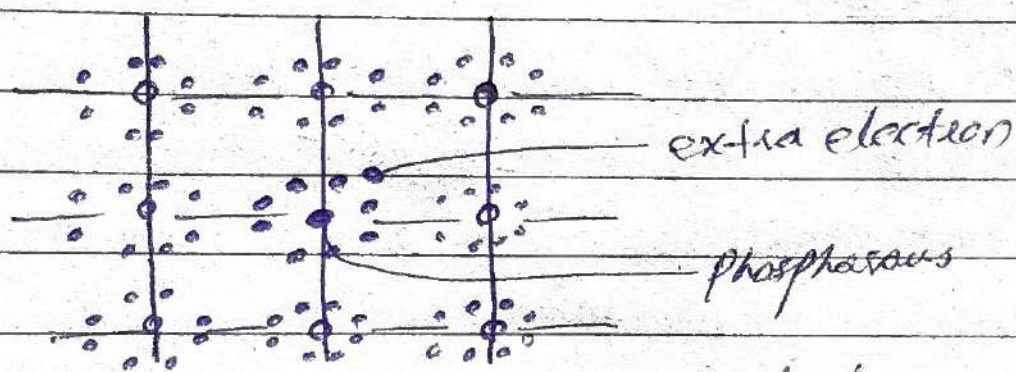


Fig: N-type Semiconductor.

P-type Semiconductor:

It is formed when dopant (Boron) has only three electrons in its valence shell. When boron is incorporated, it forms bonds with Silicon. But due to the presence of only three electrons in its valence shell, a hole is formed which behaves as a positive charge and starts attracting electrons. When an electron moves into a hole, it leaves a hole at its previous location. Thus, holes continue to move within a crystal and

P-type semiconductor is formed.

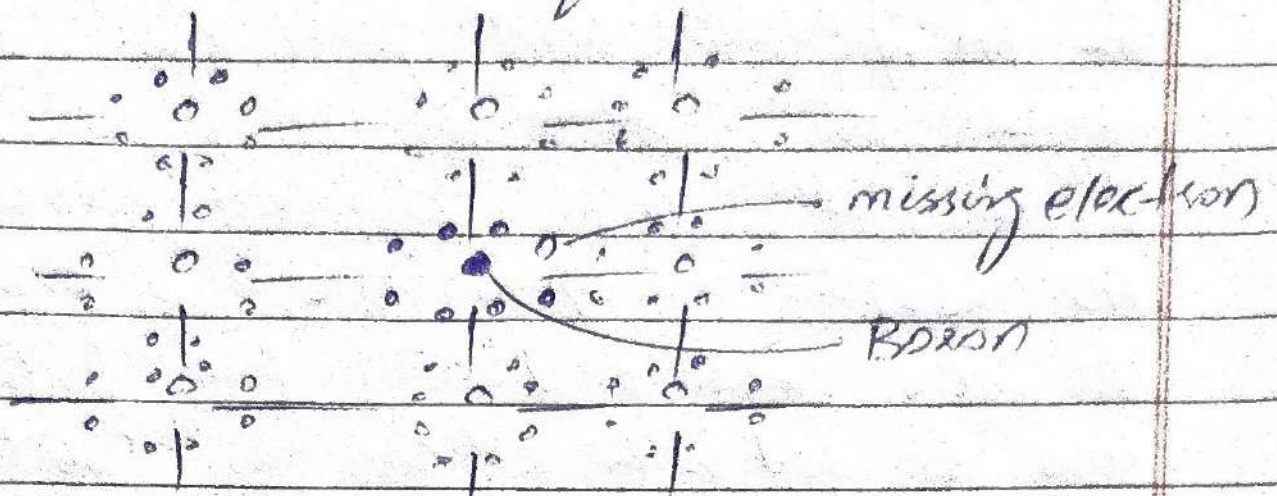


Fig: P-type Semiconductor.

Applications of Semiconductor:

- 1- They are used in Solar cell and LEDs
 - 2 They are used in Transistors and in mobile phones.
- C- Define Global Warming. Explain mechanism of Greenhouse Effect and list three major greenhouse gases.

Global Warming:

Global warming refers to the increase in earth's average surface temperature. According to IPCC, Global warming refers to an average and gradual increase in temperature of earth.

It is an international environmental problem which is the result of human activities. Because human activities caused the Green-house gases to increase in concentration.

Mechanism of Greenhouse Effects

It is a natural thermal process in which the heat gets trapped into the atmosphere under the action of greenhouse gases.

It is a natural process necessary to maintain the life on earth. Without it, earth would be cold to sustain life.

However, this normal Green-house Effect has been speeded up due to human activities, which have increased the amount of GHGs in atmosphere. This is called the enhanced green house effect.

This mechanism starts with sun light reaching the atmosphere and surface. The surface gets warmed and emit the remaining energy into the atmosphere. This heat is absorbed and then re-emitted by GHGs. The excessive amount of these gases trap the heat into the earth's atmosphere that would have otherwise escaped into the space.

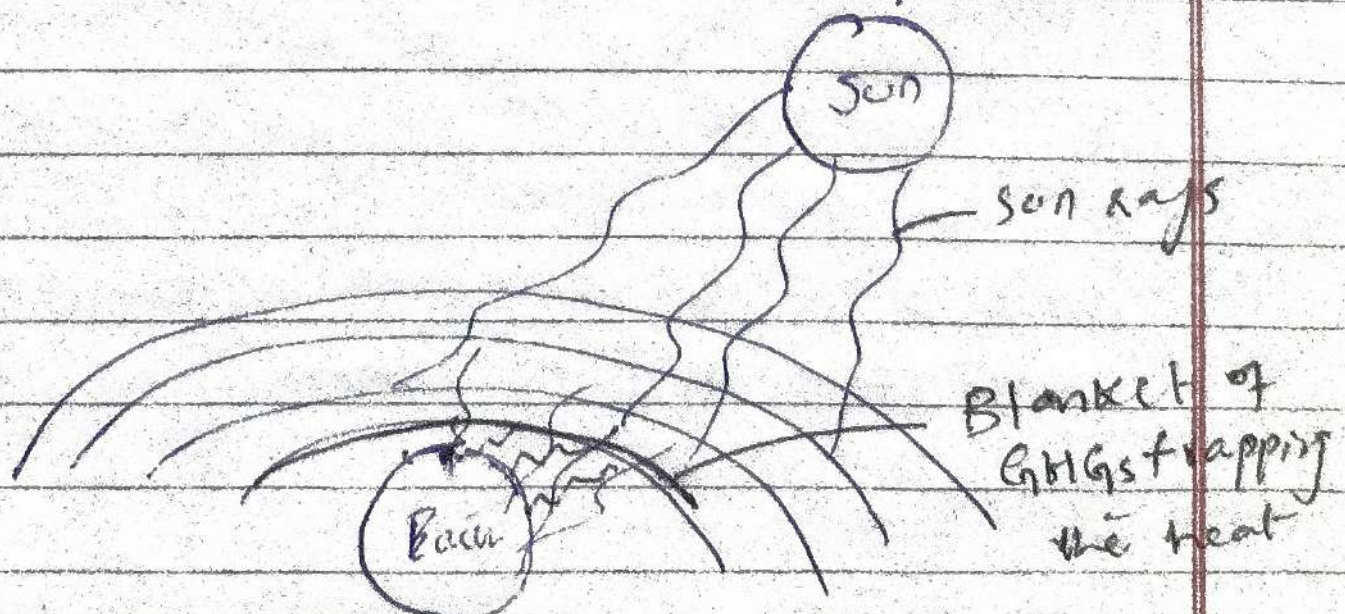


Fig. GHGs trapping heat

Three major greenhouse gases:

- 1- Carbon dioxide (CO_2)
- 2- Methane (CH_4)
- 3- Chlorofluorocarbon gases (CFCs)
- 4- Nitrous oxide (N_2O)

d- What is a Tsunami. Explain the natural processes that trigger a Tsunami and potential impacts on Coastal areas.

Tsunami:

Tsunami is a Japanese word meaning "harbour wave". It is caused by a rapid displacement of water due to the disturbance such as tectonic plate movement or volcanic activities. These disturbances cause the water waves to travel long distances and reach Coastal areas.

Natural triggering processes of Tsunami:

- Natural processes that trigger tsunami are; earthquakes on sea bed, volcanic eruption under or above, landslide, and impact from meteorite.

- These natural processes cause serious rapid disturbance in water that results in the formation of tsunami.

- More than 80% of tsunamis are caused by Seagoakes.

Effects of tsunami on Coastal areas

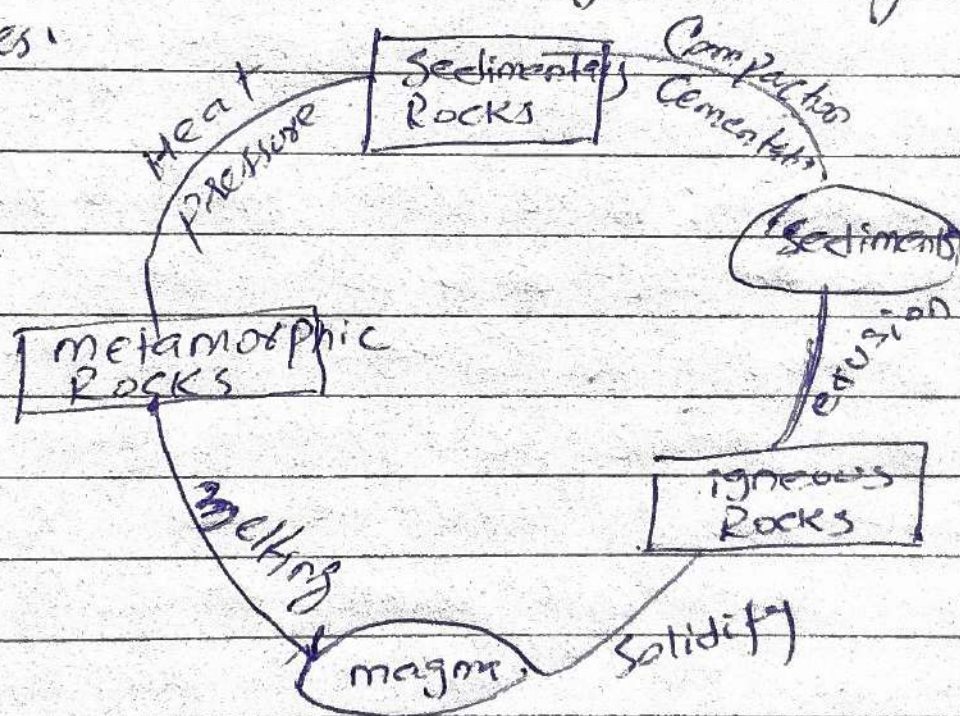
- Tsunami Can Cause flood on the Coastal areas which can effect the crops and buildings and can even demolish the building and infrastructure near Coastal area
- Animals Can be washed up to the shore and die by tsunamis
- Shipwreck is left after the tsunami which cause pollution and require time and money to be removed
- Tsunamis Can erode beaches and deposit debris over large area, which requires much time and money to be cleared
- Tsunamis Can be deadly, because it reaches the shore without clear warning

Q4 (a) Explain Rock Cycle. Differentiate between igneous, Sedimentary and metamorphic rocks with examples.

Rock Cycle:

The rock cycle starts with the magma coming out from volcano. This magma sometimes solidify below earth's surface forming intrusive igneous rocks and sometimes solidify above ground surface, forming extrusive igneous rocks. Once igneous rocks are formed, then due to mechanical and chemical weathering the fragments of these rocks are broken and eroded. The fragments then transported by streams, wind, etc.

and deposited anywhere. The deposition process continues at depths of hundreds of meters. They become compressed and cemented into sedimentary rock. Again due to plate tectonics different rock are either lifted or buried deeper into the surface of earth, where they are squeezed and heated up, and changed into metamorphic rock. In this way rock cycle continues.



Differentiate between igneous, sedimentary, and metamorphic rock

Igneous Rocks:

- Formed by solidification of magma
- They are shiny, hard and crystalline
- Example: Granite, Basalt

Sedimentary Rocks:

- Formed by compaction and cementation of sediments.
- They are layered or unlayered and softer than igneous & metamorphic rocks
- Example: Limestone, Sandstone.

Metamorphic Rocks

- Formed when existing rocks are subjected to excess heat and pressure
 - They may have banded texture
 - They are more harder and durable as compare to igneous and sedimentary rocks
 - Example: Marble, slate.
- b-

What is acid rain? Discuss chemical reactions involved in its formation and its harmful effects on aquatic life and vegetation.

Acid rain: Acid rain refers to a mixture of wet and dry deposition from atmosphere containing sulfuric acid and nitric acid higher than normal amount. The sulfur dioxide and nitrogen oxides reacts with water and other chemicals to form sulphurous acid and nitric acid

Chemical reactions:

- 1 Formation of sulphurous acid: Sulphur dioxide react with water to form sulphurous acid



- 2 Formation of Nitric acid: Nitrogen dioxide reacts with water to form nitric acid



HNO_2 = Nitrous acid

HNO_3 = Nitric acid

Effects of acid rain on aquatic life and vegetation:

- Acid rain leaches out the nutrients required by the plant for their growth.
- Acid rain can dissolve toxic substances like mercury and lead that either poison the plants that absorb it or pollute water and disturb aquatic life.
- Acid rain directly falling in ponds, lakes or marshes, pollute the water, and make the water unfavourable for life.
- Acid rain falling on trees cause the brown dead spots on the leaves of trees.

Q-7 In a survey of 100 people. 65 watch Cricket, 40 watch Hockey and 20 watch none. Total number of people who watch both? Data:

$C =$ Number of people who watch Cricket $= 65$

$H =$ "

Hockey $= 40$

$N =$ "

"

None $= 20$

Total number of people $= 100$

Number of people who watch both $= ?$

Sol:-

Let's find total number of people who watch at least one sports:

Total people $-$ People who don't watch any sports

$$= 100 - 20$$

$$= 80$$

So, total number of people who watch at least one sports is 80

$(C \cup H) =$ People who watch ~~at~~ at least one

$$(C \cup H) = 80$$

$(C \cap H) =$ People who watch both sports

$$|C \cup H| = |C| + |H| - |C \cap H|$$

$$80 = 40 + 65 - |C \cap H|$$

$$|C \cap H| = 40 + 65 - 80$$

$$= 105 - 80$$

$$= 25$$

b- Rectangular Swimming pool . . .

Given:

$$\text{Length of pool} = W + 4$$

$$\text{perimeter of pool} = 72 \text{ meters}$$

Volume needed to fill the pool
at depth of 2.5 meters = ?

Sol:-

Let find the L and width of pool

$$\text{perimeter} = L + L + W + W$$

$$72 = W + 4 + W + 4 + W + W$$

$$72 = 4W + 8$$

$$72 - 8 = 4W$$

$$64 = 4W$$

$$W = \frac{64}{4}$$

$$W = 16 \text{ meters}$$

if $W = 16$ then

$$L = W + 4$$

$$L = 16 + 4$$

$$L = 20 \text{ meters}$$

$$\text{Area of pool } A = 16 \times 20$$

$$A = 320 \text{ m}^2$$

Volume needed to fill the pool at
2.5m depth = $A \times 2.5$

$$= 320 \times 2.5$$

$$= 800 \text{ m}^3$$

$$320$$

$$\times 2.5$$

$$1600$$

$$6400$$

$$8000$$

C. A train leaves at 8:00 AM ...

Data:

Train leaves City A = $T_A = 60 \text{ km/h}$

" " City B = $T_B = 40 \text{ km/h}$

Distance between City A and B = 400 km

Time of departure = 8:00 AM

Time at which T_A and T_B meet = ?

Soln

First, find the relative speed

$$\text{Relative speed} = \text{speed of } T_A + \text{speed of } T_B$$

$$60 + 40$$

$$= 100 \text{ km/h}$$

Time to meet?

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

$$\text{Time} = \frac{400}{100}$$

$$\text{Time} = 4 \text{ hours}$$

So, Both T_A and T_B will meet after 4 hours of their departure at

8:00 AM + 4 hours

12:00 PM

d- The sum of the present ages of father and son is 75 years...

Data:

Sum of present ages of father & son = 75 years

Ten years ago father was 4 times the son's age

Current ages of father and son = ?

Sol:-

Let age of father = x

age of son = y

So, according to Condition 1

$$x + y = 75 \quad \text{--- (1)}$$

According to Condition 2

$$(x - 10) = 4(y - 10)$$

$$x - 10 = 4y - 40$$

$$x - 10 + 40 = 4y$$

$$x = 4y - 30 \quad \text{--- (2)}$$

Put it in eq (1)

$$x + y = 75$$

$$-30 + 4y + y = 75$$

$$5y = 75 + 30$$

$$y = 105 / 5$$

$$y = 21 \text{ years}$$

Put in eq (2)

$$x = 4y - 30$$

$$x = 4 \times 21 - 30$$

$$x = 54 \text{ years}$$

So, present age of

Father = $x = 54$ year

Son = $y = 21$ years

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Q-8 If in a certain language 'ROAD' is coded as 'UQDQ'. How would LAKE be coded in same language
Sol:-

ROAD is coded as UQDQ

	R	O	A	D
	18	15	1	4
+3	U	+2	Q	+3
	21	17	4	7

Now applying same pattern to

L	A	K	E
12	1	11	5
+3	+2	+3	+3
15	3	14	8
O	C	N	H

So, in same language 'LAKE' will be coded as 'OENH'

b. A man tells a woman, "The son of my sister's husband is the father of your son". How is woman related to man

Man is brother in law of her sister's husband
So, son of her sister is his nephew
Nephew of man is the father of woman's son

So, it means the nephew of man is husband of woman

So, the woman is niece in law of man

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because she is the wife of man's nephew.

c- Find the next number

i- 4, 12, 6, 18, 9, 27, —

$$4 \times 3 = 12$$

$$12 \div 2 = 6$$

$$6 \times 3 = 18$$

$$18 \div 2 = 9$$

$$9 \times 3 = 27$$

$$27 \div 2 = 13.5$$

So, the sequence will be

4, 12, 6, 18, 9, 27, 13.5

ii. 1, 2, 6, 24, 120,

$$1 \times 2 = 2$$

$$2 \times 3 = 6$$

$$6 \times 4 = 24$$

$$24 \times 5 = 120$$

$$120 \times 6 = 720$$

So, series will be

1, 2, 6, 24, 120, 720

d- Five friends (P, Q, R, S, T) have different heights

P is shorter than Q but taller than R

S is shorter than T, but taller than Q

The shortest person is 150 cm tall.

and tallest is 180 cm tall

Who among friends is 3rd tallest

What is the maximum possible range of their heights

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1 Condition ascending order of tall

R P Q S T

So,

T is Tallest

S is Second Tallest

[Q is Third Tallest]

P is Fourth Tallest

R is Shortest

Range = ?

$$\begin{aligned} \text{Range} &= \text{Max Height} - \text{min Height} \\ &= 180 - 150 \end{aligned}$$

$$[\text{Range} = 30 \text{ cm}]$$