

Question No. 4

Part a :

1- Earthquake :

Earthquake is defined as :

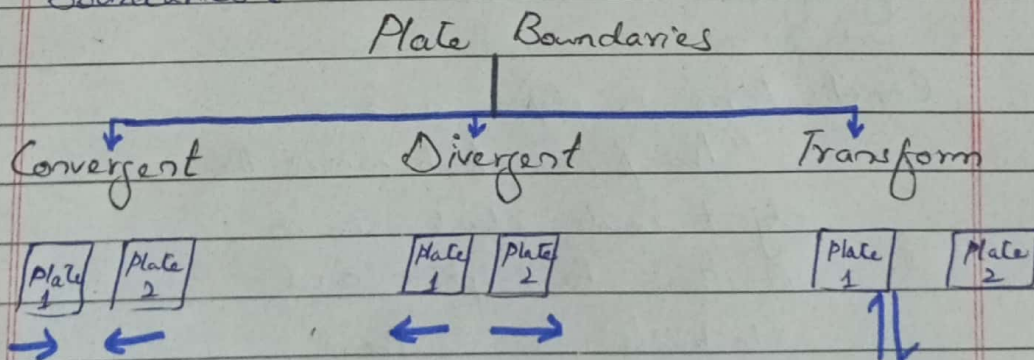
“shaking or vibration of earth which may cause harm to living organisms as well as to environment.”

Earthquake is also defined as :

“releasing of energy from inside of earth due to shaking and vibration.”

2- Cause of Earthquake :

Plate Tectonic Theory explains the cause of earthquake. Earth is composed of different major and minor plates whose movements could trigger the earthquake. Main drive force responsible for movement of these plates is gravity. There are different types of plate boundaries :



3- Measurement of Earthquake :

Earthquake is measured by using Richter scale. On 3rd January 2024, an

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Earthquake of around 7.8 magnitude was felt in Japan which has caused more than 150 deaths.

4. What is Tsunami?

Unlike earthquake, Tsunami is a series of ocean waves with extremely long wavelengths and high energy, and are triggered by underwater earthquakes, volcanic eruption or landslides. While earthquake occurs beneath the earth surface, tsunami is associated with displacement of water in ocean or large bodies of water.

For example in February 2023, a local tsunami was recorded in Mediterranean sea following the Syria-Turkey earthquake with magnitude of 7.7.

Part b:

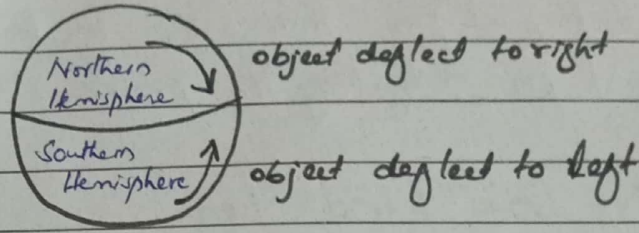
1. Defining Coriolis Force:

Coriolis Force is define as:

"the force which moves the object counter clockwise in Northern hemisphere and clockwise in Southern Hemisphere."

As a result of coriolis force objects move in a rotating system, eg such as Earth.

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Coriolis Force

2- Hurricanes :

Hurricanes are formed over the ocean, often beginning as a tropical wave, a low pressure area that moves through the moisture-rich tropics, possibly enhancing shower and thunderstorm activity.

3- Steps for Generation of Hurricanes

Hurricane is created in the following given steps:

i- A Pre-existing Weather Disturbance:

A hurricane often starts out as a tropical wave due to disturbance in weather conditions. This gets severe with the passage of time.

ii- Warm Water Conditions :

Water at least 26°C over a depth of 50 meter powers the storm. These water waves now turned into a strong storm.

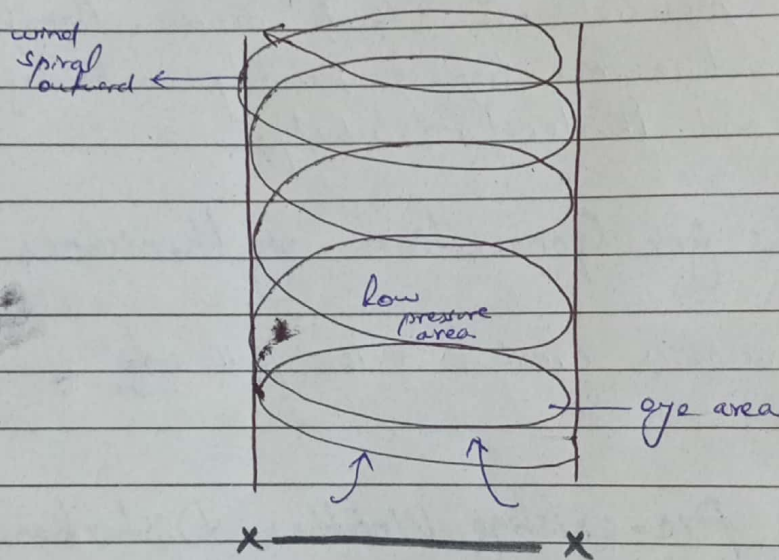
iii- Thunderstorm Activity :

The thunderstorm turn ocean^{to} fuel as

heat fuel for hurricane. This heat becomes a fuel for instigating the process.

iv. Low Wind Shear :

A large difference in wind speed and direction around or near the storm can weaken it. When all these factors are available, a hurricane is developed.



Part c

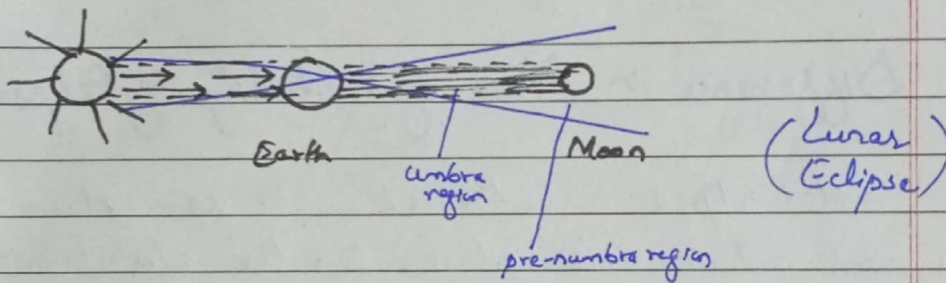
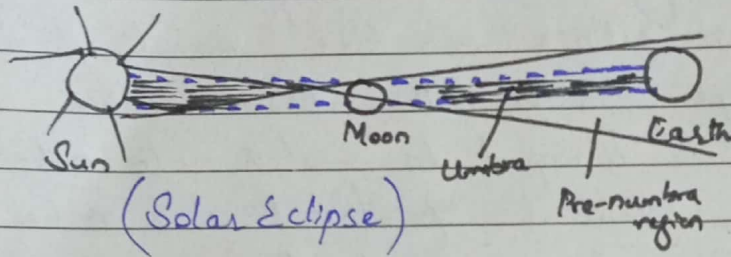
Differences between Solar and Lunar Eclipse :

i- Difference in Phenomena :

Eclipse is a process when one astronomical object goes into the shade of other. In solar eclipse, moon comes between rotating earth and sun thereby blocking the solar radiation reaching the earth. This leaves a shadow on earth. On the contrary,

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Lunar eclipse is the process when earth blocks the solar radiations reaching the moon as a result, moon comes under the shadow of earth.



ii. Difference in Time Lasting:

Solar eclipse lasts for few minutes whereas moon eclipse lasts for greater time. Solar eclipse last only for 5-7 minutes. On the contrary, lunar eclipse lasts the whole night.

iii. Different in Time of Occuring:

Solar eclipse is visible during the day time. On the other hand, lunar eclipse is visible at night time. This point makes them distinguishable.

iv. Difference in Period of Recourance:

Solar eclipse reoccurs after a long period of time i.e after 18 months.

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Whereas, lunar eclipse occurs twice a year. On this basis, solar and lunar eclipses are different from each other.

v. Potential of Threat in Eclipse:

Lunar eclipse can be visualized with naked eye. On the other hand, solar eclipse is harmful to watch with naked eye. So, potential of threat also make them different from each other.

vi. Difference in Place of Visibility of Eclipse:

Solar eclipse is witnessed in few places and not in all places. On the other hand, lunar eclipse is witnessed in many places at the same time. Therefore, all these points create a difference between two eclipses.

Part - 4

Semi-Conductors :

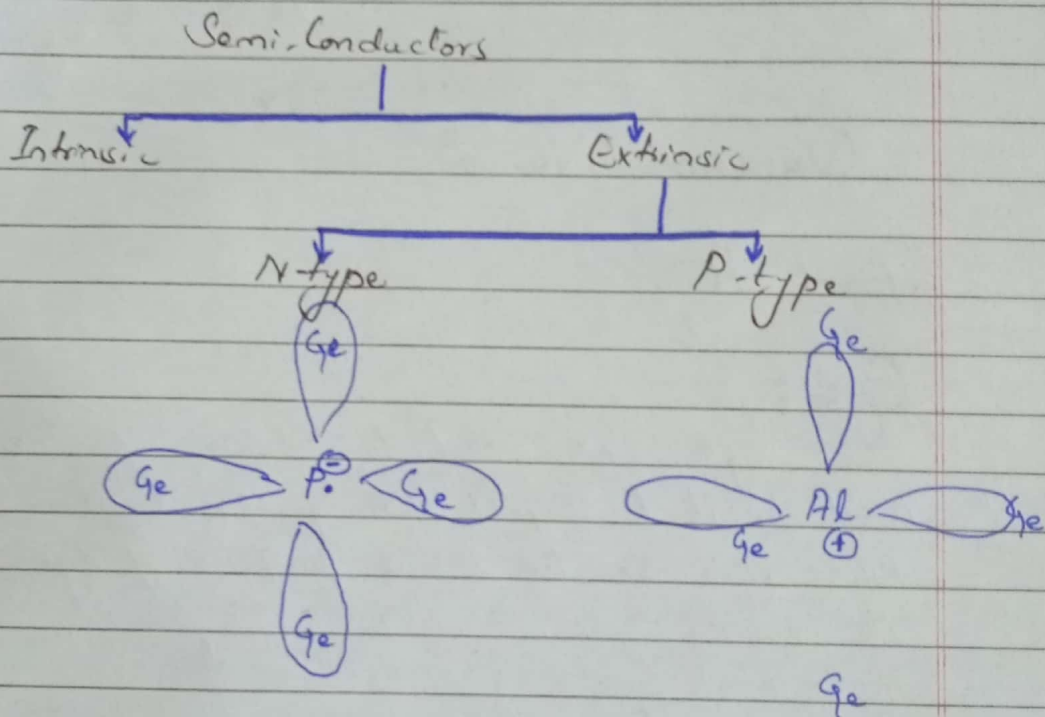
Semi-conductors are defined as :

“material which has properties between conductors and insulators are called semi-conductors.”

The common type of semi-conductors are Silicon and Germanium.

Doping in Semi-Conductor:

Doping is used to increase electrical conductivity and to reduce resistance. It is done in extrinsic semi-conductors when an impurity from group III or V of periodic table is added to pure semi-conductors.

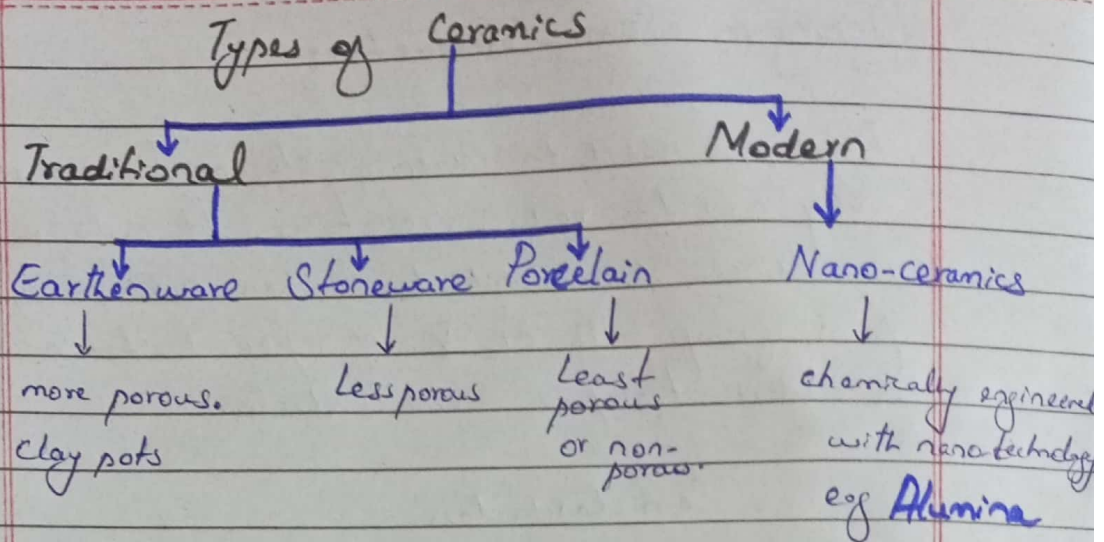


Ceramics and its Types :

Ceramic is defined as :

“material which is neither organic nor metallic and can be glass, crystalline or both with hard and resistant properties.”

Ceramics are made from clay and are shaped under high temperature and pressure.



x-----x

Question No. 3

Part A

Eye:

Eye is an important and one of the most important complex sensory organ in living organism. The basic purpose of eyes is vision.

Parts of Eye:

Eye consist of following parts:

i- Sclera :

Sclera is the outer covering, a protective tough white layer called sclera which protects eye from any external damage.

ii- Cornea:

The front transparent part of sclera is called cornea. Light enters the eye through

cornea,

iii- Iris :

Iris is a dark muscular tissue and is located behind cornea. The colour of iris determines the colour of eye. The iris also helps regulate or adjust exposure by adjusting iris.

iv- Pupil :

A small opening in the iris is pupil. The size of pupil is controlled by iris and it controls the amount of light moving in.

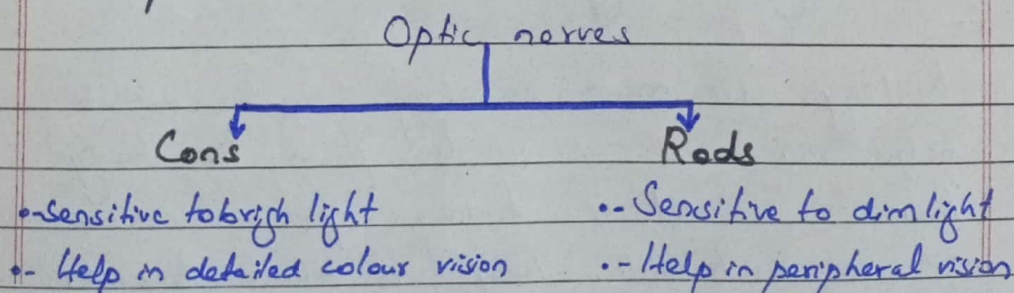
v- Lens :

Behind the pupil, there is a transparent structure called lens. By action of ciliary muscles, it changes its shape to focus light on retina. It becomes thin to focus on distant object and thick to focus on nearby objects.

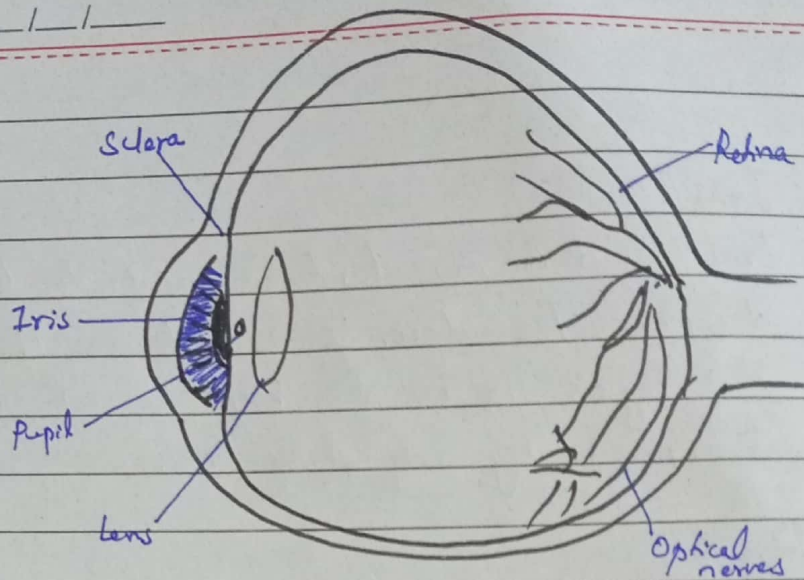
vi- Retina :

It is light sensitive layer that consists of many nerve cells. It converts image formed by lens into electrical impulses which are transmitted to the brain through optic nerves.

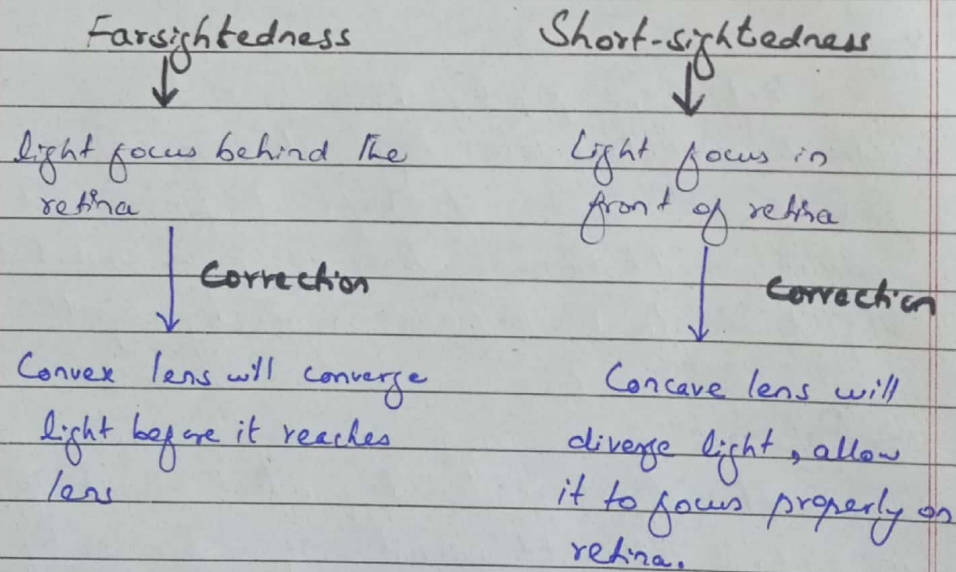
vii- Optic Nerves :



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Farsightedness and Short-Sightedness Correction:

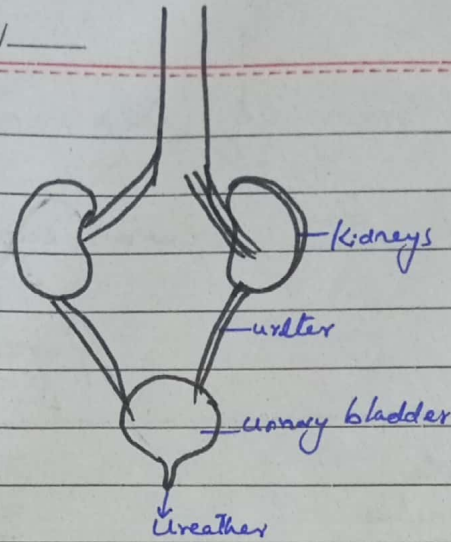


Part b

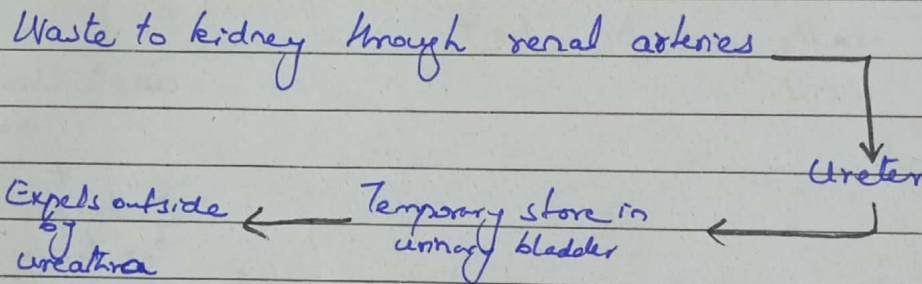
Role of Kidneys :

Kidneys are main excretory organs which helps in removal of waste from the body. There is a set of kidneys present in humans one on each side. They are bean shaped.

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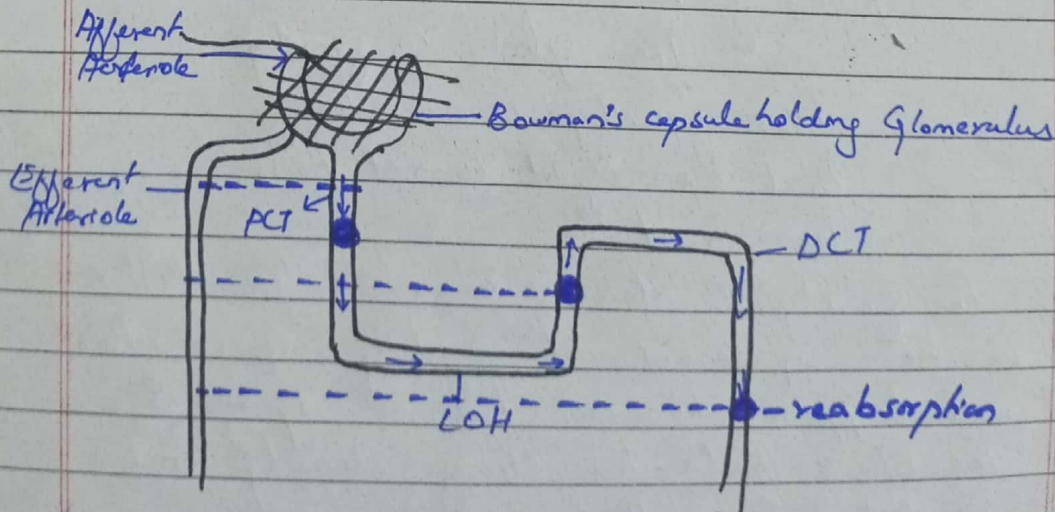


Whole Process in Flow Chart :



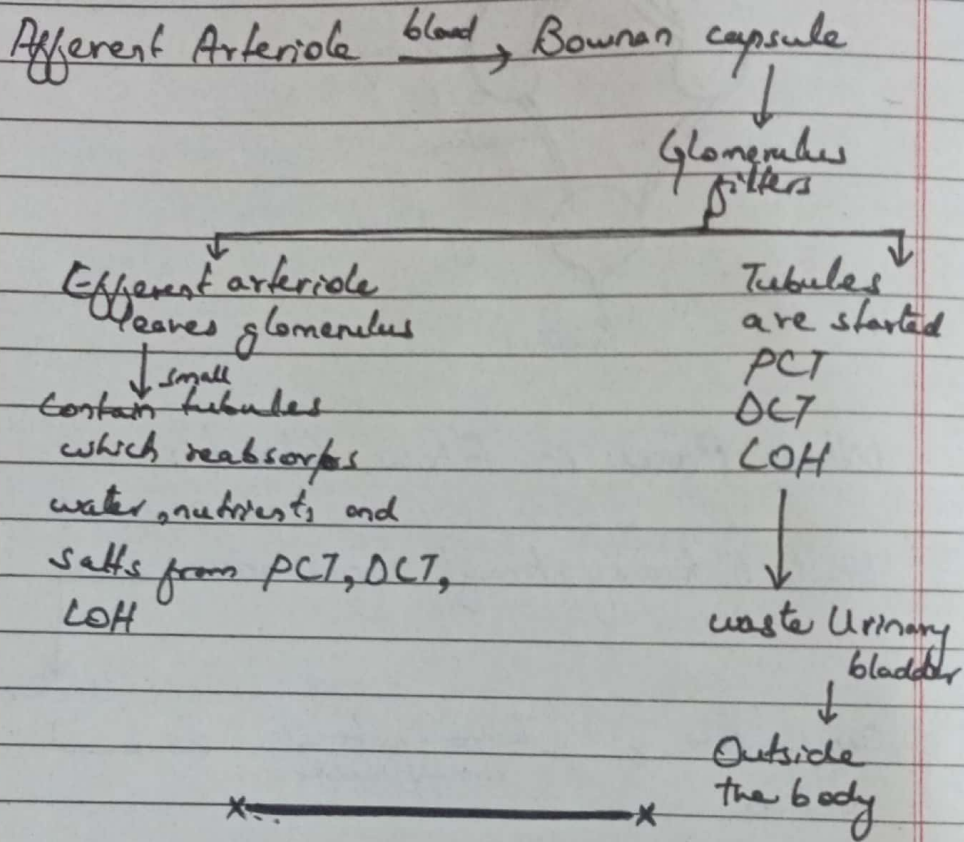
Inside Working of Kidney :

Inside kidneys there are millions of nephrons which are functional unit of kidney. They help kidney's in filtration and absorption as well.



PCT - Proximal Convoluted Tubule
LOH - Loop of Henle
DCT - Distal Convoluted Tubule

Flowchart of Working of Nephron



Part c

Black Hole :

According to NASA website, black hole is defined as:

“The place in space where gravity is so strong that even light cannot pass through it.”

The gravity is intensified because the matter has been squeezed into a tiny space. This can happen when a star is dying. So, the black hole has strong density and gravitational pull.

Formation of Black Hole:

Black hole is formed due to collapse of stars. Following are its process of formations:

i- Stellar Evolution:

A massive star undergoes fusion converts H into He, which provides energy to counteract with gravitational forces trying to collapse it,

ii- Depletion of Nuclear Fuel:

Over the million of years, when a star runs out of Hydrogen, it progresses to heavier elements through successive stages and reaches Iron. At this stage, it cannot release energy through fusion.

iii- Iron core Collapse:

As a result of deficiency of energy, the iron core collapse and it all happen under gravity within a fraction of second.

iv. Super Nova Explosion:

Core rapidly collapse and cause a rebound effect. The outer layers of star are expelled outward in a massive explosion called supernova explosion.

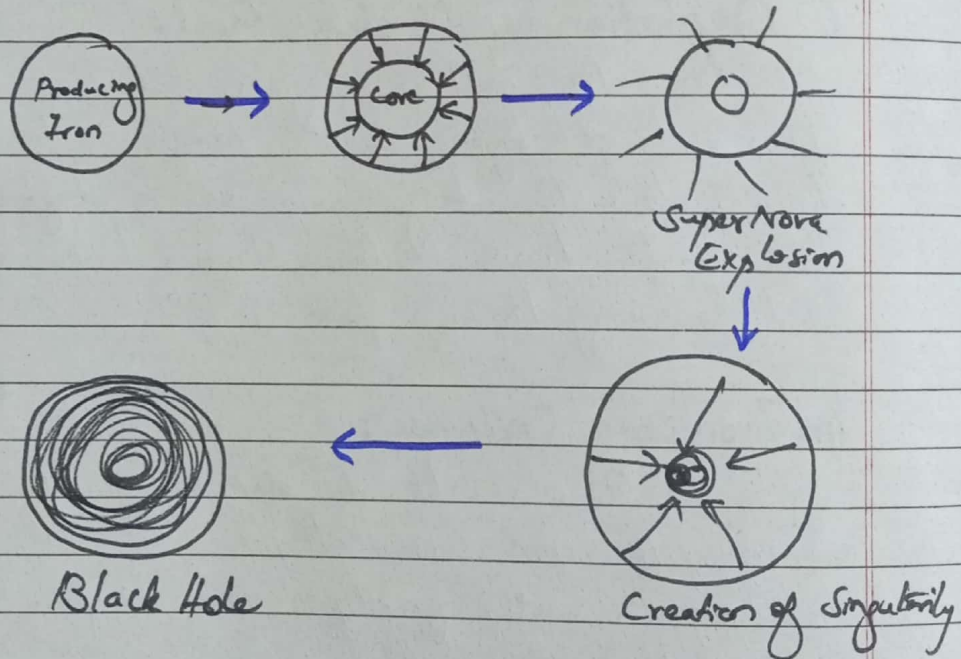
v- Formation of Singularity:

The remaining core will further collapse.

into a new single dense structure called singularity. Area around the singularity is called event horizon.

vi- Black Hole Structure:

The black hole now consist of a singularity at the center, surrounded by event horizon. Outside event horizon is region where space and time are warped due to strong gravitational pull.



Formation of Black Hole

Part 4

1- Isotopes:

Isotopes are defined as:

“atoms of same element having same atomic number but different atomic masses”

are called isotopes of each other."

For Example:

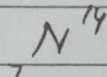
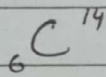
The two isotopes of Uranium are ${}_{92}^{235}\text{U}$ and ${}_{92}^{238}\text{U}$.

2- Isobars:

Isobars are defined as:
"atoms with same mass number but different atomic number are called isobars."

For Example:

Carbon-14 and Nitrogen-14 are isobars of each other.



$$K = 2$$

$$K = 2$$

$$L = 6$$

$$L = 5$$

Number of protons
= 6

No. of protons = 7

No. of neutrons = 8

No. of neutrons = 7

3- Isotones:

Isotones are defined as:
"atoms have same number of neutrons but different atomic and mass number are isotones."

For Example:

Sulphur 36 and Chlorine 37 are isotones

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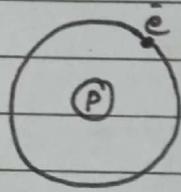
because they have two neutrons.

Isotopes of Hydrogen:

Hydrogen has 3 isotopes: Protium, Deuterium, Tritium

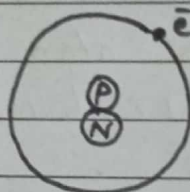
Protium

H^1



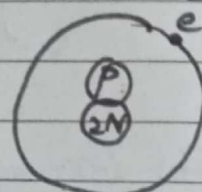
Deuterium

H^2



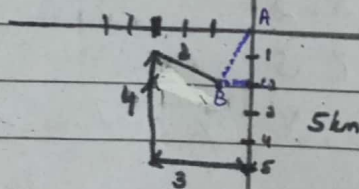
Tritium

H^3



Question 8

Part a:

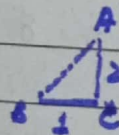


Man covers 5 km in South

3 km in West

4 km in North

2 km in South East



At this point B, we have to find distance between

A and C. In correspondence to axis, distance

between B and C is 1 and A and C is 2 km.

Using Pythagoras Theorem

$$(c)^2 = (b)^2 + (a)^2$$

$$(c)^2 = (1)^2 + (2)^2$$

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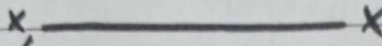
$$c^2 = 1 + 4$$

$$c^2 = 5$$

$$c = \sqrt{5}$$

$$\boxed{c = 2.2 \text{ km}}$$

Crow is 2.2 km away from his starting point and his in South-West direction from his starting point.

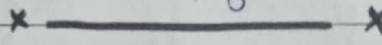
Part b: 

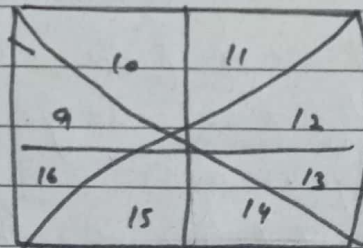
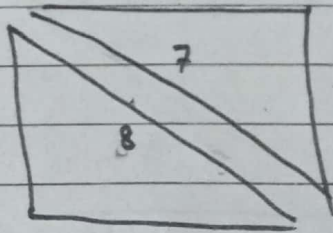
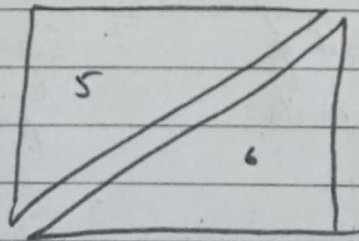
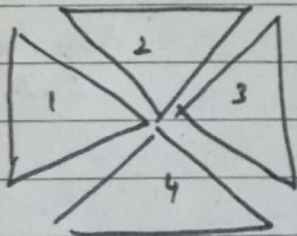
Total slices of pizza = 8

Slice with resin = 3


Probability of slice with resin = $\frac{\text{No. of possible outcomes}}{\text{Total number of outcomes}}$

$$P(\text{Slice(resin)}) = \frac{3}{8}$$

Part c 



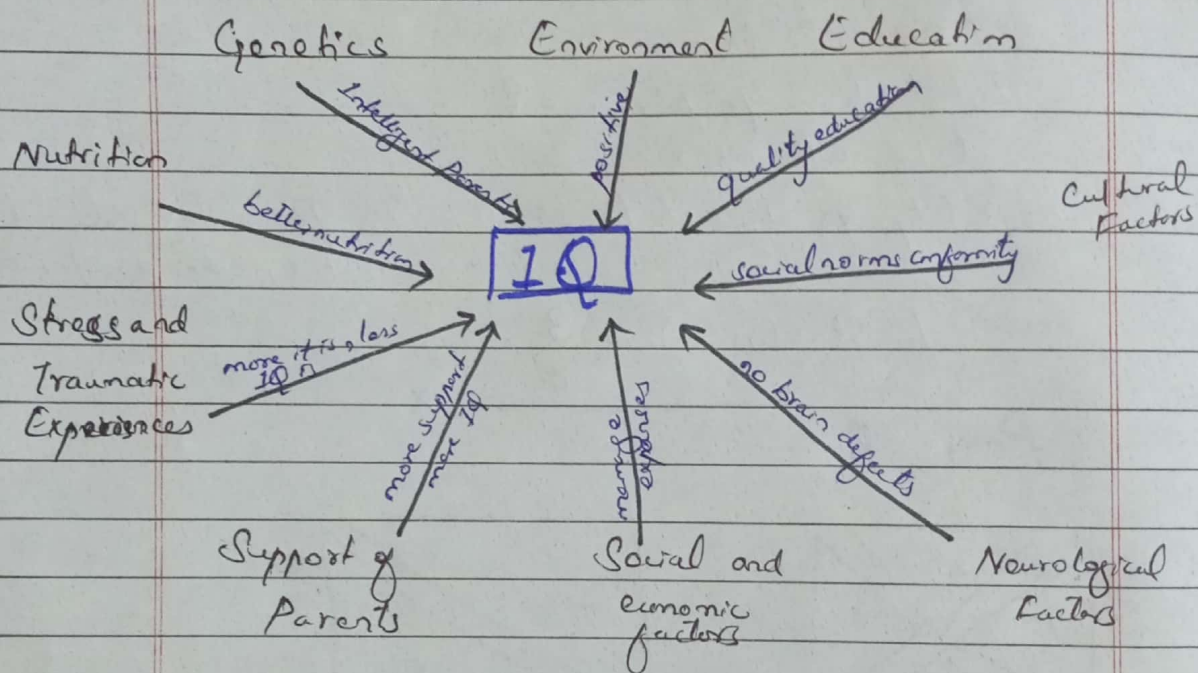
No. of triangles in this figure is 16.

Part d 

IQ : IQ stands for Intelligence Quotient.

It refers to a person ability of intelligence. Different IQ tests are conducted to check individual intellectual ability. The score is usually standardized, with an average score set at 100.

Factors Affecting IQ:



Question No. 6 (Part a)

Let age of father = x

Age of son = 30 years

5 years ago

Age of father was thrice the age of son.

$$x - 5 = 3(30 - 5)$$

$$x - 5 = 3(25)$$

$$x - 5 = 75$$

$$x = 80 \text{ years}$$

Age of father is 80 years.

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Mean of 10, 30, x and 50 = 50, $x = ?$

$$\therefore \text{Mean} = \frac{\text{Sum of numbers}}{\text{No. of quantities}}$$

$$50 = \frac{10 + 30 + x + 50}{4}$$

$$200 - 90 = x$$

$$x = 110$$

part c

i- 2, 6, 18, 54, 162

This is a multiplication series where each number is multiplied by 3 and it gives the next number and so on.

2

$$2 \times 3 = 6$$

$$6 \times 3 = 18$$

$$18 \times 3 = 54$$

$$54 \times 3 = 162$$

ii- 3125, 256, 27, 4, 1

The series observes the following order $5^5, 4^4, 3^3, 2^2, 1^1$

$$5^5 = 3125$$

$$4^4 = 256$$

$$3^3 = 27$$

$$2^2 = 4$$

$$1^1 = 1$$

So missing number is 27

Part d

Let numbers = x and y

$$xy = 320 \text{ (Product of numbers)} \Rightarrow x = \frac{320}{y}$$

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Ratio of x and $y = 1:5$
 $1:5$

$$\frac{x}{y} = \frac{1}{5} \rightarrow (i)$$

Put value of x in eqn (i)

$$\frac{320/y}{y} = \frac{1/5}{1}$$

$$\frac{320}{y} = \frac{y}{5}$$

$$y^2 = 1600$$

$$y = 40$$

Find value of x

$$xy = 320 \Rightarrow x = \frac{320}{y} = \frac{320}{40} = 8$$

Difference between squares of these two numbers = ?

$$y^2 - x^2 = ?$$

$$(40)^2 - (8)^2 = 1600 - 64$$

$$y^2 - x^2 = 1536$$

So difference between square of these numbers is 1536.

