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Question

(A)

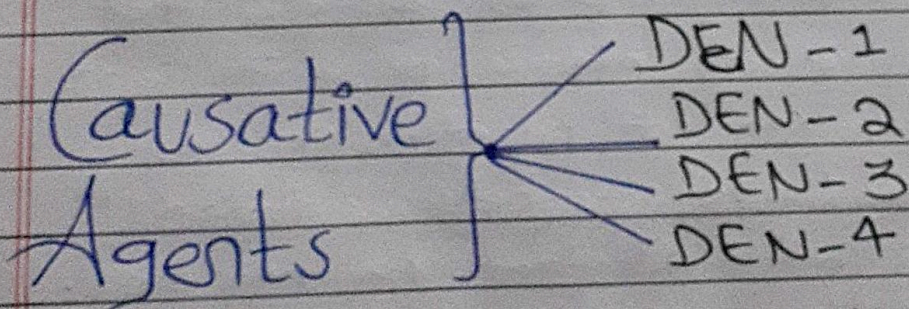
What is dengue? Give a brief account of its causative agents and its symptoms.

Definition of Dengue

Dengue (break-bone fever) is a mosquito-borne viral disease that has rapidly in all regions in recent years. It is more common in tropical and subtropical climates. It is transmitted by female mosquitoes mainly of the species *Aedes aegypti*, and to a lesser extent, *Ae. Albopictus*. Today, severe dengue affects most Asian and Latin American countries and has become a leading cause of hospitalization and death among children and adults in these regions.

Causative Agents of Dengue

There are four different but closely related serotypes of the virus that cause dengue:

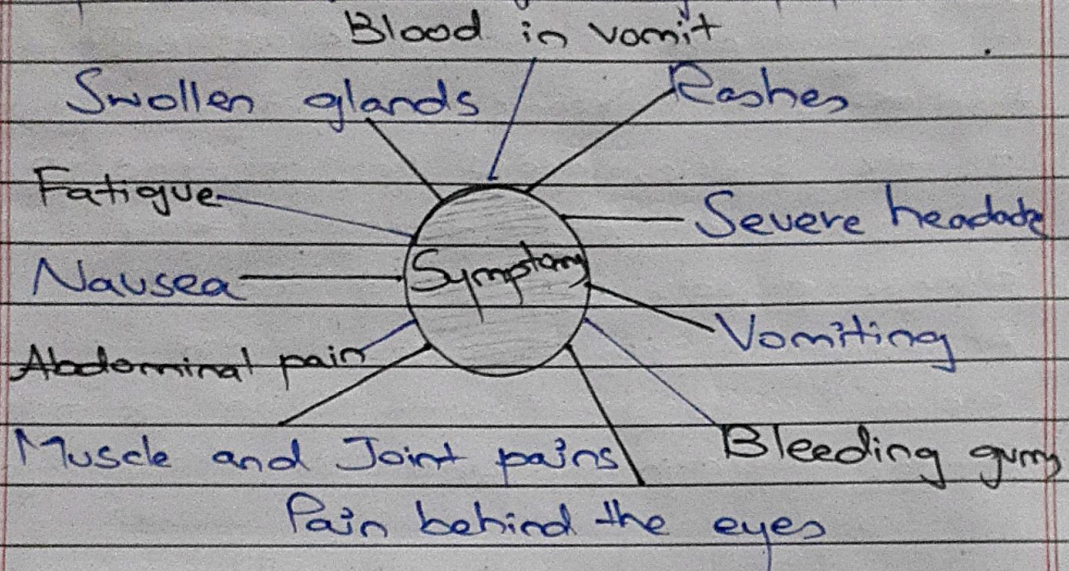


Infection with one DENV confers long-term immunity to that virus but conveys only short-lived protection against the other dengue viruses.

Symptoms of Dengue

The most common symptoms of dengue are following:

Dengue should be suspected when a high fever ($40^{\circ}\text{C}/104^{\circ}\text{F}$) is accompanied by two of the following symptoms:



B

Explain dark matter and dark energy.

Defining Dark Matter

Dark matter comprises particles that do not reflect, absorb, or emit light. Thus, they can not be detected by observing electromagnetic radiations. It is a material that can not be seen directly. We believe it exists because of its affects on the objects. Moreover, the force of dark matter is always attractive. It attracts all the particles even though light can not move out of them. Astronomers believe that dark matter exists because visible matters does not have enough gravita-

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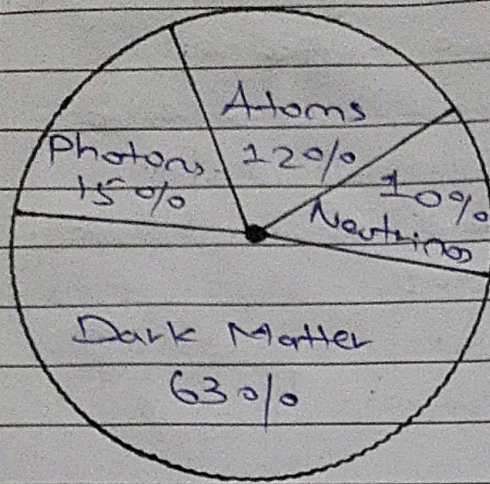
ational muster to hold galaxies together.
The composition of dark matter is:
hyper-dense astronomical bodies called
massive astrophysical compact halo
objects (MACHOs) and weakly interacting
massive particles (WIMPs)

Examples ← Neutron stars
Black holes

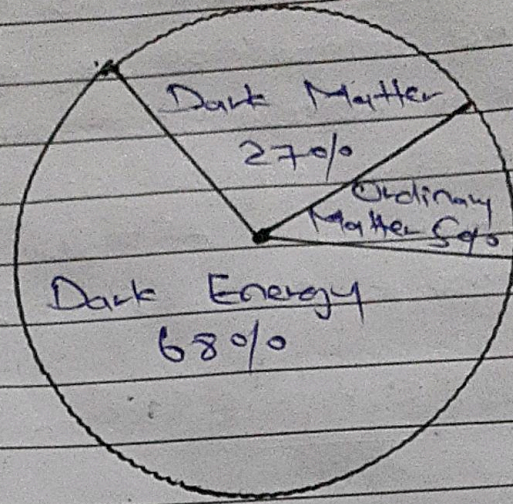
Defining Dark Energy

Dark energy is the energy that helps
in the expansion of the universe. In fact
in 1988, astronomers studying distant
supernovae were shocked to learn that
the universe began expanding faster
around 7.5 billion years after Big
Bang. That indicates some unknown
force is fighting gravity's pull, causing
galaxies to speed apart from one
another. Dark energy is a repulsive
force and repels the object, due to
which things move far away from
each other.

Example [Phantom dark energy, where
not only its expansion
accelerating, but the acceleration is also
increasing over time - the Big Rip,
where expansion becomes infinitely
fast, tearing galaxies, atoms and
the fabric of space-time itself
apart.



13.8 Billion
Years ago



Today

C Discuss structure and function of mitochondria. How is the power house?

Defining Mitochondria

Mitochondria are membrane-bound organelles present in the cytoplasm of all eukaryotic cells, that produce adenosine triphosphate (ATP), the main energy molecules produced by the cell.

Structure of Mitochondria

Mitochondria is a double-membraned, rod-shaped structure found in both in plant and animal cell.

Its size ranges from 0.5 to 1.0 micrometre in diameter.

The structure comprises an outer membrane, an inner membrane, and a gel-like material called the matrix.

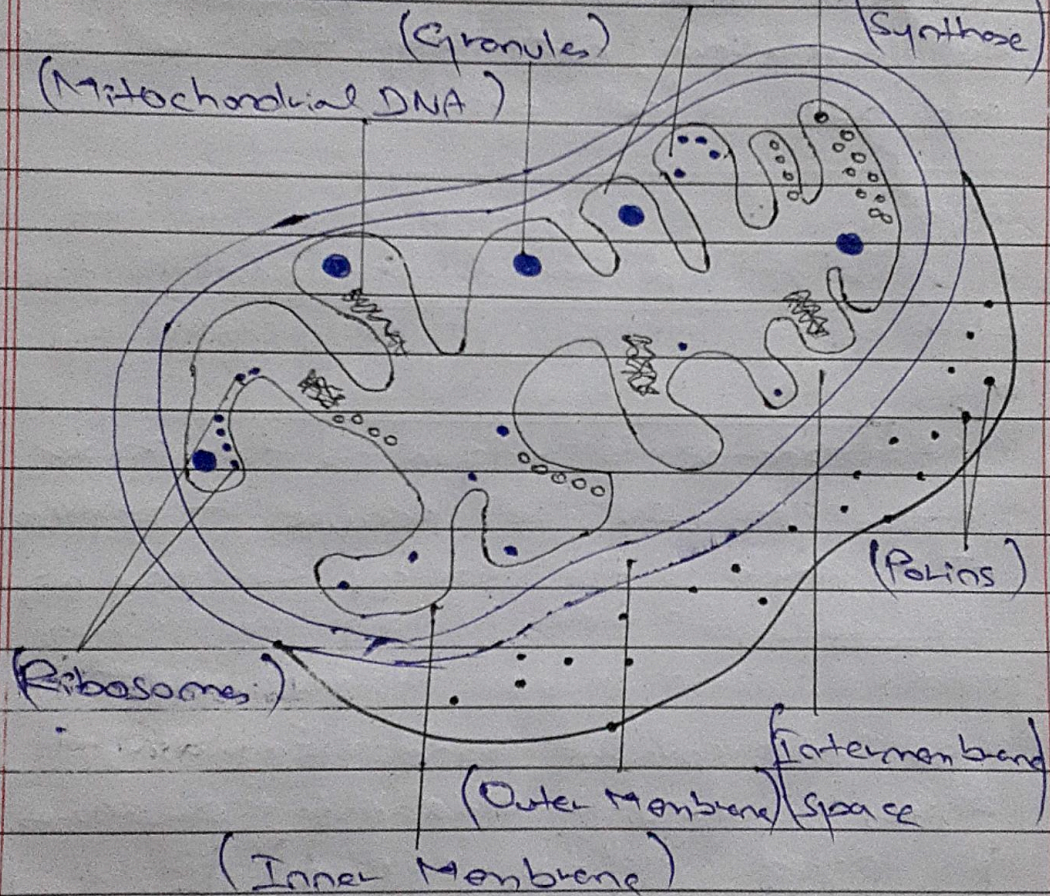
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The outer membrane and inner membrane are made of proteins and phospholipid layers separated by the intermembrane space.

The outer membrane covers the surface of the mitochondrion and has a large number of special proteins known as porins.

The inner membrane forms many infoldings called cristae.



Functions of Mitochondria

- It regulates the metabolic activity of cell.
- It promotes the growth of new cells and cell multiplication.
- It helps in detoxifying ammonia in the liver cells.

- It plays an important role in apoptosis or programmed cell death.
- It is responsible for building certain parts of the blood and various hormones like testosterone and estrogen.
- It helps in maintaining an adequate concentration of calcium ions within the compartments of the cell.
- It is also involved in various cellular activities like cellular differentiation, cell signalling, controlling the cell cycle and also in cell growth.

Mitochondria: Power House of the Cell

Mitochondria is known as the power house of the cell because it produces ATP which is the energy currency of the cell.

D) What are covalent bonds? Explain types along with elaborating structures.

Defining Covalent Bond

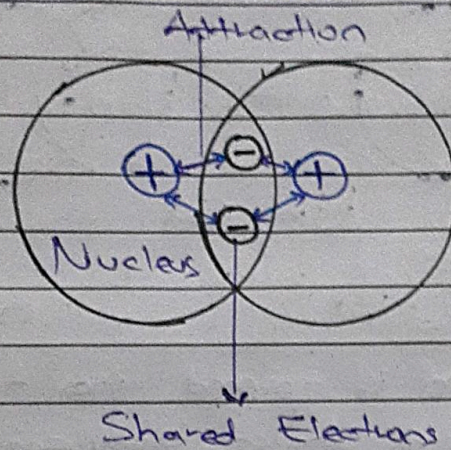
Elements having very high ionization energies are incapable of transferring electrons, and elements having very low electron affinity can not take up electrons. The atoms of such elements tend to share their electrons with the atoms of other elements or with

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other atoms of the same element in a way that both the atoms obtain octet configuration in their respective valence shells, and thus achieve stability.

Such association through sharing of electron pairs among different or same kind is known as covalent bond



Types of Covalent Bonds

Single
c.B

Double
c.B

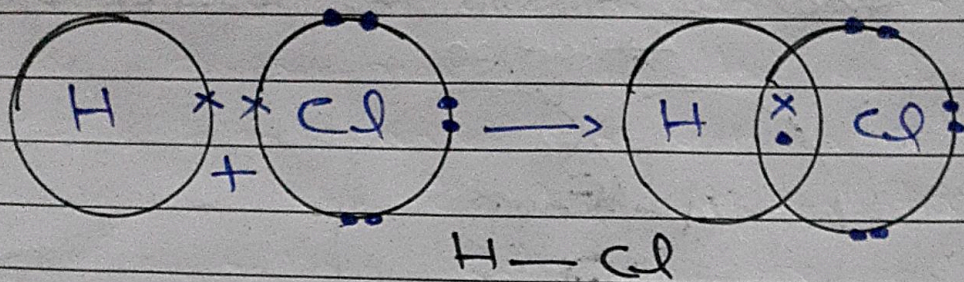
Triple
c.B

This classification is on the basis of number of shared electron pairs.

Single Covalent Bond

A single bond is formed when only one pair of electrons is shared between the two participating atoms. It is represented by a single dash (-). Although this type has a smaller density and is weaker than double and triple bond, it is the most stable one.

Example: The HCl molecule has one hydrogen atom with one valence electron and one chlorine atom with seven valence electrons. In this case, a single bond is formed between hydrogen and chlorine by sharing one electron.

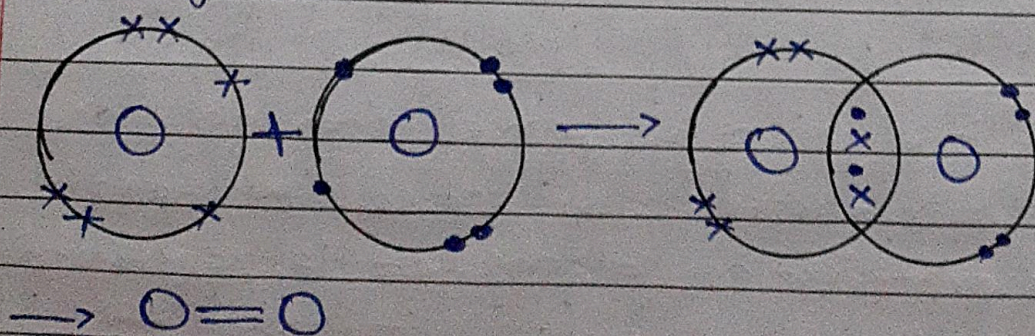


Double Covalent Bonds

A double bond is formed when two pairs of electrons are shared between the two participating atoms. It is presented by a double line between the atoms ($=$).

These bonds are much stronger than single bonds, but they are less stable.

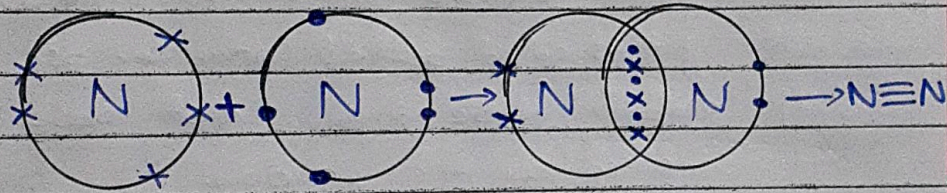
Example: In order to form an oxygen molecule, each oxygen molecule needs to gain two electrons to complete its outer shell. So, two pairs of electrons are shared and two covalent bonds are formed.



Triple Covalent Bond

It is formed when three pairs of electrons are shared between the two participating atoms. It is represented by three dashes (\equiv). It is the least stable type of covalent bonds.

Example: In the formation of nitrogen molecule, each nitrogen atom needs to gain three electrons to complete its outer shell. So, three pairs of electrons are shared and three covalent bonds are formed.



Two Nitrogen
Atoms

Nitrogen Molecules

Q.3 What is lunar eclipse? Explain in detail with apt diagrams.

A

Defining the term Eclipse

Eclipse means the obscuring of one astronomical object by another.

Definition of Lunar Eclipse

When earth comes between the sun and the moon and casts the shadow across the lunar surface, is known as lunar eclipse.

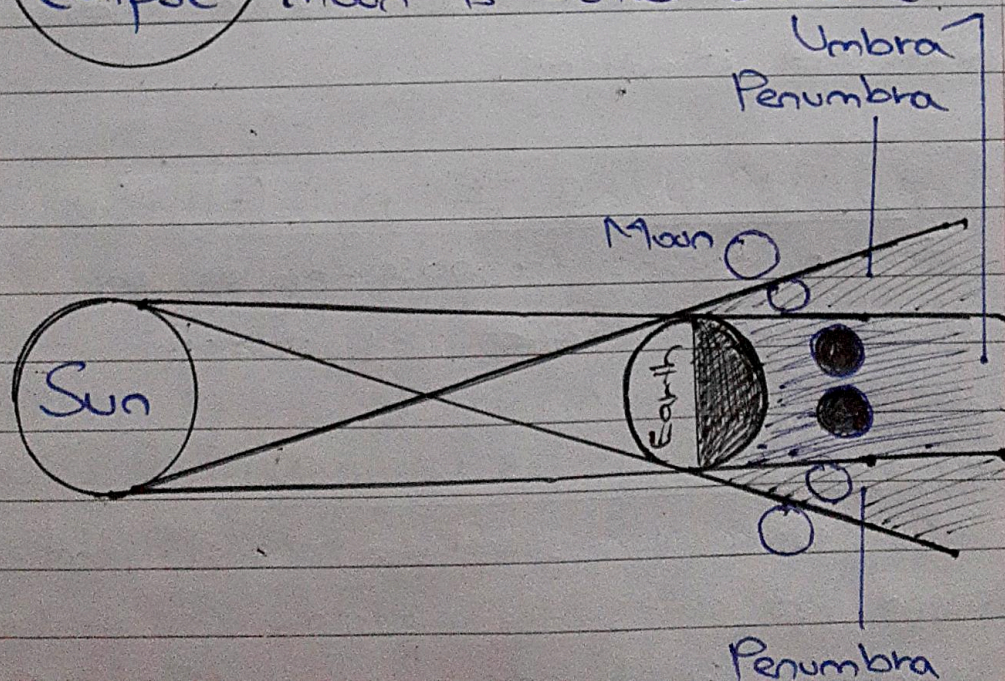
It is a common phenomenon, and about three lunar eclipses occur yearly. A lunar eclipse takes place on a full moon day.

Types of Lunar Eclipse

Penumbral Lunar Eclipse The moon only passes through the penumbra of Earth's shadow. It is rarely visible from earth as there is slight change of colour of the moon. It also occurs due to imperfect alignment of the sun, earth, and moon.

Partial Lunar Eclipse When the moon passes through the umbra of Earth's shadow, it is called partial lunar eclipse as its whole area is not obscured by the shadow.

Total Lunar Eclipse When the entire moon passes through the umbral region of Earth's shadow and moon is total obscured.



B Explain functions of enzymes in detail with examples.

Definition of Enzyme

Enzyme is specialized organic substance composed of polymers of amino acids that act as catalyst to regulate the speed of the many chemical reactions involved in the metabolism of living organisms.

Functions of Enzymes

- Help in signal transduction

Enzymes are major components in signal transduction. The most common enzyme used in the process includes protein kinase that catalyzes the phosphorylation of protein.

- Break down of large molecules

Enzymes break down large molecules into smaller substances that can be easily absorbed by the body.

- Energy generation in body

Enzyme help in generating energy in the body. ATP synthase is the enzyme involved in the synthesis of energy.

- Movement of ions

Enzymes are responsible for the movement of ions across the plasma membrane.

- Performs several biochemical reactions

They perform a number of biochemical reactions, including oxidation, reduction, hydrolysis etc. to eliminate the non-nutritive substances from the body.

- Regulation of cellular activities

Enzymes function to recognize the internal structure of the cell to regulate cellular activities.

(Given a brief account of electromagnetic radiations. What is EMR spectrum?

Defining Electromagnetic Radiations:

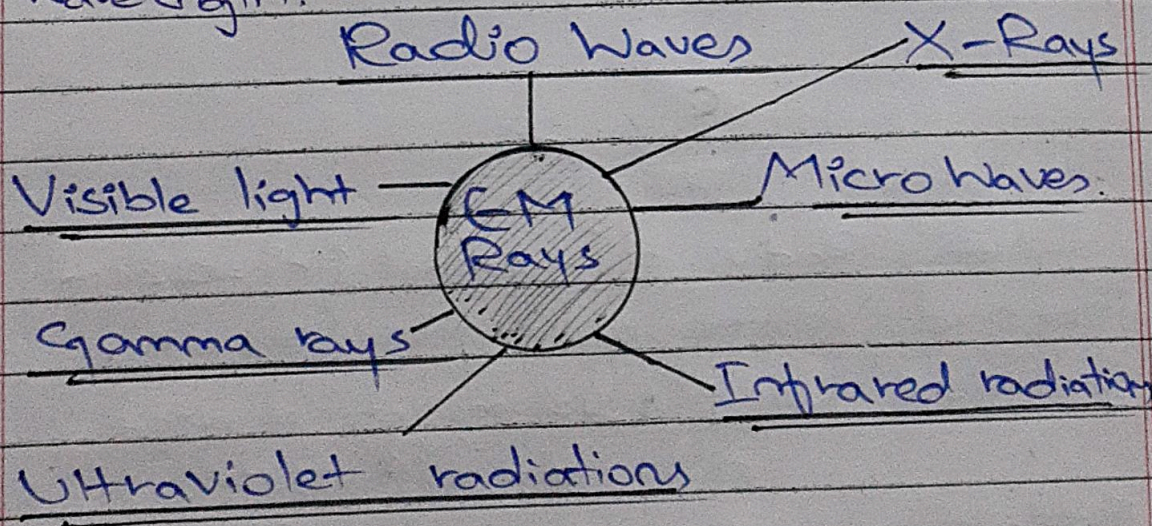
Electromagnetic radiation (EM) is a form of energy that is all around us and takes many forms, such as light rays, radio waves, micro waves, X-rays, and gamma rays. Visible light is only a small portion of EM spectrum, which contains a broad range of electromagnetic wavelengths.

Defining EMR Spectrum

The electromagnetic spectrum is a collection of frequencies, wavelengths and photon energies of EM waves spanning from 1 Hz to 10^{25} Hz , equivalent to wavelengths ranging from a few hundred kilometers to a size smaller than the size of an atomic nucleus.

EMR Waves in EMR Spectrum

Following rays make up the full range of EMR spectrum in decreasing order of frequency and rising order of wavelength.



Q6 Determine the "k" value if the A.M of
~~A~~ 9, 8, 10, k, 12 is 15.

Solution

Formula Used: $\bar{x} = \frac{\sum x}{n}$

Given: $\bar{x} = 15$

$x = 9, 8, 10, k, 12$

Find the value of "k"

putting values in formula

$$15 = \frac{8+9+10+12+k}{5}$$

$$5 \times 15 = 39 + k$$

$$75 = 39 + k$$

$$k = 75 - 39$$

$$k = 36$$

∴

Solution

Given: Radius of football (r) = 12 cm

Required: Volume of football (V) = ?

Formula Used: Volume of a sphere

$$V = \left(\frac{4}{3}\right) \pi r^3$$

Putting the value of radius in formula

$$V = \left(\frac{4}{3}\right) \pi (12)^3$$

$$= \left(\frac{4}{3}\right) \pi (1728)$$

$$= \left(\frac{4}{3}\right) \pi (1728)$$

$$= \left(\frac{4 \times 1728}{3}\right) \pi$$

$$V = 2304 \pi \text{ cm}$$

dGiven a series $-10, -8, 6, 40, 102$?

Q7 Solution

a Given: 20% of $x = y$
 i.e. $0.2x = y$ — 1

Required: find 4% of 20 terms of x
 → Multiply both sides of eq 1 with
 $20\% = 0.2$

$$(0.2)y = 0.2(0.2x)$$

$$0.2y = 0.04x$$

If 20% of x is equal to y , then
 20% of y is equal to 4% of x .

b

Solution

Given:

The average monthly income of:

$$P + Q = 5050 \text{ Rs} \quad \text{--- } \underline{1}$$

$$Q + R = 6250 \text{ Rs} \quad \text{--- } \underline{2}$$

$$P + R = 5200 \text{ Rs} \quad \text{--- } \underline{3}$$

Required: Monthly salary of P
 (to find the value of P)

First, let's find the value of $P + Q + R$

Adding eq 1, 2, and 3

$$(P + Q) + (Q + R) + (P + R) = 5050 + 6250 + 5200$$

$$P + Q + Q + R + P + R = 16500$$

$$2P + 2Q + 2R = 16500$$

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$$2(P+Q+R) = 16500$$

$$P+Q+R = 16500/2$$

$$P+Q+R = 8250$$

$$P = 8250 - (Q+R)$$

$$P = 8250 - 6250$$

$$P = 2000$$

The average monthly income of P is 2000

Solution

C

Given	Outcome	Two Head (HH)	1 head (HT) & (TH)	No Head (TT)
	Frequency	105	275	120

Required: Find the probability of each event to occur.

Formula Used = $\frac{\text{Probability of each event}}{\text{Total probability}}$

$$1. P(HH) = \frac{105}{500}$$

$$= \frac{21}{100} \checkmark$$

$$2. P(HT/TH) = \frac{275}{500}$$

$$= \frac{11}{20} \checkmark$$

$$3. P(TT) = \frac{120}{500}$$

$$= \frac{6}{25} \checkmark$$