

# GSA

## —: SECTION - I of

### PART II

Q no: 2

(a)

### —: Dengue :-

Dengue is mosquito transmitted viral disease, which affect the monocytes (immune cells) of human body. It is transmitted through *Aedes Aegypti* (most commonly) or *Aedes Albopictus* mosquitoes.

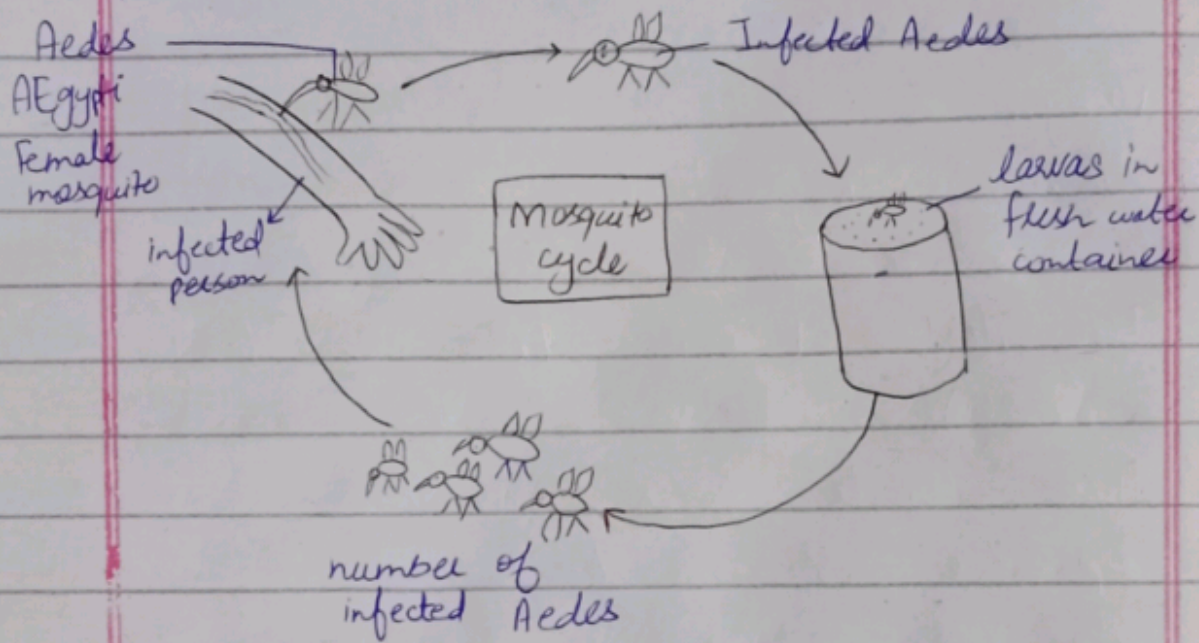
These female *Aedes* mosquitoes also responsible to transmit other disease like yellow fever or Chikengunya.

According to WHO (world health organization) and CDC (center for Disease control), almost 400 million people affected with dengue virus annually.

#### • Transmission of Dengue virus:

The infected person either symptomatic or non-symptomatic is the major source of dengue virus. Female *Aedes Aegypti* mosquito after breeding required blood, and if she bite an infected person, she can carry this virus

for her lifetime and transmit it also into their female offsprings. Thus these infected *Aedes aegypti* can transmit this virus into number of people. And this cycle continues.



### • Symptoms:

Dengue virus infection leads to dengue fever. The symptoms of dengue fever include high grade fever ( $40^{\circ}\text{C}$  /  $104^{\circ}\text{F}$ ), muscle and joint pain, pain behind the eyes, nausea, vomiting, fatigue and some times severe decrease in platelets count.

Severe dengue or dengue haemorrhagic fever 1<sup>st</sup> time reported in Thailand in 1950s. It is the most complicated type of dengue fever. It includes

internal bleeding, respiratory stress, cardiovascular disturbances and can even lead to death. According to WHO severe dengue fever systems also include severe abdominal pain, bleeding gums, hemoptysis (blood in vomit), convulsions and death, if not treated or managed within 24-48 hours after the symptoms appear. The incubation period of dengue virus is 4-10 days so symptoms of normal dengue fever may resolve in 2-7 days. But if they persist greater than 10 days then lead to severe dengue.

• Treatment or prevention:

There is no proper treatment for dengue virus exist. But palliative care for symptomatic relief do exist, like ORS to balance platelets and NSAIDs with antipyretics to deal with pain and fever.

Preventive measures like environmental management and behavioural change can be adopted.

Qno:2 (b)

—: Dark Matter and Dark Energy

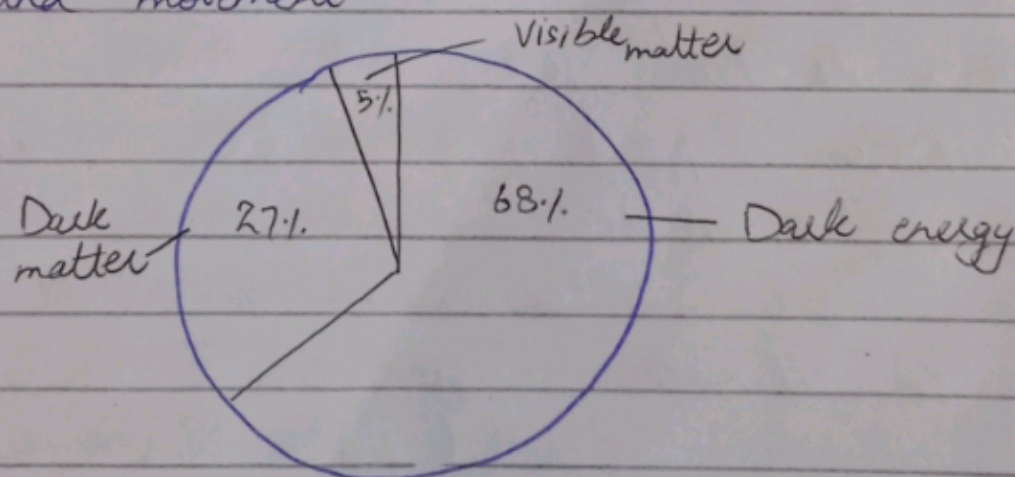
According to NASA, the sum of all the light and atoms in the universe accounts for less than 5% of total universe components. Other than the visible portion of universe, 95% invisible part is a major portion of universe which includes dark matter and dark energy.

• Dark matter:

Dark matter makes up most of the mass of the clusters of galaxies and individual galaxies. This matter is responsible for the grand scale organization of universe. This matter holds mass but is not visible.

Dark matter discovered by Swiss scientist Fritz Zwicky, in 1930, when he studied Coma galaxy cluster. In 1970, its presence is confirmed by Vera Rubin, an astronomer. Dark matter is surrounding the galaxy ordinary

matter and resides in a halo. Galaxy cluster contains hundreds to thousands of galaxies, in which each galaxy has its dark matter halo. The significant thing is galaxy cluster has its own dark matter halo which is greater than anything else combined in the universe. Dwarf galaxies have small light mass but greater dark matter halo than other galaxies. Dark matter existence is proved by its interaction with matter. It influences the galaxies rotation and movement.



### Universe Components : NASA

#### • Dark energy:

Dark energy is the mysterious force in the universe that is responsible for continuing expansion of the

universe. It is not like the dark matter except both are invisible. But dark matter exerts attractive force while dark energy exerts repelling force. Dark matter interacts with matter, it does not. It is still a mystery so too much is not known about it.

"The universe is full of mysterious things and dark energy is the biggest mystery in it."

(Dr. Stephen Hawking)

Some scientists believe that it is the fifth still unknown intermolecular force but little evidence supports this idea.

The more I learn, the more I learn how much I have to learn

(Charles Brown)

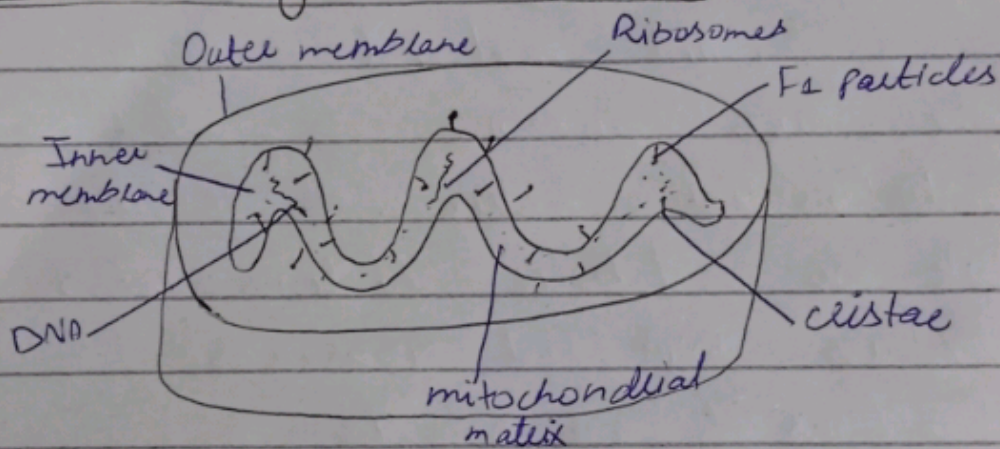
Qno: 2 (c)

— : "Mitochondria" : —

Mitochondria is an eukaryotic, self-replicating organelle. It is

discovered in 1878 by Albert Von Koliker first time. Then in 1890 Richard Altman termed it as "bioblast" by further studying it. Carl Ben coined the term "mitochondria" in 1898. It is considered as the power house of the cell.

### Structure of Mitochondria:



It is a shoe-shaped structured organelle usually but can have multiple shapes including vesicle, rod or filament shape.

Its size ranges from 0.5-10  $\mu\text{m}$ .

### Double membranous structure:

It is a double membrane bounded organelle. Outer layer is smooth while inner layer has foldings. Both layers are formed of lipoproteins but composition of lipid and

protein varies in both layers;

Inner membrane is 60% lipid and 40% proteins while outer layer is composed of 80% lipids and 20% protein components.

**Cristae:** The inner folding of inner membrane is called cristae.

**F<sub>1</sub>:** The knob like structure of cristae is called F<sub>1</sub> particles.

**Matrix:** Fluid material inside the inner membrane is called mitochondrial matrix. It is the site for metabolic reactions, also contains DNA and ribosomes.

### Functions of mitochondria:

- 1) **Power house of the cell;** Mitochondria generates energy in the form of ATP through metabolic reactions. Therefore it is considered as the power house of the cell. ATP is energy source of cell.
- 2) **Site for metabolic reactions;** Mitochondria is a major site for metabolic reactions including Krebs cycle, aerobic respiration, fatty acid metabolism etc.
- 3) **Responsible for cell growth;** It



contains its own DNA and ribosomes replicating machinery that's why it is a self replicating body and control the growth of cell, also called multiplication

- 4) Responsible for generating signals; Mitochondria stores  $Ca^{2+}$  that is responsible for signalling of cell contraction - generating action potential.

Qno: 2 (d)

### — : Covalent Bond: —

Covalent bond is formed by the mutual sharing of paired electrons in non-metallic things. Atoms which form covalent bond share their valence shell electron mutually.

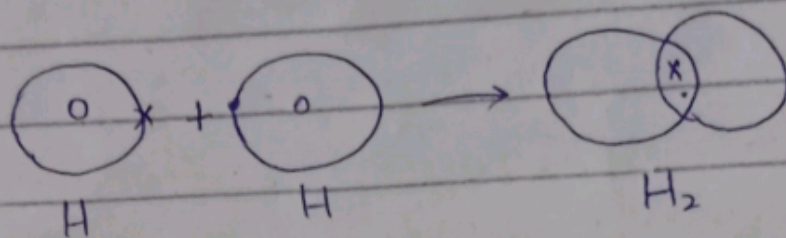
It is a directional bond and can be present in all <sup>states</sup> types of matter such as solid liquid or gas

### Types of Covalent bond:

⇒ Single covalent bond:

When only one electron pair is shared between atoms then it is called single covalent bond

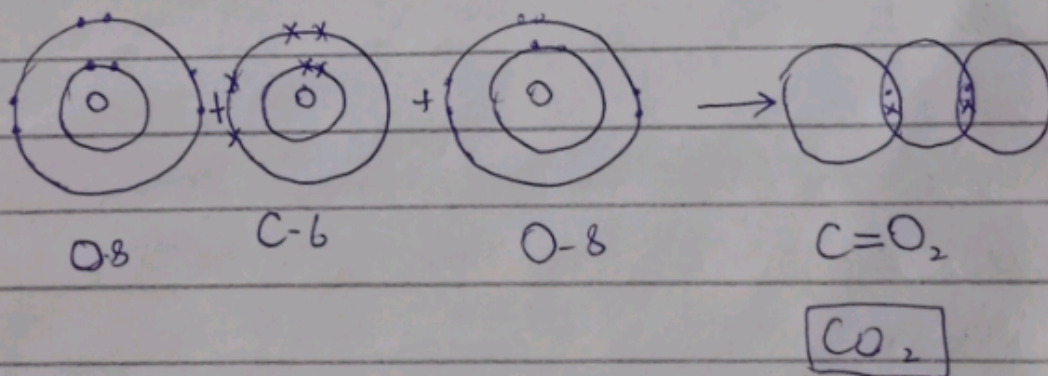
It is represented by single line between bonding atoms. e.g.  $H-H$



⇒ Multiple covalent bond:

When covalent bond occurs in such a way in which more than one pair of electron is mutually shared called multiple covalent bond.

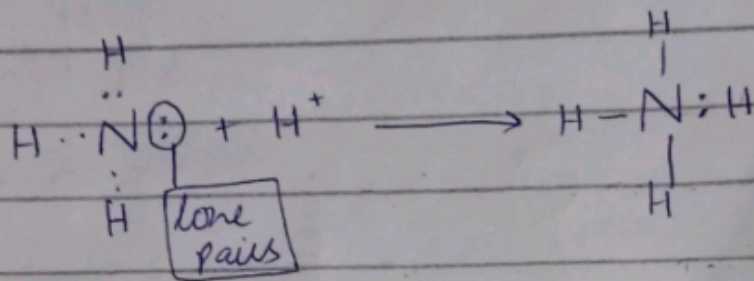
e.g.  $CO_2$



⇒ Coordinate covalent bond:

The coordinate covalent bond is formed when lone pair from only one atom is mutually shared. Lone pair is the pair of electron not involved in bonding. The atom which donates lone pair is called **donor** while the other which

acceptor is called acceptor. e.g.  $\text{NH}_3$



$\text{NH}_4$

Ammonia

Qno:3 (a)

— : Lunar Eclipse : —

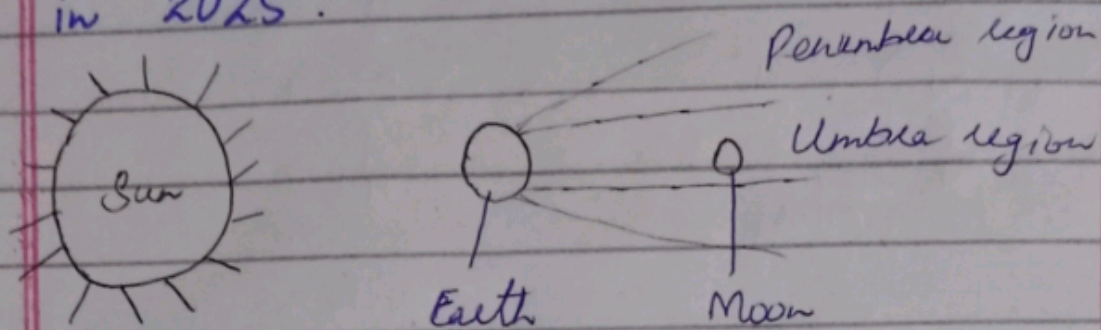
Lunar eclipse is formed when earth is present between sun shadow and moon in such a way that blocks or resist the sunlight from reaching to moon.

Sun, earth and moon form a syzygy.

Mechanism:

Earth ~~rotates~~ revolves around the sun and moon ~~rotates~~ revolves around the earth. When the ~~rotation~~ revolution of moon and earth is adjusting in such a way that earth comes in the shadow of sunlight then lunar eclipse occurs. The last lunar eclipse occurred on 8 Nov, 2022.

and next will be after 3 years in 2025.



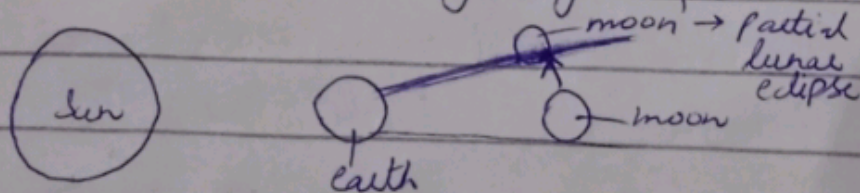
**Umbra:** Umbra is the conical shape region in which no sunlight falls.

**Penumbra:** Penumbra is the region surrounding umbra, here the light left from the earth falls.

### Types

1) **Penumbral lunar eclipse:** It occurs when moon falls in penumbra region, and appears more darker than usual.

2) **Partial lunar eclipse:** It occurs when the umbra region partially blocks moon's lighting from sunlight.



3) **Total lunar eclipse:** It occurs when moon falls in Umbra region. It also appears as 'blood Moon'.

Lunar eclipse only occurs when moon is full. And looking at lunar eclipse without protective goggles does not affect eyes.

Qno:3 (b)

### —: Enzymes :—

Enzymes are the globular proteins that are organic in nature and presents in inside and outside the biological system.

#### Functions of enzymes inside the body:

Enzymes are the catalytic substances that speed up the chemical reactions inside the body.

- **Speed up digestion:** Trypsin and pepsin are the enzymes that are present in digestive organs of human body and ten times increase the digestive process.
- **Speed up metabolic process:** Urea is an enzymes that is present in liver for protein metabolism. It converts amino acids into urea.
- **Ensure Blood clotting:** Certain enzymes are responsible for blood clotting at the site of bleeding within or outside the body. Fibrinogen is one of that.
- **Responsible for muscular contraction:** Myosin is an enzymatic protein that is very essential for muscle contraction.

#### Functions of enzymes outside the body:

- **In food industry:** various enzymes are used in food industries like amylase is

- used to convert sugar into starch. Cellulase and amylase are also used in juice manufacturing for clarifying the suspended particles in the juice. Renin is used for cheese manufacturing. Papain, present in papaya, is a meat tenderizer.
- In paper industry: Cellulase, amylase and ligninase is used to remove lignine from paper and make it smooth.
  - In biofuel manufacturing cellulase and other enzymes are used in biofuel industry.
  - Enzymes are also used in producing detergents, insecticides and degrading waste material to clean environment.

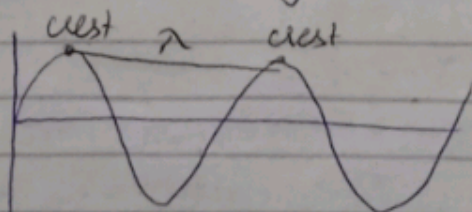
Qno: 3 (c)

## Electromagnetic Radiations

Electromagnetic radiations are form of energy that is produced by moving charged particles called photon. These electrically charged particles can move in vacuume or space also because they do not required medium for their propagation. These waves can also be generated by oscillating electric & magnetic field.

### Characteristic:

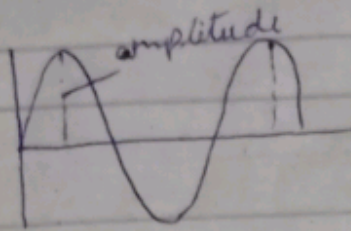
Wavelength: These waves have specific wavelength that is the distance between two adjacent crest or trough. It is denoted by lambda  $\lambda$ .



Frequency: It is the rate at which no. of waves travel per sec. It is represented by  $f$ .

$$f = \frac{1}{T}$$

Amplitude: It is the height of wave that is generated, from the equilibrium point. It represents the intensity of wave.



Transverse waves: Electromagnetic waves are transverse in nature. It means they travel perpendicular to the direction of propagation.

Speed: Speed of electromagnetic waves is equal to  $3.0 \times 10^8$  in vacuum that is equal to speed of light.

## EMR

Electromagnetic ray spectrum is the array of electromagnetic rays. It includes electromagnetic rays that are characterized in the form of ascending frequency or energy or descending wavelength.

Electromagnetic rays include in electromagnetic spectrum are Radio waves, microwaves, infrared ray, visible light, ultraviolet ray, X-rays and gamma rays.

|           | Radio waves | Microwaves | Infrared rays | Visible           | Ultraviolet |
|-----------|-------------|------------|---------------|-------------------|-------------|
| $\lambda$ | $10^3$      | $10^2$     | $10^5$        | $0.5 \times 10^3$ | $10^{-10}$  |
| $f$       | $10^4$      | $10^8$     | $10^{12}$     | $10^5$            | $10^6$      |

|           | X-rays     | Gamma rays |
|-----------|------------|------------|
| $\lambda$ | $10^{-12}$ | $10^{-14}$ |
| $f$       | $10^{18}$  | $10^{20}$  |

Q no: 3 (d)

### Earthquake:

It is the sudden shaking of earth due to release of energy at the earth crust in the form of seismic waves. These waves are travelling in all direction from its source.

### Volcanic eruption:

Volcanic eruption is the emerging of earth's magma onto its crust in the form of molten lava, with the release of huge amount of energy and gases.

### Volcanic Eruptions and earthquakes are interconnected:

Volcanic eruption and earthquakes are interconnected in two cases that are given as,

- Tectonic plate movement: The divergent movement of tectonic plates in which they move apart from each other resulted in the constructive movement that followed by earthquakes and volcanic eruptions both. The earthquakes that are of magnitude greater than 6 are considered



to be followed by volcanic eruption at some place. e.g. 1991 pinatuba earthquake.

• Earthquake due to volcanoes:

Lava emergence at earth crust is also followed by regional earthquake of low magnitude. e.g. Pacific ring of fire is the major hotspot for both earthquakes and volcanic eruption.

## Part - II - Section - II

Qno: no 6 (a)

To find =  $k$  :

Data given :

$$\text{mean} = 15$$

$$\text{mean} = \frac{\text{no. of obs}}{\text{total no}}$$

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

$$75 = 39k$$

$$k = \frac{75}{39}$$

$$\frac{25}{13}$$

$$k = 1.92$$

(c)

To find = Volume of football

Given data =  $r = 12 \text{ cm}$

Formula of volume of sphere =  $\frac{4}{3}\pi r^3$

$$= \frac{4}{3} \times \frac{22}{7} \times (12)^3$$

$$= \frac{50668}{7}$$

Volume of =  $\boxed{7241.41}$   
football.

(d)

-10, -8, 6, 40, 102, ?

The difference between numbers

2, 14, 34, 62

But these are not representing constant interval

$$2 - 14 = 12$$

$$14 - 34 = 20$$

$$34 - 62 = 28$$

Other difference will be

$$20 - 12 = 8$$

$$28 - 20 = 8$$

Then add the differences into last number

$$= 102 + 8 + 28 + 62$$

$$= \boxed{200}$$

The next number would be 200

Qno: 7

(b)

$$P + Q \text{ salary} = 5050 = x$$

$$Q + R \text{ salary} = 6250 = y$$

$$P + R \text{ salary} = 5200 = z$$

$$P+Q \text{ salaries} = \frac{P+Q}{2} = 5050$$

$$P+Q = 5050 \times 2$$

$$\boxed{P+Q} = 10100 \quad \text{---(i)}$$

$$R+Q \text{ salaries} = \frac{R+Q}{2} = 6250$$

$$\boxed{R+Q} = 12500 \quad \text{---(ii)}$$

$$P+R \text{ salaries} = \frac{P+R}{2} = 5200$$

$$\boxed{P+R} = 10400 \quad \text{---(iii)}$$

Adding all the 3 equation

$$(P+Q) + (Q+R) + P+R = 12500 + 10100 + 10400$$

$$2P + 2Q + 2R = 33000$$

$$2(P+Q+R) = 33000$$

$$P+Q+R = \frac{33000}{2} = 16500$$

$$P+Q+R = 16500$$

Add the value of  $Q+R$

$$P + (12500) = 16500$$

$$P = 16500 - 12500$$

$$P = \boxed{4000}$$

(c)

2 coins tossed = 500 times

each coin  $\begin{cases} \text{head} \\ \text{tail} \end{cases}$

2 coins  $\begin{cases} 2 \text{ head} \\ 2 \text{ tail} \\ 1 \text{ head, } 1 \text{ tail} \end{cases}$

$$\text{Probability of 2 heads} = \frac{105}{500} = \frac{21}{100}$$

$$= 0.21$$

$$\text{Probability of One head} = \frac{275}{500} = \frac{11}{20}$$

$$= 0.55$$

$$\text{Probability of No head} = \frac{120}{500} = \frac{12}{50} = \frac{6}{25}$$

$$= 0.204$$

R-W

$$100 \overline{) 210} \\ \underline{200} \\ 10$$

$$20 \overline{) 110} \\ \underline{100} \\ 10$$

$$25 \overline{) 60} \\ \underline{50} \\ 10$$

Qno: 3 (d)

$$\text{Jamie age} = x$$

$$\text{Jamie's dad age} = 4(x) = y \quad \text{--- (i)}$$

In 14 years:

$$14 + x = x$$

$$y + 14 = 2(x + 14)$$

$$y + 14 = 2x + 28$$

$$y - 2x = 28 - 14$$

$$y - 2x = 14$$

$$y - 2x = 14$$

put value of y

$$4x - 2x = 14$$

$$2x = 14$$

$$x = \frac{14}{2}$$

$$x = 7$$

$$\text{Jamie age} = 5$$

$$\text{Jamie's dad age} = 4(5) = 20$$

Put value of y in --- (ii)

$$14 + 2(4x) = x$$

$$14 + 8x = x$$

$$14 = x - 8x$$

$$14 = -7x$$

$$\frac{14}{-7} = -x$$

$$x = 7$$

Sum of both ages

$$= 7 + 28 = 35$$