

General Science & Ability

Descriptive Part

(Question no. 2)

(a)

Dengue :-

Definition :

" Dengue is a mosquito borne viral disease that appears as flu like illness, affecting infants, adults and young children and often results in death."

Causative Agents

There are 2 main causative agents of dengue. That are :

(i) *Aedes aegypti* : Primary vector of dengue. The virus is transmitted through the bites of infected female mosquitos. This mosquito lives in urban areas and are day time feeder; Its peak biting periods are early in the morning and in evening before dusk.

(ii) *Ae. albopictus* : Lesser extent than *Aedes aegypti*.
This mosquito also transmits Chikungunya, Yellow fever and Zika infection.

Major Symptoms of Dengue

Following are some common symptoms of dengue:

- (i) High fever (40°C / 104°F)
- (ii) Severe headache.
- (iii) Pain behind the eyes.
- (iv) Muscle and Joint pains.
- (v) Nausea and vomiting.
- (vi) Swollen glands or rash.

⊙ Symptoms usually last for 2-7 days, after an incubation period of 4-10 days after the bite from an infected mosquito.

(b)

1) Dark Matter

- Definition :

⁶⁶ Dark matter is a form of matter that does not emit, absorb or reflect light, making it invisible and detectable only through its gravitational effects on visible matter, radiation.

and the large scale structure of the universe.

Function:

It act as sort of "cosmic glue" helping to bind galaxies and clusters together. Without dark matter the gravitational pull of visible matter alone would be too weak to hold galaxies together.

Evidence:

Observations of galactic rotations curves, gravitational lensing and cosmic microwave background radiations all suggest the presence of dark matter as these phenomena require more gravitational force than visible matter can provide.

2) Dark Energy

Definition:

"Dark energy is an unknown form of energy that is thought to be responsible for the accelerated expansion of the universe."

Unlike dark matter, dark energy does not interact with matter through gravity, instead

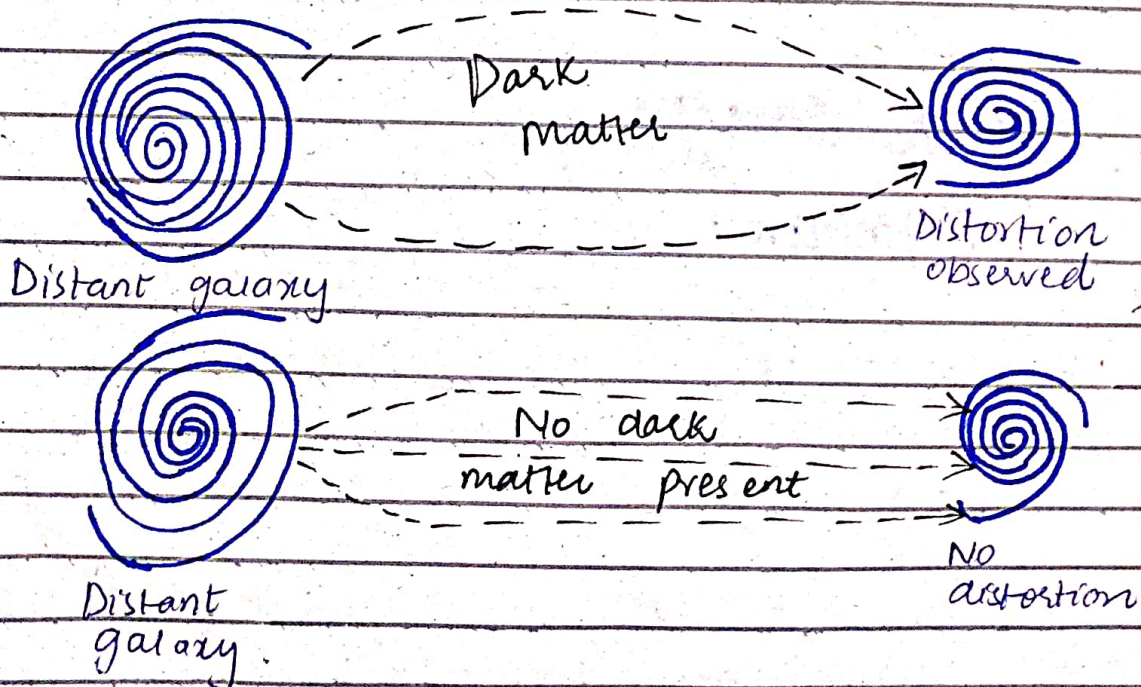
seems to work against the gravity.

Function:

Dark energy contributes towards the stretching of the space, leading to accelerated expansion of the universe. It's thought to roughly make up to 68% of total energy content of universe.

Evidence:

Observations of distant supernovae, cosmic microwave background and large scale structure of the universe indicates that the universe's expansion is accelerating and implying the presence of dark energy.



(C)

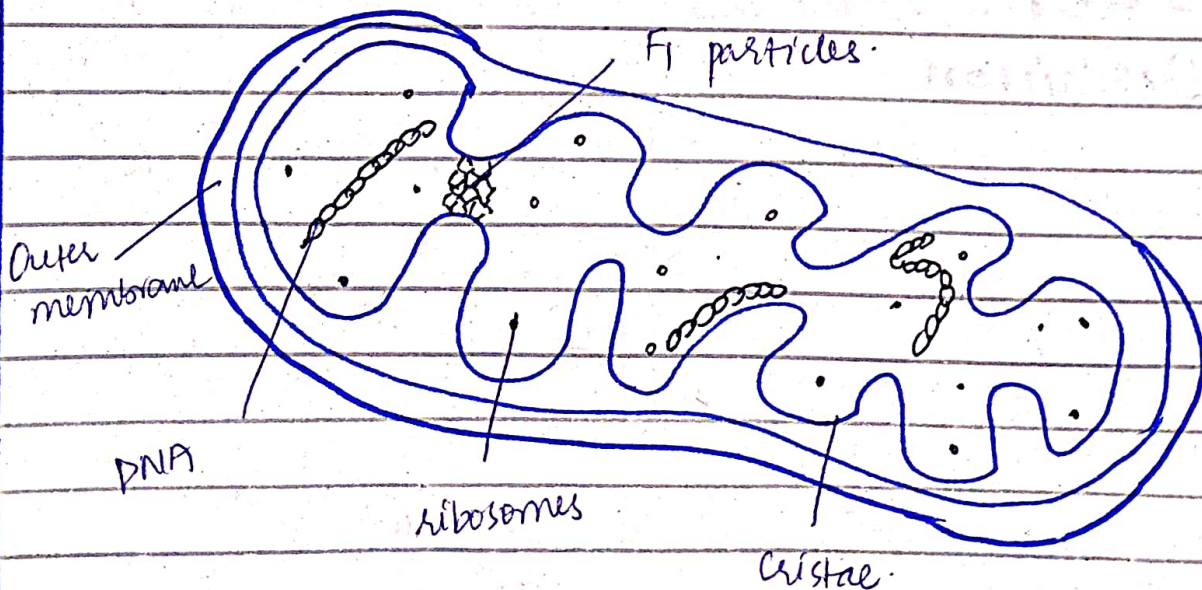
Mitochondria

" Mitochondria are the cell organelles that are responsible for producing energy for cells functioning and working and thus are known as power house of cells.

Structure of Mitochondria

Mitochondria is a double membrane cell organelle. The outer member is smooth while the inner membrane contains many foldings known as cristae. The inner surface of cristae contains knob-like structures known as F_1 particles that are suspended in mitochondrial matrix.

The following diagram shows the structure of mitochondria.



Function of Mitochondria

① Hub of important metabolic processes
Like Krebs cycle, aerobic respiration, fatty acid metabolism etc.

② Responsible for synthesizing ATP
Energy rich compound; Adenosine Triphosphate that provides energy to cell on demand.

Mitochondria as Power House of cell

Since mitochondria is responsible for producing energy that is provided to cell to perform various functions, that's why it is known as power house of cell i.e. responsible for generating and supplying power to cell.

(d)

Covalent Bonds

Definition

"The bonds that are created by the common sharing of electrons between non metals or metals are known as covalent bonds."

They are represented by line between the symbol of atoms depending upon the number

of bonds they may make e.g. $H-H$, $O=O$, $N \equiv N$.

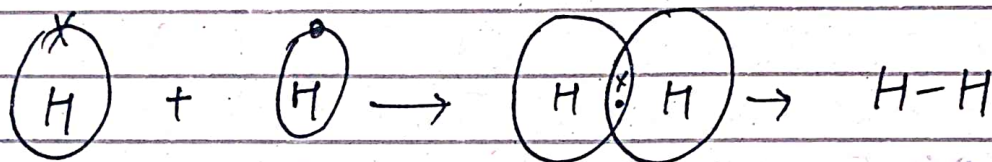
Types of Covalent Bonds

Based on number of electrons shared, there are 3 types of covalent bonds

(i) Single Covalent Bonds

When only one pair of electron is shared

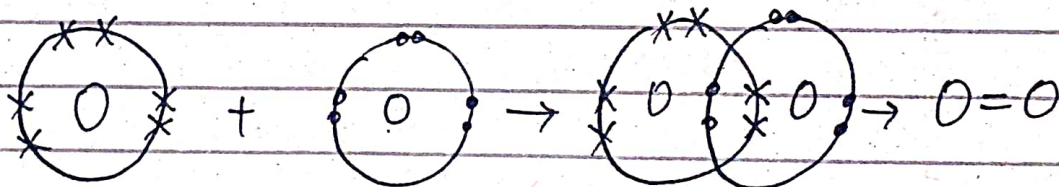
e.g. Hydrogen (H_2)



(ii) Double Covalent Bonds

When two pairs of electrons are shared

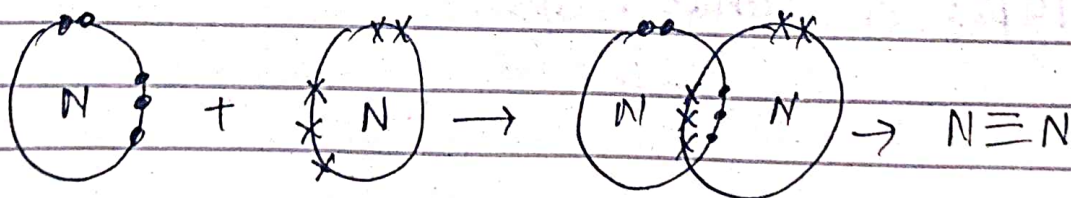
e.g. Oxygen (O_2)



(iii) Triple Covalent Bonds

When three pairs of electrons are shared

e.g. Nitrogen (N_2)



(Question no 3)

(a)

Lunar Eclipse:

"The pattern ^{observed} when Earth comes in between the Sun and moon is called lunar eclipse.

Mechanism

- ① The moon moves in an orbit around Earth
- ② At the same time Earth orbits the Sun.
- ③ Sometimes Earth moves between Sun and Moon.
- ④ This results in a condition called lunar eclipse.
- ⑤ A lunar eclipse can only occur when moon is full.

Types of lunar eclipses

- ① Penumbral eclipse
- ② Partial lunar eclipse
- ③ Total lunar eclipse

(i) Penumbral ^{Luna} Eclipse

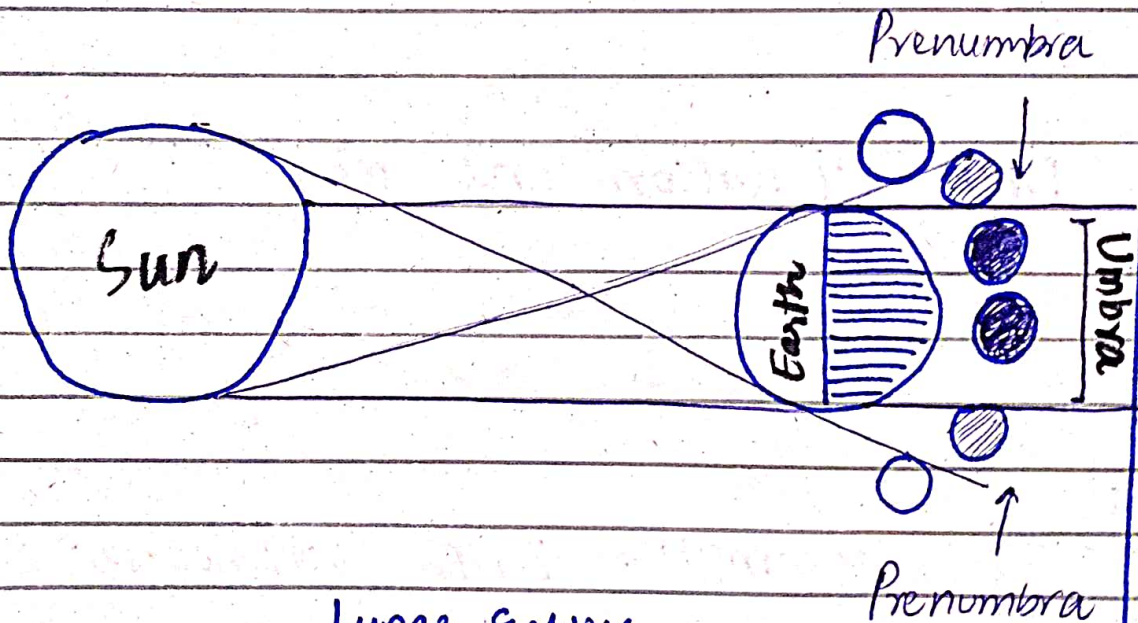
a) The Moon only passing through the penumbra of Earth's shadow.

(ii) Partial Lunar Eclipse

When part of moon passes through the umbra of Earth's shadow, then whole area is not obscured by shadow.

(iii) Total Lunar Eclipse

When the entire moon passes through the umbral region of Earth's shadow and moon is totally obscured.



Lunar Eclipse

(b)

Function of Enzymes

(a) Catalyzing Metabolic Reactions

Enzymes are crucial for metabolic reactions that include anabolic and catabolic reactions. They lower the activation energy and act as catalyst to speed up the reaction.

Example: Amylase found in saliva and pancreas

It breaks down starch into simple sugars.

(b) DNA replication and repair

Enzymes are essential in unzipping the DNA helix, adding nucleotides and proof reading for errors. They also repair DNA damage.

Example: DNA polymerase is an enzyme that synthesizes a new DNA strand complementary to the template strand during DNA replication.

(3) Cellular Respiration and Energy Production

Enzymes facilitate cellular respiration that converts glucose into ATP the energy currency of cells.

Example : ATP synthase is an enzyme that produces ATP in mitochondria during cellular respiration.

(4) Detoxification and Waste Removal

Enzymes help detoxify harmful substances and break down waste products keeping cells and tissue safe from toxins.

Example : Catalase breaks down hydrogen peroxide (a toxic byproduct of metabolism) in liver.

(5) Signal Transduction and Regulation

Enzymes regulate cellular signals and control various pathways.

Example : Protein kinases are enzymes that transfer phosphate groups to proteins, activating or deactivating them.

(C) Electromagnetic Radiations

"Electromagnetic radiations or EMR are the form of energy that can propagate through space and vacuum in the form of electromagnetic waves in form of oscillations."

Properties of EMR

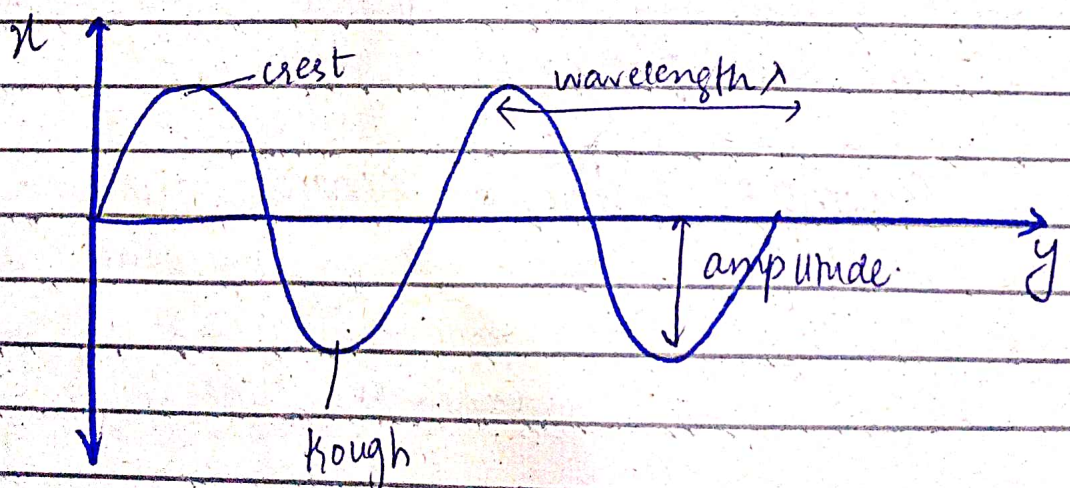
(a) **Amplitude** : The height of waves.

(b) **Wavelength** : The distance between 2 crests or 2 troughs - denoted by λ .

(c) **Frequency** : Number of waves passing through medium in a second.

The velocity of waves is calculated by

$$v = f \lambda$$



EMR Spectrum

Electromagnetic waves are characterized by either frequency or wavelength of their oscillations to form electromagnetic spectrum.

This includes:

- Radio waves
- Micro waves
- visible light
- UV radiation
- X rays
- Gamma rays.

increasing
frequency

decreasing
wavelength

(d)

Earthquakes & Volcanic eruptions connection

Yes, earthquakes and volcanic eruptions are interconnected as both are driven by tectonic forces.

Following is the description:

① Tectonic plate movement

Both occur near tectonic plate boundaries where plate shifts can trigger both events.

② Earthquakes triggering volcanic eruptions

Large earthquakes near volcanoes can crack rock, allowing magma to rise.

and potentially causing eruptions
Subduction zones and volcanic arcs

③

In subduction zones, sinking plates generate pressure that lead to earthquakes and magma formation resulting in volcanic arcs.

—(Question - 7)—

(a)

According to the given condition,

$$20\% \text{ of } x = y$$

$$\Rightarrow \frac{20}{100} \times x = y$$

$$20x = 100y \Rightarrow x = \frac{100}{20} y$$

$$\boxed{x = 5y} \rightarrow \textcircled{1}$$

Required

y.% of 20 in terms of x

First, find y.% of 20.

Let p be the unknown value.

$$p = y.\% \text{ of } 20.$$

$$p = \frac{y}{100} \text{ of } 20$$

$$= \frac{y}{100} \times 20$$

$$\boxed{p = \frac{y}{5}} \rightarrow \textcircled{2}$$

In term of x , replace y with its value from eq ①

$$\rightarrow y = \frac{x}{5}$$

So

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

$$= \frac{x/5}{5}$$

$$P = \frac{x}{25}$$

Hence y.o.f of 20 in terms of x is $\frac{x}{25}$

~~(b)~~

According to the given conditions

$$1) \quad \frac{P+Q}{2} = 5050$$

$$P+Q = 10100 \rightarrow (1)$$

$$2) \quad \frac{Q+R}{2} = 6250$$

$$Q+R = 12500 \rightarrow (2)$$

$$\textcircled{3} \quad \frac{P+R}{2} = 5200$$

$$P+R = 10,400 \quad \rightarrow \textcircled{3}$$

Required :-
P's salary monthly

From eq $\textcircled{3}$

$$P = 10400 - R$$

From eq $\textcircled{2}$

$$R = 12500 - Q$$

From eq $\textcircled{1}$

$$Q = 10100 - P$$

Back substituting the values, we get

$$R = 12500 - (10100 - P)$$

$$R = 2400 + P$$

$$\Rightarrow P = 10400 - (2400 + P)$$

$$P = 10400 - 2400 - P$$

$$P = 8000 - P$$

$$2P = 8000$$

$$P = 4000$$

Hence the monthly salary of P is Rs. 4000.

(c)

Probability of :

$$a) \text{ Two heads} = \frac{105}{500}$$

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

$$b) \text{ One head} = \frac{275}{500}$$

$$= \frac{55}{100} = \frac{11}{20}$$

$$c) \text{ No head} = \frac{120}{500}$$

$$= \frac{24}{100} = \frac{6}{25}$$

(d)

Present condition

Let Jamies dad's age be x

and Jamies age be y

According to the given condition

$$x = 4y$$

$$x - 4y = 0 \rightarrow \textcircled{1}$$

After fourteen years

$$\text{Jamie's age} = y + 14$$

$$\text{Jamie's dad age} = x + 14$$

According to the given condition

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

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

$$x - 2y = 14 \rightarrow \textcircled{2}$$

Equation solving eq $\textcircled{1}$ and $\textcircled{2}$

$$\begin{array}{r} x - 4y = 0 \\ \oplus x \ominus 2y = \oplus 14 \\ \hline \end{array}$$

$$-2y = -14$$

$$y = \frac{-14}{-2}$$

$$\boxed{y = 7}$$

$$x = 4y \Rightarrow 4(7)$$

$$\Rightarrow \boxed{x = 28}$$

Required = ?

Sum of Jamie's age and her dad's age at present time is

$$7 + 28 = 37$$

— (Question no. 8) —

— (a) —

Given formula:

$$\text{Charge} = \text{£}20 + 4n$$

n = NO. of windows

In given situation $n = 7$
Put in above formula

$$\text{charge} = \text{£}20 + 4(7)$$

$$= \text{£}20 + 28$$

$$\text{Charge} = \text{£}48$$

So Brian will charge $\text{£}48$ for window cleaning.

(b)

Correct spellings

- ① Placier ④
- ② Humanity
- ③ Sreach

(c)

$$\text{L.H.S} = (A \cup B)'$$

$$A \cup B = \{10, 11, 12, 13, 15\} \cup \{10, 12, 14\}$$

$$= \{10, 11, 12, 13, 14, 15\}$$

$$(A \cup B)' = U - (A \cup B)$$

$$= \{10, 11, 12, 13, 14, 15, 16, 18\} -$$

$$\{10, 11, 12, 13, 14, 15\}$$

$$= \{16, 18\} \longrightarrow \text{①}$$

$$\text{R.H.S} = A' \cap B'$$

$$A' = U - A$$

$$= \{10, 11, 12, 13, 14, 15, 16, 18\} - \{10, 11, 12, 13, 15\}$$

$$= \{14, 16, 18\}$$

$$B' = \{10, 11, 12, 13, 14, 15, 16, 18\} - \{10, 12, 14\}$$

$$= \{11, 13, 15, 16, 18\}$$

$$A' \cap B' = \{14, 16, 18\} \cap \{11, 13, 15, 16, 18\}$$

$$= \{16, 18\} \longrightarrow \textcircled{2}$$

It implies from eq ① and ②

Since L.H.S = R.H.S, so,

$$(A \cup B)' = A' \cap B'$$

—(d)—

The total number of triangles are 24.