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GSA

SECTION - I

QUESTION : 2

(c) Discuss structure and function of mitochondria. How is it the powerhouse?

MITOCHONDRIA

Mitochondria is a double membrane bounded organelle that is only present in the Eukaryotic cell.

Structure of Mitochondria:

Mitochondria is a vesicle rod or filament shape. It has two membranes. The outer membrane is smooth while the inner membrane contains some infoldings called cristae. The cristae has some particles known as F_1 particles.

Chemical Composition of Mitochondria:

Mitochondria contains proteins, lipids, carbohydrates, and enzymes and co-enzymes. Ribosomes and DNA are also present in mitochondria.

Self-Replicating Mitochondria:

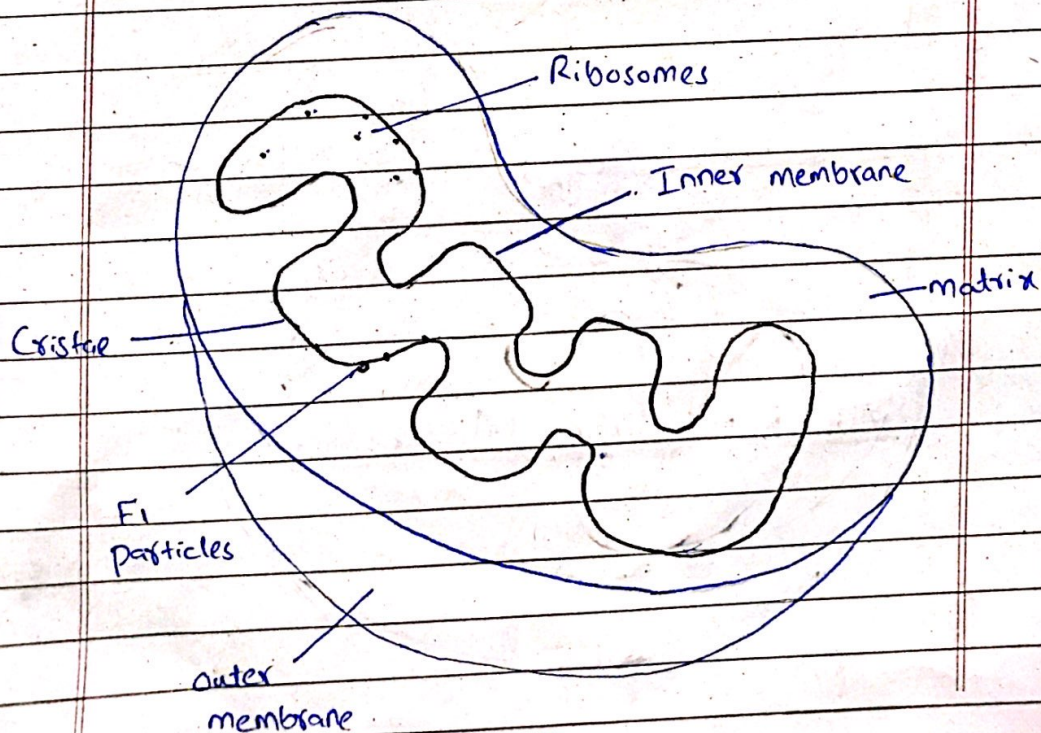
Mitochondria is a self replicating organelle. A new mitochondria can be formed from the old mitochondria.

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Mitochondria as the Powerhouse of the Cell:

Mitochondria generates energy and provide it to the cell that is why it is known as powerhouse of the cell. Many metabolic activities like glycolysis and protein synthesis occurs in mitochondria. The production of Adenosine triphosphate (ATP) occurs in mitochondria.

It takes the energy from the organic food and supply the energy to the cell for functioning. The ATP is converted into ADP. ADP travels to mitochondria to again become ATP.



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

COVALENT BOND

The bond formed by sharing of one or more pair of electrons by the atoms is known as covalent bond.

For example: $H-H$, $O=O$, $N \equiv N$

TYPES OF COVALENT BONDS

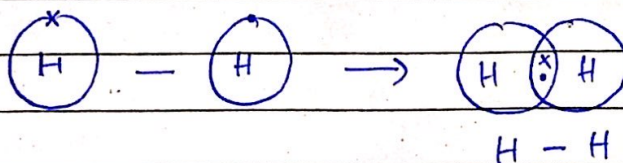
SINGLE COVALENT BOND:

When a single pair of electrons is shared between the atoms. It is called single covalent bond.

Representation: It is represented by a single line between the atoms.

For example: $H-H$, $Cl-Cl$

The bond formed between the two atoms of hydrogen is single covalent bond. Hydrogen atom has one electron and to gain the electronic configuration of the nearest noble gas, hydrogen needs one electron. So, 2 hydrogen atoms will form a bond by sharing the electron to gain stability.



Hydrogen atoms sharing
a pair of electrons

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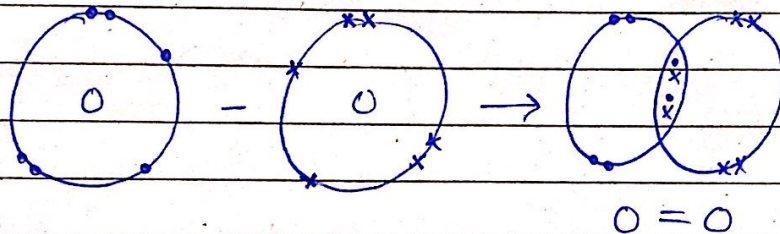
DOUBLE COVALENT BOND:

When atoms share two pairs of electrons, double covalent bond is formed.

Representation: It is represented by double line.

For Example: $O=O$, $O=C=O$

Oxygen atom has 6 electrons and to gain stability, it needs 2 electrons so it forms a bond with another oxygen atom by sharing 2 pairs of electrons.



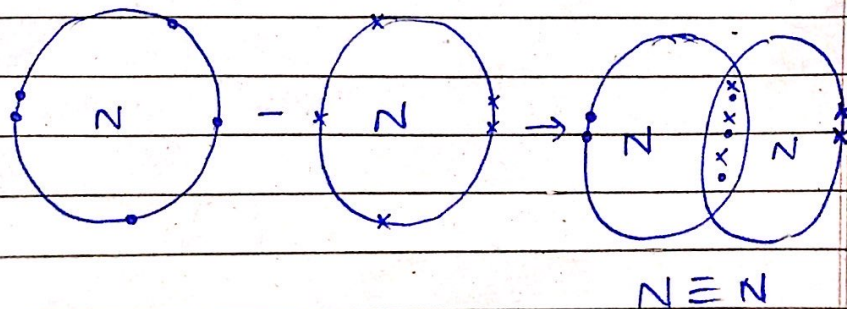
TRIPLE COVALENT BOND:

Sharing of three pairs of electrons by atoms is called triple covalent bond.

Representation: It is represented by 3 lines.

For example: $N \equiv N$

Nitrogen atoms share 3 pairs of electrons to gain the electronic configuration of a noble gas.



Two nitrogen atoms

Nitrogen molecule

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

DENGUE

Dengue is a viral mosquito-borne disease which was first recognized in 1950s in Philippines and Thailand. But today, it is also found in Asia and South American regions.

CAUSATIVE AGENTS:

It is caused by a female mosquito *Aedes Aegypti* and to a lesser extent by *Ae. albopictus*.

Aedes Aegypti is the primary vector of the transmission of the dengue virus. It is transmitted to the human blood by the bite of an infected mosquito. After the incubation period of 2-4 days, the mosquito is ready to transmit the virus.

Symptoms:

Dengue is characterized by high fever accompanied by 2 or more of the following symptoms: vomiting, nausea, headache, joint pain, abdominal pain.

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Severe Dengue has potentially ^{deadly} ↑ complications such as : bleeding, body impairment, loss of white blood cells,

(b) Explain dark matter and dark Energy.

DARK MATTER

Dark matter comprises particles that do not reflect, absorb, or emit light. Thus, they cannot be detected by observing electromagnetic radiations. It is a material that cannot be seen directly. It is a mysterious and invisible substance. We believe it exists because of its effect on the objects. Moreover, the force of dark matter is always attractive. It attracts all the particles even though light cannot move out of them. Astronomers believe that dark matter exists because visible matter does not have enough gravitational mass to hold galaxies together. The composition of dark matter is : Super-dense astronomical bodies called massive astrophysical compact halo objects (MACHOs) and weakly interacting massive particles (WIMPs).

For Example :

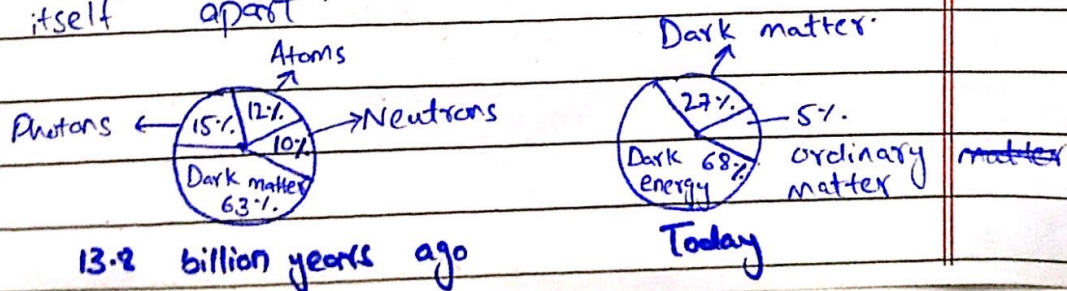
Neutron Stars

Black holes

DARK ENERGY

Dark energy is the energy that helps in the expansion of the universe. In fact, in 1998, astronomers studying distant supernova were shocked to learn that the universe began expanding faster around 7.5 billion years after the 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. It is the opposite of dark matter. Dark energy repels the objects, due to which things move far away from each other.

For example: Phantom dark energy, where not only is 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.



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QUESTION : 3

(a) What is a lunar Eclipse ?

Explain in details with apt diagrams.

LUNAR ECLIPSE

Eclipse: When a heavy object such as planet or a moon casts shadow on the other heavily object. It is known as eclipse.

LUNAR ECLIPSE :

Moon revolves around the Earth. Similarly Earth revolves around the Sun. Sometimes during the revolution the Earth comes between the Sun and the moon, blocking the sunlight to reach the moon. The moon gets the light from the Sun which is reflected but when Earth comes between the moon and the Sun, the ~~light~~^{moon} is obscured and the shadow of the Earth is formed on the moon.

Umbra: A conical shadow, umbra is formed on the moon.

Penumbra: Surrounding the umbra is penumbra region.

Lunar eclipse is very rare. It happens only 2 times per year. It can be seen from the

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Earth. It is generally safe to look at lunar eclipse by naked eye.

TYPES OF LUNAR ECLIPSE

1: Penumbral Lunar Eclipse:

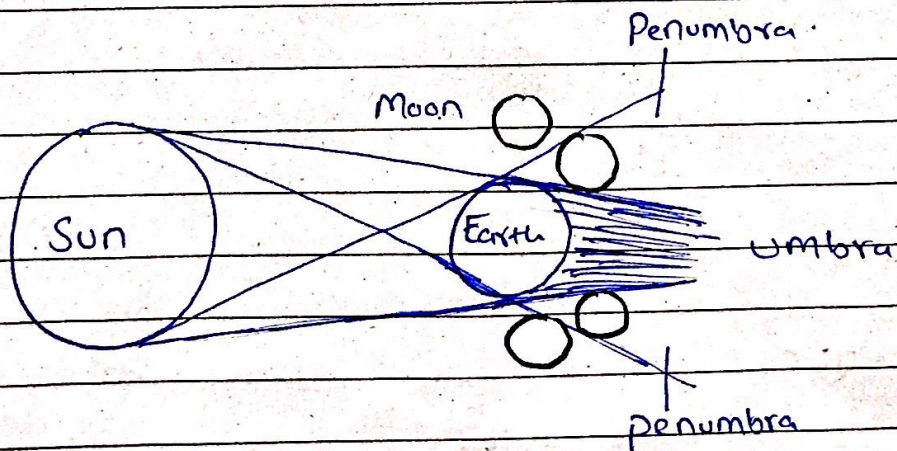
When moon passes from the penumbral region and the ~~whole~~ light of the sun does not ^{completely} obscure the moon.

2: Partial Lunar Eclipse:

When part of the moon passes through the umbra region and moon is not completely obscured.

3: Total Lunar Eclipse:

When the moon passes through the umbra region and whole moon is obscured by the shadow of the Earth.



Lunar Eclipse

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(b) Explain the function of enzymes in detail with examples.

ENZYME

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

FUNCTIONS OF ENZYMES:

Enzymes perform a wide variety of functions in living organisms.

- **Signal transduction and Cell regulation:**

Enzymes are major components in signal transduction and cell regulation. such as kinases and phosphatases.

- **Bodily Movement:**

Enzymes take part in bodily movement with the help of the protein myosin which aids in muscle contraction.

- **Digestive Activity:**

Enzymes play an important role in the digestive activity. They break down large molecules into absorbable molecules such as amylase which breaks down complex carbohydrates, Lipase breaks down fats and protease breaks down proteins.

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• Forming Metabolic Pathways:

Various enzymes work together in an order forming metabolic pathways, for example glycolysis.

• Food Processing:

Amylase enzymes are used in production of sugars from starch in making corn-syrup.

• Urea decomposition:

Enzymes also control urea decomposition, urease helps in this function.

Other Functions:

Most of the enzymes helps in the metabolic processes, like digestion and breathing. Some are related to blood clotting, healing of wounds, controlling the production of hormones, destroying pathogens and environmental toxins.

SECTION - II

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QUESTION: 6

(a) Determine the "k" value if the arithmetic mean of 9, 8, 10, k, 12 is 15.

Given: Mean = 15

Required: value of k = ?

Solution:

$$\text{Mean} = \frac{\text{Sum of all the values}}{\text{Total no. of the values}}$$

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

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

$$125 - 39 = k$$

$$91 = k$$

$$\boxed{k = 91}$$

Conclusion:

Therefore the value of k is 91.

(c) What will be the volume of a football with a radius of 12 cm?

Given Data: $r = 12 \text{ cm}$

Required: volume of the football.

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$$\text{Formula: } V = \frac{4}{3} \pi r^3$$

Solution:

$$V = \frac{4}{3} (2.17) \times 12^3$$

$$V = \frac{4}{3} (2.17) \times 2928$$

$$V = 1.33 \times 2.17 \times 2928$$

$$= 2.8861 \times 2928$$

$$V = 8450.5$$

Conclusion:

The volume of the football is 8450.5

(d) Given a number series. what number would come in place of question mark (?)

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

Solution:

$$-10 \xrightarrow{+2} -8 \xrightarrow{+14} 6 \xrightarrow{+34} 40 \xrightarrow{+62} 102 \xrightarrow{+98} 201$$

Conclusion:

The missing number is 201.

$$\begin{array}{r} 62 \\ 37 \\ \hline 99 \\ 0 \\ \hline 0102 \\ 99 \\ \hline 201 \end{array}$$

QUESTION : 7

(a) If 20% of $x = y$, what is the value of $y\%$ of 20 in terms of x ?

SOLUTION:

Given Data: 20% of $x = y$

Required: $y\%$ of 20 in terms of x

Solution:

$$20 \frac{1}{100} \times x = y$$

$$0.2x = y$$

Finding $y\%$ of 20 in terms of x .

$$y \frac{1}{100} \times 20 = z \quad \text{--- (1)}$$

Substituting $y = 0.2x$ in eq (1)

$$0.2x \frac{1}{100} \times 20 = z$$

$$z = \frac{0.2x \times 2}{10}$$

$$z = 0.04x$$

Conclusion: Therefore, $y\%$ of 20 in terms of x is $0.04x$

(b) P and Q have an average monthly salary of Rs. 5050. Q and R have an average monthly income of Rs. 6250, while P and R have an average monthly income of Rs. 5200. Find the monthly salary of P.