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SECTION - I

QUESTION #3

(a)

Why cells form organelles? Discuss mitochondria in a human cell?

Cells form organelles to divide its various functions among separate compartments to maintain efficiency and seamlessness of various processes such as energy production, protein synthesis, storage and movements of materials etc.

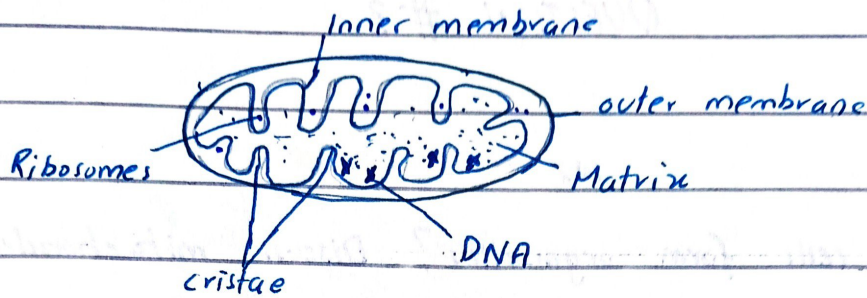
⇒ Mitochondria is the powerhouse of cell.

The number of mitochondria in a cell varies, depending upon the type and nature of the cell.

⇒ Structure of mitochondria:-

Mitochondria consists of a double membrane, an outer membrane and an inner membrane that forms foldings which are finger-like and are known as cristae. The liquid part present inside the mitochondria is called the matrix. Mitochondria have their own DNA and these are self-replicating.

organelles.



DIAGRAM

⇒ Function:-

Mitochondria are responsible for the production of energy through the synthesis of Adenosine Triphosphate (ATP) in the cell.

(b)

What is doping? Discuss different types of semiconductors

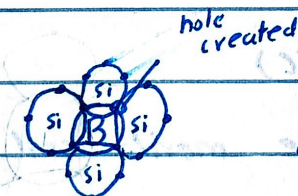
⇒ Doping:-

Doping is the process by which certain impurities are added to semi-conductors in order to amplify and enhance their property of conduction. Depending upon the types of impurities added, there are two major types of semiconductors:- P-type semiconductor and N-type semiconductor

⇒ P-type semi-conductors:-

These are the semi-conductors in which trivalent (giving off 3 electrons) electron

deficient impurities such as boron or iridium in silicon or germanium semi-conductors. The three valence electrons of iridium form covalent bond with the three neighbouring valence electrons of three atoms of silicon. There is some space called hole which is left in the silicon crystal because of the deficiency of electrons. This hole acts as a positive charge and moves from one place to another in the crystal, rendering silicon a better conductor. This type of a semi-conductor is called **P-type semiconductor**



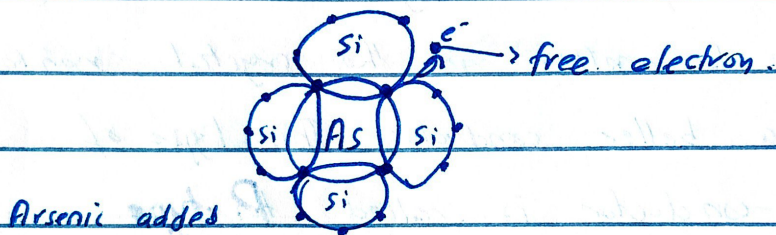
Diagram

Boron added

⇒ N-type semi-conductor

The type of semi-conductor in which pentavalent impurities such as antimony and arsenic are added to silicon and germanium semi-conductors are called N-type semi-conductors. At low temperature, silicon and germanium are insulators because all electrons form covalent bonds with neighbouring electrons, leaving no electron free

for conduction. When arsenic is added, four out of five electrons are joined in a covalent bond w the nearby silicon atoms. The one electron that is not held in any bond can move freely, thus allowing the charge to move and hence, improves the conduction of semi-conductor. Such materials are called n-type semi-conductor.



(c)

State some of the merits and demerits of volcanic eruption.

- Volcanic eruption:-

The sudden release of gases, ash, rock, minerals, and molten lava from the surface of the Earth via a vent of a volcano is known as volcanic eruption. There are several famous events of volcanic eruption in history such as the 1883 eruption of Krakatoa in Indonesia and the 1991

eruption of Mount Pinatubo in Philippines.

There are several merits as well as demerits of volcanic eruptions.

• Demerits:-

(i) Environmental pollution:-

The eruption of a volcano releases extremely harmful gases in the atmosphere such as sulphur, which then leads to air pollution as well as acid rain.

(ii) Loss of life:-

Human losses are another disadvantage of volcanic eruptions since they are extremely catastrophic and can cause deaths of human beings, animals, and several other species. For

~~example~~ example, the Krakatoa eruption killed around 40,000 people in total.

(iii) Loss of infrastructure and habitat:-

Volcanic eruptions release lava that leads to widespread damages, destroying everything in its path from natural to man-made construction.

Vegetation, forests and plants are destroyed that are an important habitat for millions of species.

Buildings, homes and small constructions are also destroyed due to the lava flows.

⇒ Merits:-

(i) Tourism:-

Volcanoes are a fascinating natural phenomenon, despite the havoc they are capable of wreaking. This makes the locations of volcanoes an attraction for tourists and travellers. For example, Mount Fuji in Japan is one of the biggest and popular volcanoes on the planet and attracts thousands of tourists each year.

(ii) Mineral sources:-

The release and cooling of magma gives rise to igneous rocks such as basalt, feldspar, granite etc. that are important sources of minerals such as silica, olivine, mica etc which are used for many purposes.

(iii) Fertile soil:-

i Volcanic ash is rich in minerals and other beneficial ingredients that promote the fertility of soil and improve its quality and properties.

(d)

DENGUE.

Dengue fever is an illness spread by the bite of mosquitoes infected with one of the dengue viruses. It is a viral infection caused by the *Aedes Aegypti* mosquito. It is also known as "Breakbone fever."

• Symptoms:-

- High fever
- Severe headache
- Bodyaches (muscle and joints)
- Nausea
- Pain behind the eyes
- Fatigue
- Shortness of breath.

• Causative agents:-

⇒ Dengue is caused due to the bite of *Aedes Aegypti* mosquito.

⇒ Dengue virus (DENV) is the causative agent of dengue fever and has four different types: DENV-1, DENV-2, DENV-3, DENV-4

⇒ Poor hygiene conditions eg stagnant water in ponds, houses, flowerpots etc can lead to multiplication of the mosquito, increasing risks of dengue.

(5)

There is no specific medicine that can cure dengue infection. However, commonly the cases of dengue are mild and can be treated at home.

- For pain relief, pain killers such as acetaminophen can be taken.
- Rest is recommended as the body needs time to heal and recover.
- Hydration and drinking plenty of fluids is always a good way to improve health during and after dengue.
- Medicines such as aspirin or ibuprofen must be avoided as they exacerbate the risk of bleeding.
- Medical attention must be sought in adverse cases such as severe abdominal pain, bleeding from gums or difficulty in breathing.

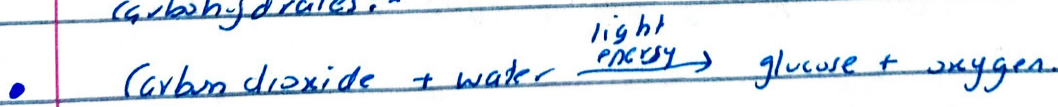
QUESTION # 4

(a)

Write a note on plant kingdom
'Chlorophyll'

Chlorophyll is the green pigment that is essential for photosynthesis, thus being one of the most important components of a plant cell. Chlorophylls, as the name suggests, impart green color to the leaves and plants since it reflects green light and absorbs red and blue light wavelengths. Chlorophylls are present in chloroplasts and are attached to the grana. Chlorophyll is similar to haemoglobin in ~~structure~~ except it contains a magnesium (Mg) ion instead of an iron (Fe) ion.

Chlorophyll captures light energy which is then converted to chemical energy (food) by turning carbon dioxide and water into carbohydrates:-



The most common type of chlorophyll found in higher plants and green algae are chlorophyll a and chlorophyll b.

(b)

Rule of ribosomes in protein synthesis

Ribosomes play a significant role in protein synthesis by promoting the translation of messenger RNA (mRNA) into a polypeptide chain. Ribosomes are composed of ribosomal RNA and proteins and can be found either floating freely in the cytoplasm or are attached to the rough endoplasmic reticulum. During translation, ribosomes read the sequence of codons on the mRNA and match each codon to the appropriate transfer RNA (tRNA) carrying a specific amino acid. The ribosome catalyzes the formation of peptide bonds between amino acids, linking them together to form a growing polypeptide chain. This process continues until a stop codon is reached, completing the synthesis of the protein.

(c)

Methods of solid waste management

There are several methods of solid waste management such as :-

(i) Open Dumping:-

Open dumping involves the disposal of solid domestic waste commonly in an open area without any treatment or separation of materials such as glass, plastic, scraps, papers, peels etc. However, this is harmful as the lack of treatment can cause environmental degradation and diseases as well as aesthetic displeasure.

(ii) Landfills :-

The development of landfills which are designated areas for dumping waste and garbage, in a systematic manner is one of the most effective methods of solid waste management. This method requires active organization by a government authority and engineers. Such a waste management site involves formation of soil layers atleast 3 feet deep under the waste, and a subsequent compressing of the waste and covering up

with more soil. This is effective as it reduces the risk of pollution and damage to the animals, environment and groundwater.

(iii) Incineration:-

Waste treatment process in which solid waste is burned at high temperatures, varying at $400-1000^{\circ}$ Celsius. The advantages of this method are:-

- Reduces the bulk volume
- Combustible items like plastic and wood burn to produce high temperature
- Small volumes are easy to dump off
- The heat of combustion can be used to run turbine to produce electricity.

(d)

(i) Biofuel:-

Biofuel is a type of fuel obtained from living matter such as plants or animal waste (biomass). It is considered a renewable source of energy. Common types are ethanol, (from sugarcane) or biodiesel (from vegetable oil or animal fats)

(ii) Adulteration:-

Adulteration refers to the mixing of additives, impurities and harmful substances to food, drinks

or other products to increase quantity and lower production cost, which is harmful to the quality of the product. An example of adulteration is the mixing of milk and water.

(iii) Hydrosphere :-

The hydrosphere includes the total amount of water on Earth, including oceans, lakes, rivers, rainfall, snow, glaciers, groundwater and even the water vapours. It is characterised by the water cycle. 97% of the Earth's ~~environment~~ is comprised of hydrosphere.

(iv) Troposphere:-

The lowest layer of atmosphere where all life exists is known as the troposphere. The troposphere extends from 6 to 20 km or 4-12 miles above the surface of the Earth. This is also the region where airplanes fly. Temperature generally decreases as the height increases.

(v) Isotopes:-

Atoms of the same element with the same number of protons but different number of neutrons are called isotopes. Isotopes are

SECTION #2

QUESTION #6

(Part b)

Total price of the camera = 200\$

discount = 25%

Calculating 25% on 200

$$\frac{25(200)}{100} = 25 \times 2 = \boxed{\$50}$$

Subtracting discounted amount from original,

Sale = Total price - discount

$$= \$200 - \$50$$

$$= \$150$$

Calculating 6% tax on \$150

$$\frac{6(150)}{100} = \frac{900}{100} = \boxed{9\$}$$

Sale price (final) = discounted price + tax

$$= \$150 + 9$$

$$= \boxed{\$159}$$

Hence total amount paid is \$159 dollars.

(Part c)

Distance covered = $d = 36 \text{ km}$

Speed = $v = 18 \text{ km/h}$

Journey started at = 1 pm

Time taken = ?

21

Applying formula

$$v = \frac{d}{t}$$

adjusting $\frac{V}{d} = \frac{1}{L}$

$$t = \frac{d}{v}$$

Putting values

$$t = \frac{362}{181}$$

$t = 2$ hours.

The journey was started at 1 pm and took 2 hours. Hence, the bicycle reached the destination at 3 pm.

(Part d)

UNSCRAMBLE

(i) STATICITY

STATISTICS

(ii) LGEBMAR

ALGEBRA

QUESTION # 7

(Part 1)

Number series

(i) - 2, 6, 18, 54, 162, 486

The provided sequence is a numerical progression in which each term is formed by multiplying the previous term by 3. For example,

$$2 \times 3 = 6$$

$$6 \times 3 = 18$$

$$18 \times 3 = 54$$

$$54 \times 3 = 162$$

$$162 \times 3 = 486$$

Hence, none of the numbers fit the description of not fitting.

(ii) $3, 5, 7, 11, 13, \dots$

Since 3, 5, 7, 11, 13 are all prime numbers, the most fitting and obvious answer is the next prime number which is 17. Hence, the new series is

3, 5, 7, 11, 13, 17

