

QUESTION : 03

(a)

Reason:-

Cells form organelles to achieve compartmentalization i.e. the separation of different biochemical processes into specialized, membrane bound structure. This organization provides several advantages.

Benefits of Compartmentalization:-

The benefits of compartmentalization are given below:

① Optimal Condition:

Each organelle can maintain optimal conditions like pH and ion concentration for its specific function

② Protection:

Isolating potentially harmful processes like oxidation and digestion prevents cellular damage

③ Smooth working:

Different processes can occur at the same time without interference.

④ Regulation:

Cellular processes can be controlled more precisely through organelle-specific mechanisms.

Mitochondria :-

Mitochondria have a unique double-membrane system. Outer membrane is smooth, permeable to small molecules. Inner membrane is highly folded into cristae (increases surface area), contains electron transport chain proteins. Intermembrane space is the space between two membranes, site of proton accumulation. Matrix is inner compartment containing enzymes, mitochondrial DNA and ribosomes.

Functions:-

One of the primary function of mitochondria is ATP production. This ATP production occurs in 3 steps

- (i) Krebs cycle
- (ii) Electron transport
- (iii) Oxidative phosphorylation. chain

Other important functions are given below

- ① Calcium ion storage and regulation.
- ② Apoptosis regulation
- ③ Certain steps of heme synthesis.

(b)

Doping :-

Doping is the intentional introduction of impurity atoms into an intrinsic (pure) semiconductor to modify its electrical properties. This process increases the conductivity of semiconductors by adding charge carriers.

Purpose of Doping :-

- ① Increase electrical conductivity.
- ② Allow creation of p-n junctions essential for electronic devices
- ③ Enable fabrication of transistors, diodes, solar cells and integrated circuits.

Types of Semiconductors :-

1. Intrinsic Semiconductors.

The intrinsic semiconductors are made up of pure semiconductor material

Example: Pure Silicon (Si), Ge.

- ① Equal number of electrons and holes $n_i = p_i$
- ② Conductivity is relatively low but increases with temperature.

- ⇒ At absolute zero; act as insulator
- ⇒ At room temperature → thermal energy creates electron-hole pairs.

2- Extrinsic Semiconductors:

Semi conductors modified by doping. Divided into two types

- (i) N-type
- (ii) P-Type.

N-type Semiconductors:-

Common dopants are P, As and Sb.

Dopant atom has 5 valence electrons 4 electrons form covalent bond with Si/Ge and 1 extra electron becomes free (donated to conduction band).

P-Type Semi conductors:-

Common dopants are B, Al, Ga and In.

Dopant atom has 3 valence electrons and cannot complete all covalent bonds with Ge/Si. Also creates hole that can accept an electron.

P-N Junction:- When n-type and p-type semi-conductors are joined following devices are formed

- ⊙ Diodes
- ⊙ LEDs
- ⊙ Solar cells
- ⊙ Circuits.

(C)

Volcanic eruptions, while often devastating play a crucial role in Earth's geological and ecological systems.

① Positive Impacts:

Soil Fertility: Volcanic ash contains essential minerals like Ca, Mg, P and K.

Examples: Italian vineyards.

Land Formation: Creates new landmasses and islands like Hawaiian Islands, Iceland. Forms unique landscapes that become tourist destination.

Energy Resource: Provides renewable energy source. Countries like Iceland generate ~25% of electricity from geothermal, Hot springs for heating and therapeutic purposes.

Economic Benefits:

Attracts millions of visitors (Santorini) and provides mining opportunities for extraction of volcanic minerals.

Negative Impacts:-

① Loss of life and Property:-

Direct deaths from pyroclastic flows, lava, toxic gasses.

② Environmental Destruction:

Complete ecosystem destruction in eruption zones. Water contamination from ash and chemicals. Acid rain from sulphur dioxide emission.

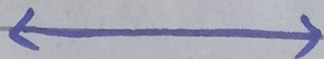
③ Economic Losses:

Loss from agricultural damage (crop destruction).

Infrastructure damage and aviation disruption. Cost of rebuilding and evacuation affects economy badly.

④ Health hazard :

Health hazards like respiratory problems from ash inhalation. Mental health impacts from displacement and trauma.



(d)

Dengue:-

Dengue is a mosquito-borne viral disease that occurs in

tropical and subtropical regions. Worldwide, often called break bone fever due to severe joint and muscle pain it causes, dengue has become one of the most rapidly spreading mosquito borne diseases globally.

Pathogen :-

Dengue Virus is single stranded RNA virus. ~~It~~ Virus is of four different serotypes.

Transmission Cycle:

Infected Human



Mosquito bites



Virus incubate



Infected mosquito

Infected mosquito → bites healthy human
↓
New Infection

Symptoms:-

Incubation period is 4-10 days after infected mosquito bite. There are three phases

→ Day 1 - 3:

Common symptoms include

- ① High fever
- ① Skin rash
- ① Muscle and joint pain
- ① facial flushing
- ① Severe Headache

→ Day 4-7 :-

Some patients improve while some progress to severe signs:

- ① Rapid breathing
- ① Bleeding gum or nose
- ① Pale, cold skin
- ① Abdominal pain

Some cases worsen and those have symptoms like

- ① Severe bleeding
- ① Plasma leakage,
- ① Organ impairment

→ After Day 7 :-

- ① Return of appetite
- ① Stabilization of vital signs

Remedies:-

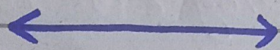
No specific antiviral medicine/treatment exists.

→ For mild dengue: doctors recommend pain killers and fever management and some prescriptions like:

○ Hydration (ORS) ○ Rest

→ For severe dengue: For severe dengue patient needs to be admitted to hospital where doctors will carefully monitor fluid (management).

If needed platelet transfusion



QUESTION : 07

(a)

Diameter = 14cm

Volume = ?

$$r = \frac{D}{2} = \frac{14}{2}$$

$$[r = 7\text{cm}]$$

$$\text{Volume of sphere} = \frac{4}{3} \pi r^3$$

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

$$= \frac{4}{3} \times \frac{22}{7} \times 343$$

$$[V = 1437.33\text{cm}^3]$$

(b)

Smallest share = ?

Total savings = Rs. 25000

Ratio = 1 : 2 : 3 : 4 : 5

Let share be $1x, 2x, 3x, 4x, 5x$

$$\begin{aligned}\text{Total share} &= 1x + 2x + 3x + 4x \\ &\quad + 5x \\ &= 15x\end{aligned}$$

$$15x = 25,000$$

$$x = \frac{25,000}{15}$$

$$\boxed{x = 1666.6}$$

Smallest share Rs. $1666.6 = 1x$

Second

$$2x = 2 \times 1666.6 = \text{Rs. } 3333.3$$

Third

$$3x = 3 \times 1666.6 = \text{Rs. } 5000$$

Fourth

$$4x = 6666.67 \text{ Rs}$$

Fifth

$$5x = 8333.33 \text{ Rs.}$$

(c)

(i)

$$\begin{array}{ccccccccc} 2 & , & 6 & , & 18 & , & 54 & , & 162 & , & 486 \\ \underbrace{\quad} & \underbrace{\quad} & \underbrace{\quad} & \underbrace{\quad} & \underbrace{\quad} & & & & & & \\ 3 \times & 3 \times & 3 \times & 3 \times & 3 \times & & & & & & \end{array}$$

All numbers fit

(ii) 3, 5, 7, 11, 13, —

These are all prime number
so next sequence will also
be a prime number.

[3, 5, 7, 11, 13, 17]

(d)

If its a right triangle

$$5^2 + 12^2 = 25 + 144$$

$$= 169$$

$$13^2 = 169$$

$$5^2 + 12^2 = 13^2 \quad (\text{It is right angle triangle})$$

Angles:-

It is right angle triangle

So

$$a = 5\text{cm}$$

$$b = 12\text{cm}$$

$$c = 13\text{cm} \quad (\text{hypotenuse})$$

The angle opposite to hypotenuse
is 90°

QUESTION : 06.

(a)

Ration of apple : berry : cherry : Date
= 3 : 6 : 2 : 5

Apple candies exceed date by 35.

Let common factor be x .

$$\text{Apple} = 3x$$

$$\text{Berry} = 6x$$

$$\text{Cherry} = 2x$$

$$\text{Date} = 5x$$

$$\text{Apple} - \text{Date} = 35$$

$$3x - 5x = 35$$

$$-2x = 35$$

$$-x = 35$$

~~7~~

$$\boxed{x = -17.5}$$

$$\begin{aligned}\text{Berry } 6x &= 6 \times 17.5 \\ &= 105\end{aligned}$$

(b)

Original Price = \$ 200

Discount = 25 %

Tax = 6 %

$$25 \% \text{ discount} = 200 \times 25 \%$$

$$= 200 \times \frac{25}{100}$$

$$= \$ 50$$

$$\begin{aligned}\text{Price after discount} &= 200 - 50 \\ &= \$ 150\end{aligned}$$

$$6\% \text{ tax} = 150 \times 6\%$$

$$= 150 \times \frac{6}{100}$$

$$= \$ 9$$

$$\text{Final price} = 150 + 9$$

$$= \$ 159.$$

(c)

$$\text{Distance} = 36 \text{ km}, \text{ Speed} = 18 \text{ km/hr}$$

$$\text{Start time} = 1:00 \text{ pm}$$

$$\text{Time} = \frac{D}{S}$$

$$= \frac{36}{18}$$

$$= 2 \text{ hours}$$

$$\text{Start time} = 1:00 \text{ pm}$$

$$= 1 + 2 \text{ hrs}$$

$$= 3:00 \text{ pm}$$