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LMSID 40053

General Science and ability

Section-I

— Q2 —
— (a) —

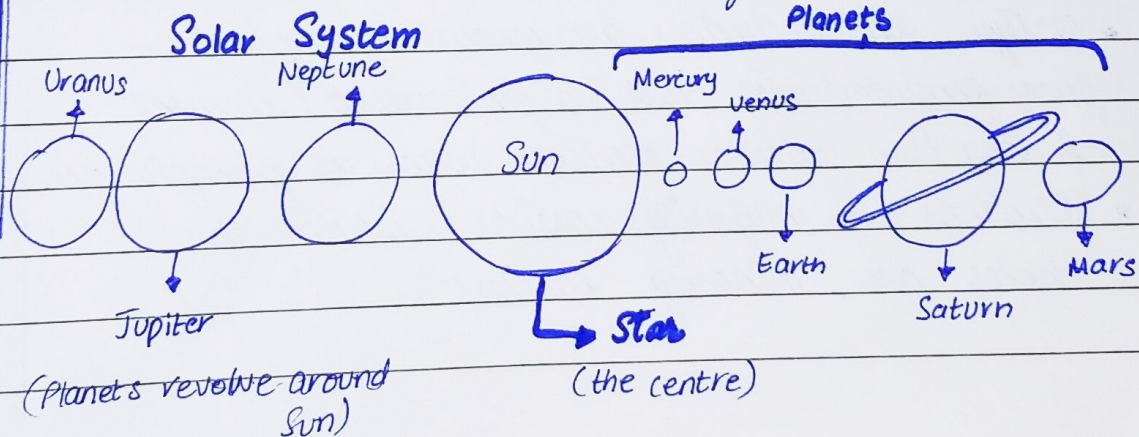
Differentiate between a star and a planet.
Briefly describe the life cycle of a star from Nebula to a black hole.

Star

1. Star is a huge shining sphere of hot gases
2. A star produces light by nuclear fusion
3. Stars revolve at the centre of their galaxy
4. Stars have extremely high temperatures of 5000 to 6000°C
5. Example: Sun, Proxima centauri

Planet

1. Planet is a round sphere which orbits the star.
2. A planet do not produce any light
3. Planets revolve around star
4. Planets derive energy and heat from stars
5. Example: Earth, Jupiter, Mars, Saturn



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Lifecycle of a Star

1. Stellar Nebula →
2. Red Supergiant (similar to red giant, much larger and hotter.) →
3. Supernova (core collapses, massive explosion)

neutron star

Black hole

massive core, gravity overwhelms all forces.

— (Qb) —

What are semiconductors? Explain n-type and p-type semiconductors and list two of their modern applications

A semiconductor is a material with electrical conductivity between a conductor and an insulator, and its ability to conduct current can be improved by adding impurities.

Example: Silicon is the common semiconductor

N-Type Semiconductors

- N-type semiconductors are created by doping a pure semiconductor with a pentavalent (element having five valence electrons) such as phosphorus.
- Electrons are majority carriers while the holes are minority carriers

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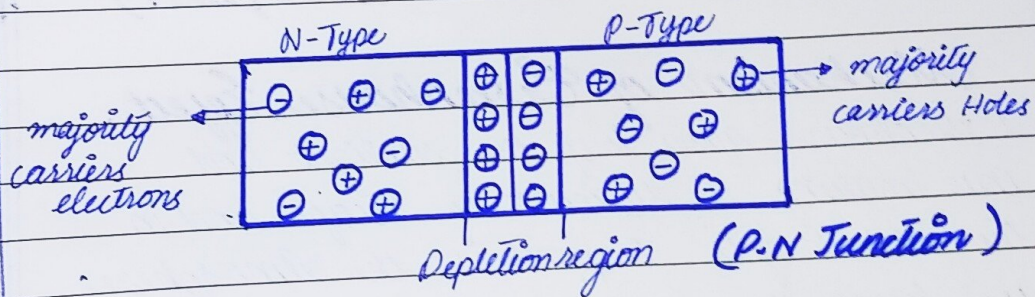
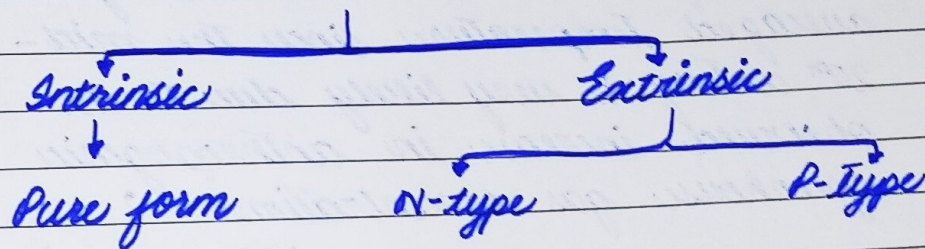
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P-Type semiconductors

- P-Type semiconductors are created by doping a pure semiconductor with a trivalent impurity (element having three valence electrons) such as Boron.
- Holes are the majority carriers while electrons are minority carriers.

Semiconductors



Modern Implications

1. Healthcare: modern medical equipments like MRI, scanners.
2. Computing and communication: used in phones, microchips, integrated circuits.
3. Automobiles: used in electrical vehicles (EVs).

— (Qc) —

Define Global Warming. Explain the mechanism of Greenhouse effect and list three major greenhouse gases

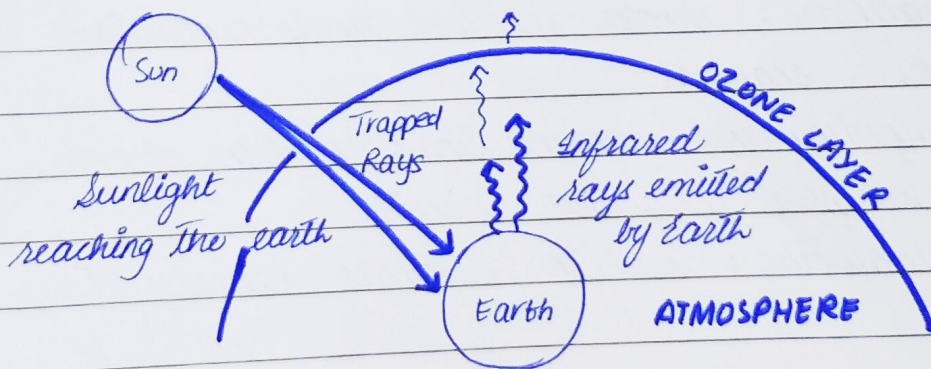
Global Warming is the long-term increase in Earth's temperature primarily caused by human activities like burning fossil fuels, greenhouse gases.

'Most of the observed increase in globally averaged temperature since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations',

(IPCC, 2007)

Mechanism of Greenhouse Effect.

Greenhouse gases trap the sunlight and thus making it difficult to escape and in the end it gets trapped in the atmosphere and keeps the earth warm



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Solar radiation in



Surface warming and Re-emission



Infrared Absorption



Heat Trapped (doesn't escape)



Unusual rise in Temperature

Some greenhouse gases are:

1. Carbon dioxide (CO_2)
2. Methane (CH_4)
3. Hydrofluorocarbons (HFCs)
4. Perfluorocarbons (PFCs)
5. Water vapours (H_2O)

— Qd —

What is Tsunami? Explain the natural processes that trigger the Tsunami and the potential impact on coastal areas.

A Tsunami is a series of waves caused by a rapid displacement of a body of water (ocean, lake). Almost 80% of tsunamis occur within the Pacific Ocean's 'Ring of fire'.

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Natural Processes Triggering Tsunami

- Earthquake (undersea)
- undersea landslide
- Eruption of an undersea volcano
- Force of an asteroid crashing into the ocean.

Potential Impact of Tsunamis on Coastal areas

- Causes shipwrecks
- great loss of life (more number of casualties)
- Animals can be washed up to the shore and die.
- It can flood the land near the shore
- Infrastructure destruction
- Threat to livestock in coastal areas

— Q₃ —
— (a) —

What are Enzymes? Explain the 'lock and key' model of enzyme action and list two main factors that affect enzyme activity

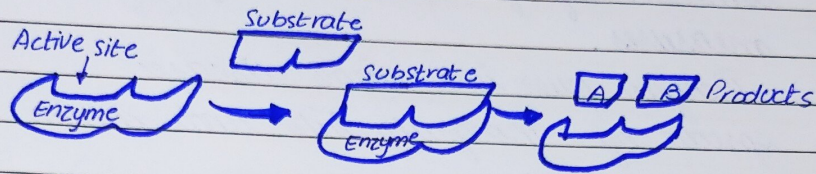
Enzyme is an organic substance that act as a catalyst to regulate or boost up the chemical reactions in living organisms

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Enzymes have a part where only certain kind of substrate can bind it, this site of activity is called 'active site'. The molecule which react and bind to the enzyme is called as 'substrate'.



• Lock and key model

Lock and key model proposed by John Lock who stated that enzymes are site specific; They work like a key and lock and it is famous a 'Lock and key model'. It means enzymes would only attach to a specific site of the substrate.

Factors affecting the Enzyme Activity

Enzymes are highly sensitive to

1. Temperature
2. PH

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— Qd —

What is dengue fever? Describe the vector responsible for its transmission common symptoms and key preventive measures.

Dengue fever is a viral disease spread by mosquito bite and causes severe fever.

Vector responsible for Transmission of dengue fever.

Mosquito *Aedes aegypti* is the common vector for its transmission.

Symptoms of Dengue Fever

- temperature above 100°C .
- headache
- chills
- nausea
- fatigue
- muscle cramps.

after 7-8 days symptoms are severe if not treated well.

- drop in temperature ($<98^{\circ}\text{C}$)
- blood vomiting
- Nausea

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Preventive measures

- Proper hygiene care and sanitation
- Lowering large water storage areas at homes.
- spraying anti-dengue sprays on weekly basis
- Wearing full sleeves and fully cover bodies
- using net around beds and net curtains
- Dengvaxia (vaccination)

— Qa —

Describe the structure and function of Mitochondria and Ribosomes. Why is mitochondria often called power house of a cell?

Mitochondria

Ribosome

Structure

Mitochondria may be vesicle rod or filament shaped. It is bounded by two membranes. Inner membranes has foldings (cristae)

Ribosomes are granular structures present in cytoplasm. Two subunits (large and small) each composed of ribosomal RNA and proteins

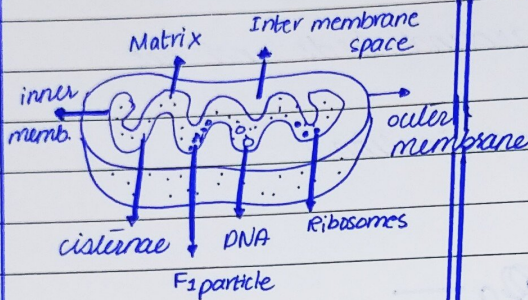
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Mitochondria

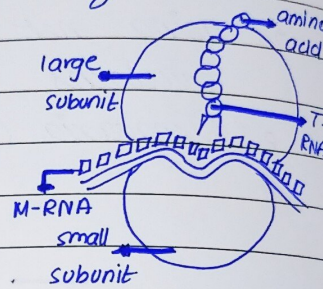
Function

- Energy production: generate energy through cellular respiration, producing ATP.
- Power house of the cell: converts nutrients into energy



Ribosomes

Ribosomes translate messenger RNA into specific sequences of amino acids, building proteins essential for cellular functions.



— Qc —

Differentiate between Renewable Energy Resources

- They are sustainable, can be replenished naturally
- Environment friendly
- Abundant resources
- reduced GHGs.
- Examples:
Solar energy, wind energy, Thermal and hydro energy

Non-Renewable Energy Resource

- They are finite, will eventually run out.
- Contribute to climate change
- air and water pollution
- limited reserves
- Examples:
fossil fuels, nuclear energy.

Potential of wind energy as a sustainable source for future

Wind energy has a significant potential as a sustainable source for future.

- **Renewable and clean:**

It is renewable, can be generated, and environment friendly which is the hallmark to reduce pollution and green house gases in 21st century.

- **Abundant resource:**

Wind is a natural resource and it is abundant everywhere. It has no cost as it is natural.

- **Energy independence:**

Wind can reduce energy reliance of fuels and nuclear and enhance energy security.

- **Economic lift:**

It stimulates local job opportunities thus boosting the economy.

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Section-II

— Q 8 —

(a)

In a certain code language, if ROAD is coded as UQOG, how would LAKE be coded in same language

In a certain language,
ROAD is coded as UQOG which is as:

R	U	3 step forward		L	O	+3 step
O	Q	2 step forward		A	G	+2 step
A	D	3 step forward		K	N	+3 step
D	G	3 step forward		E	H	+3 step

Thus, the code for LAKE is OCNH

— (b) —

A man tells a woman, "The son of my sister's husband is the father of your son." How is the woman related to the man.

The man pointing towards the son of his sister's husband who is the father of the woman's son, in this the man is woman is the daughter-in-law of the man.

— (c) —

Find the next number and explain the pattern

(i) 4, 12, 6, 18, 9, 27, 13

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The given numbers are multiplying by 3. 4×3 , 6×3 , 9×3 and the adjacent numbers are the result of the product 12, 18, 12. The numbers 4, 6 having a gap of one number. 6-9 gap of two numbers so 9-13 is the actual gap in series:
 4^{+1} 6^{+2} 9^{+3} 13 so, the number is **13**.

(ii) 1, 2, 6, 24, 120, ~~720~~ 720

each ^{second} ~~first~~ number is the numerically sequenced product of the previous number.

$1 \times 2 = 2$, $2 \times 3 = 6$, $6 \times 4 = 24$, $24 \times 5 = 120$, $120 \times 6 = 720$

so, the missing number is **720**

(Q.1)

Five friends (P, Q, R, S, T) have different heights

P is shorter than Q but taller than R.

S is shorter than T but taller than Q.

T $\rightarrow$ 180cm (Tallest)

S

Q $\rightarrow$ Third tallest.

P

R $\rightarrow$ 150cm (shortest)

T is the tallest (180cm), R is the shortest (150cm) while Q is the third tallest amongst. The possible range is 30 cm.