Part-II

Section: I

Q:2a) What is dengue? .....

Ans

Dengue is a viral infection transmitted primarily by Aedes mosquitoes, particularly Aedes aegypti and Aedes albopictus. It is endemic in tropical and subtropical regions around the world.

Causative Agents:

It is caused by Dengue Virus (DENV), which has four distinct serotypes: DENV-1, DENV-2, DENV-3, and DENV-4. Infection of one serotype provides immunity to that specific serotype but not to the others, which increase the risk of severe disease upon subsequent infections.

Symptoms:

The symptoms typically appear 4 to 10 days after being bitten by an infected mosquito and can include:

* high fever
* Severe headache
* Pain behind the eyes
* Joint and muscle pain.
* Nausea and vomiting
* Fatigue
* skin rash.

In some cases, dengue can progress to severe dengue (formerly known as dengue hemorrhagic fever), characterized by bleeding, organ impairment, and potentially death. Early detection and proper medication are crucial for reducing complications

b. Explain dark matter & dark energy.

Dark matter and dark energy are key concepts in astrophysics, both are crucial for understanding the universe.

Dark matter:

Def:
An invisible form of matter that does not emit light, detected through gravitational effects.

Evidence:
Observed in galaxy rotation curves, gravitational lensing, and cosmic microwave background radiation.

Composition:
Likely made of non-baryonic particles like WIMPs or axions.

Dark Energy:

Def:
A mysterious energy causing the accelerated expansion of the universe.

Evidence:
Discovered through observations of distant supernovae showing that expansion is speeding up.

Composition:
Accounts for about 68% of the universe, potentially a cosmological constant or dynamic field.

Together, they shape our understanding of cosmic structure and the universe's fate.

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

Ans:
Structure of Mitochondria:
They are double-membrane organelles found in most eukaryotic cells. Their structure consists of:

1. Outer membrane: Smooth and permeable to small molecules and ions, containing proteins called porins.

2. Inner membranes: highly folded into structures called cristae, which

increase surface area. It is less permeable and contains proteins involved in the electron transport chain and ATP synthesis.

3. **Intermembrane Space:** The space between the inner and outer membranes.

4. **Matrix:** The innermost compartment, containing enzymes for the Krebs cycle, mitochondrial DNA, ribosomes, and other molecules.

Function of Mitochondria

Mitochondria are often referred to as the "powerhouse of the cell" due to their primary function in energy production through:

• **Cellular respiration:** Mitochondria convert biochemical energy from nutrients into adenosine triphosphate (ATP), the energy currency of the cell. This process occurs in several stages:

1. **Glycolysis** (in the cytoplasm) converts glucose into pyruvate.

2. **Krebs Cycle** (in the matrix) processes pyruvate to produce NADH and FADH₂.

3. **Electron Transport chain** (in the inner membrane) uses NADH and $FADH_2$ to generate ATP through oxidative phosphorylation, involving the production of a proton gradient across the inner membrane.

Outer membrane — / Inner membrane / Cristae / Matrix / Outer Compartment
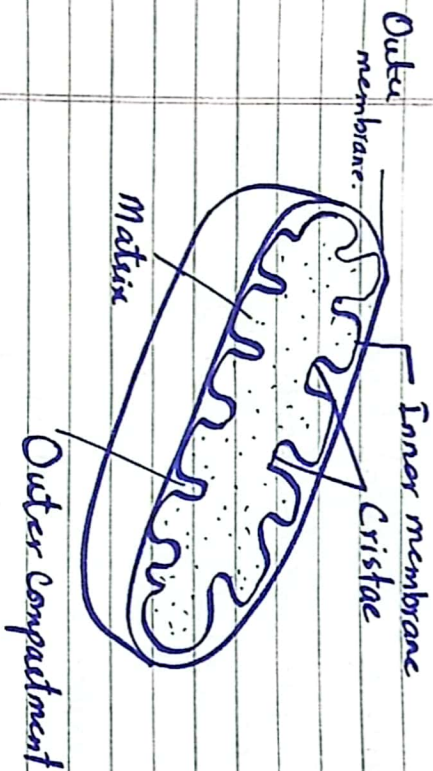
Why mitochondria are powerhouse:

They are considered the powerhouse because:

• They produce the majority of a cell's ATP through aerobic respiration.

• The energy generated fuels various cellular activities, including muscle contraction, nerve impulse propagation, and biosynthesis of macromolecules.

• They play a crucial role in regulating metabolism and signaling of cell.

D. What are covalent bond —?

Ans: **Covalent bonds**

They are chemical bonds formed when two atoms share one or more pairs of electrons. This sharing allows

each atom to achieve a more stable electron configuration, often resembling that of noble gases. Covalent bonds typically occur between non-metal atoms.

Types of covalent bonds:

★ **Single covalent bonds:**

Def: In a single covalent bond, one pair of electrons is shared between two atoms.

Example: The bond in a hydrogen molecule (H_2), where two hydrogen atoms share one pair of electrons.

$$H-H$$

★ **Double covalent bonds:**

Def: In a double covalent bond, two pairs of electrons are shared between two atoms.
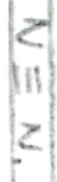
Example: The bond in an oxygen molecule (O_2), where two oxygen atoms share two pairs of electrons.

$$O=O$$

★ **Triple covalent Bonds:**

Def: In a triple covalent bond, three pairs of electrons are shared between two atoms.

Example: The bond in a nitrogen molecule (N_2), where two Nitrogen atoms share three pairs of electrons.

$$N\equiv N$$

Q4
a) **Structure of human brain**

The human brain consists of three main regions:

1. **Cerebrum**
Structure: largest part, with two hemispheres and four lobes (frontal, parietal, temporal, occipital).
Function: Responsible for cognitive functions like reasoning, sensory processing, and voluntary movements.

2. **Cerebellum**
Structure: located at the back, with highly folded surface.
Function: Coordinates balance, posture and fine motor skills.
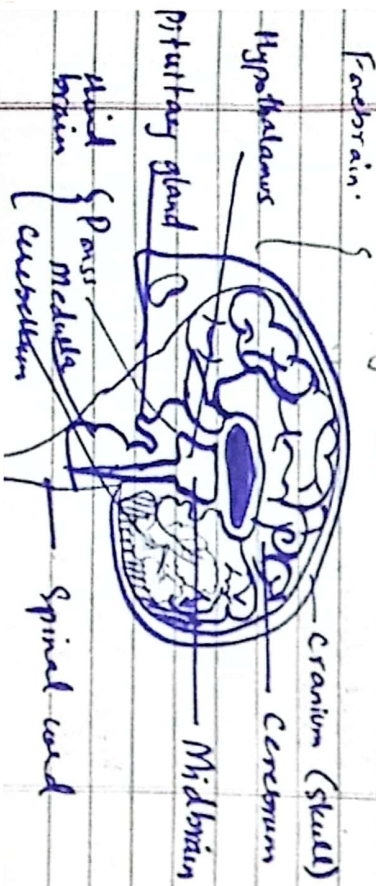
3. **Brainstem**
Structure: comprises the midbrain,

pons and medulla oblongata.

Function: Controls vital functions like heart rate and breathing, regulate sleep.

Why is Brain the control centre;
The brain is the control center because it:

1. Integrates Information: Processes sensory input for decision-making

2. Coordinates Activities: Manages voluntary and involuntary actions.

3. Regulates homeostasis: Maintains internal balance through automatic function.

4. Facilitates higher functions: Involved in thinking, learning, and emotions.

5. Enables communication: Connects different body parts via the nervous system.

In summary, the brain's complex structure and functions allow it to orchestrate essential bodily processes and cognitive activities.

Forebrain:

Hypothalamus
Pituitary gland { Ant, Post
Hind brain { Pons, Medulla, Cerebellum

cranium (Skull)
Cerebrum
Midbrain
Spinal cord

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b- DRM:

Ans: Disaster risk management (DRM) refers to the systematic approach to identifying, Assessing and reducing the risks of disasters. It encompasses all phases of the disaster management cycle, including;

1. Prevention: Strategies to avoid or mitigate risks

2. Preparedness: Planning and training for effective response.

3. Response: Immediate actions taken during and after a disaster.

4. Recovery: Process to restore and improve affected areas.

DRM integrates various sectors and disciplines to enhance resilience and reduce vulnerabilities to natural and man-made disasters.

Situation of DRM in Pakistan:

In Pakistan, DRM is crucial due to the country's vulnerability to various natural disasters, including floods, earthquakes, and droughts. Here are some key aspects of the situation:

1. Vulnerability: Pakistan is highly susceptible to disasters due to its geographical location, climate

variability and socio economic factors.

2. **Policy framework:** The Govt has developed policies like the National Disaster Management Act of 2010, which established the National Disaster Management Authority (NDMA). This authority is responsible for formulating and implementing disaster risk management strategies.

3. **Challenges**
- **Coordination:** There is often a lack of effective coordination among various Government departments and agencies.
- **Resources:** Limited funding and resources hinder comprehensive DRM efforts.
- **Awareness:** Public awareness and education about disaster preparedness remain inefficient.

4. **Recent initiatives:** The Government and various NGOs are working to improve DRM through community engagement, training programmes, and the establishment of early warning systems.

5. **International collaboration:** Pakistan collaborates with international organizations and countries to enhance its DRM capacity, especially in response to major disasters.

Conclusion: While Pakistan has made strides in establishing a framework for DRM, challenges persist that require ongoing efforts to build resilience and effectively manage disaster risks. Enhanced coordination, resource allocation, and public awareness are essential for improving the country's disaster preparedness and response capabilities.

Section: II

Q5:
a) As we know,

$$\text{Mean} = \frac{\text{Sum of All values}}{\text{No. of values}}$$

So,

$$= \frac{9+8+10+k+12}{2}$$

$$= 39 \text{ Tk.}$$

The no. of values is 5. Therefore, The arithmetic mean will be;

$$\frac{3a+b}{5} = 15$$

To solve b, Multiply both sides by 5.

$$3a+b = 75$$

Now subtract "3a" from both sides.

$$b = 75-39$$
$$b = 36.$$

Thus, the value of b is 36.

b. Let the initial quantity of sugar solution be the litres, and the quantity of water be 3x. Proportion of water be 3x litres, based on the initial value of x=3.

We have:
$$\frac{4x}{3x+10} = \frac{4}{5}$$

By cross multiplication:
$$4 \times (3x+10) = 5 \times 4x$$

Expanding both sides:
$$12x + 40 = 20x$$

By rearranging:
$$40 = 20x - 12x$$

$$40 = 8x$$
$$\frac{40}{8} = 8x$$

Now, we can find the initial quantity of sugar solution in the mixture will be 20 litres.

c. To find volume of a football which is approximated as a sphere, we can use the formula for a sphere:

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

$$R = 12\ cm.$$

Let's substitute the values into formula.

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

Calculating 12^3:

$$12^3 = 1728.$$

Now substituting this back into the volume formula:

$$V = \frac{4}{3} p (1728)$$

Calculating $\frac{4}{3} \times 1728$:

$$\frac{4 \times 1728}{3} = \frac{6912}{3} = 2304$$

As we know,
$$V = 2304 BC$$

Using $P \approx 3.14$ for numerical approximation.
$$V \approx 2304 \times 3.14 \approx 7238.56 cm^3$$

Therefore, the volume of the football is approximately $7238.56 cm^3$.

d.

1. Calculate the differences:

- $-8 - (-10) = 2$
- $6 - (-8) = 14$
- $40 - 6 = 34$
- $102 - 40 = 62$

2. Calculate the difference between consecutive terms are:

$2, 14, 34, 62.$

So, the difference between consecutive terms are:

- $14 - 2 = 12$
- $34 - 14 = 20$
- $62 - 34 = 28.$

So, the 2nd differences are
$12, 20, 28.$

3. Calculate the 3rd differences:

- $20 - 12 = 8.$
- $28 - 20 = 8.$

The 3rd difference is constant at 8.

4. Predict the next 2nd difference:

$$28 + 8 = 36.$$

5. Calculate the next 1st difference:

$$62 + 36 = 98.$$

6. Calculate the next term:

$$102 + 98 = 200$$

So, the no. in place of $? = 200.$

Calculate the differences of differences
(2nd differences)

Q7
a)

Given that 20% of $x = and$ in.

and $= 0.2x$

Now we need to find and $\%$ of
$20 :$

$$y\% \text{ of } 20 = \text{and } \times 20$$
$$= \frac{20}{100}$$

Substituting and $= 0.2x$ into

The equation :

$$\frac{0.2x \times 20}{100}$$

This simplifies to :

$$\frac{0.2 \times 20}{100} x = \frac{4}{100} x = 0.04x$$

Thus, the value of find $\frac{1}{4}$the 20in

you x is: 0.04x.

b. Let the monthly salaries of P, Q, and R be represented as P, Q, R respectively.

From the given information :

1. The average monthly salary of P and Q is Rs. 5050.

$$\frac{P+Q}{2} = 5050 \Rightarrow P+Q = 10100 - Eq.(1)$$

2. The average monthly income of Q and R is Rs. 6250.

$$\frac{Q+R}{2} = 6250 \Rightarrow Q+R = 12500 - Eq.(2)$$

3. The average monthly income of P and R is Rs. 5200.

$$\frac{P+R}{2} = 5200 \Rightarrow P+R = 10400 - Eq.(3)$$

Now all the equations will be :

- $P+Q = 10100$ — Eq. (1)
- $Q+R = 12500$ — Eq. (2)
- $P+R = 10400$ — Eq. (3)

Step 1: Add all the three equations :

$$(P+Q) + (Q+R) - (P+R) = 10100 +$$
$$12500 + 10400$$

This simplifies to :

$$2P + 2Q + 2R = 33000$$

Dividing by 2 :

$$P + Q + R = 16500 - Eq. (4)$$

Solve for each variable

Now, we can use Eq.(4) to find individual salaries.

From Eq. (1)

$$Q = 10100 - P$$

From Eq. (2)

$$R = 10500 - Q = 12500 - (10100-P)$$
$$= 2400 + P$$

Now, substituting R into Eq.(3)

$$P + (2400 + P) = 10400$$
$$P + P = 10400 - 2400 = 8000 — (3)$$

This simplifies to:

$$2P + 2400 = 10400.$$

Subtracting "2400" from bothsides

$$2P = 8000$$

Dividing by '2'

$$P = 4000.$$

Thus, monthly salary of P is 4000.

2.

Let Jamie's current age be 'j' years.
Then, Jamie's dad's current age is 4j years.

In 14 years, Jamie's age will be j+14, and Jamie's dad's age will be 4j+14.

According to the problem, in 14 years, Jamie's dad will be twice Jamie's age:

$$4j + 14 = 2(j+14).$$

Now lets solve the eqn:

i) Expand the right side:

$$4j + 14 = 2j + 28$$

Rearranging gives:

$$4j - 2j = 28 - 14$$
$$2j = 14$$

Dividing by '2'

$$j = 7$$

Now we can find Jamie's dad's age:

$$\text{Dad's age} = 4j = 4 \times 7 = 28.$$

Sum of their ages Now

Now,

$$\text{the} = j + 4j = 5j = 5 \times 7 = 35$$

Thus, the sum of Jamie's age and Jamie's dad's age now is 35.