

29/10/2024

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Tuesday

MON TUE WED THU FRI SAT
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Mock Exam-5

General Science and Ability

Dos and Don'ts for General
Science & Ability Paper

Name: Muhammad Zikria

Hi there, you've done well. Know
that acquiring knowledge is one
thing and reproducing it in paper
according to what's asked is
another. There are a few things I
would like to highlight.

Roll No #: 59

Roll No #: 32328

Roll No #: 6979

1. A 5 marks part requires at least
2 and at max 3 sides of a paper.

Know that there can be two or
three parts of a question and their
marks are divided accordingly.

So, address all of them in a just
manner.

2. Focus on time management.

You get 35 minutes to solve one
question and about 8 minutes per
5 mark part. Manage your time
accordingly.

3. You need to understand that
your paper is supposed to look
more scientific than theoretical.

So, add flowcharts and diagrams
where required.

4. Your handwriting and neatness
can be really impactful. Avoid
cutting and overwriting.

5. Focus on your spellings and
your grammar. Here, in GSA
there's no deduction in marks but
your expression will definitely
create an impact.

6. In ability portion, give
explanation for analytical ability
question in words. You need to
understand that a 5 mark part
requires all steps written and
explained.

Good luck for CSS 2025. You're
gonna rock in sha Allah. :)

"Prevention of dengue lies in reducing
the mosquito population through
community engagement."

(Dr. Neeraj Kumar)

I. Causative Agents of Dengue:

The causative agents of dengue are four closely related viruses known as dengue virus serotypes 1, 2, 3 and 4 (DENV-1, DENV-2, DENV-3, DENV-4).

These viruses belong to the Flavivirus genus. The infection typically occurs after a bite from an infected mosquito which transmits the virus into the human bloodstream.

II. Symptoms of Dengue:

Symptoms of dengue typically appear 4 to 10 days after being bitten by an infected mosquito. Common symptoms include:

1. High Fever:

Sudden onset of a high fever, often reaching up to 104°F (40°C)

2. Severe Headache:

Intense headaches, particularly behind the eyes.

Early, critical and recovery
symptoms

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3. Joint and muscle pain :

Severe muscle and joint pain often referred to as "breakbone fever"

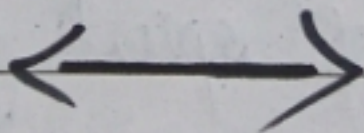
4. Rash :

A rash that may appear a few days after the onset of fever.

5. Fatigue and Nausea :

General feelings of fatigue, along with nausea and vomiting.

In several cases, additional symptoms may include bleeding from the nose or gums, blood in urine or stool, and severe abdominal pain which can indicate the development of dengue fever.



Q No 2 (b) Explain dark matter and dark energy.

1. Dark Matter:

i. Definition of Dark Matter:

Dark matter is a hypothetical form of matter that does not emit, absorb or reflect light, making it invisible and detectable only through its gravitational effects on visible matter. It is believed to account for approximately 27% of the universe's total mass-energy content.

ii. Evidence for Existence:

The presence of dark matter is inferred from several astrophysical observations, including:

a. Galaxy Rotation Curves:

Observations of spiral galaxies show that their outer regions rotate at much higher speeds than would be expected based on visible mass alone. This discrepancy suggests the presence of additional, unseen mass.

b. Gravitational Lensing:

Light from distant galaxies is bent by the gravitational influence of massive objects. The amount of bending often indicates more mass than what is visible, suggesting dark matter's presence.

c. Cosmic Microwave Background (CMB):

The CMB provides a snapshot of the early universe showing fluctuations that indicate the existence of dark matter.

"The CMB is a snapshot of the universe when it was just 380,000 years old, a time when the first atoms formed"
(Blane Greene)

iii. Composition of Dark Matter:

The exact nature of dark matter remains unknown, but it is hypothesized to consist of particles such as Weakly Interaction massive Particles (WIMPs).

(6)

2. Dark Energy :

i. Definition of Dark Energy :

Dark energy is a mysterious force that is driving the accelerated expansion of the universe. It is believed to constitute about 68% of the total universe mass-energy content.

ii. Evidence for Existence :

The evidence of the existence dark energy is supported by:

a. Supernova Observation :

Supernova in distant galaxies show that they are fainter than expected indicating that the universe's expansion is accelerating rather than decelerating.

b. Large Scale Structure :

The distribution of galaxies and cosmic structures also suggests an accelerating expansion influenced by dark energy.

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iii- Nature and Theories of Dark Energy:

The exact nature of dark energy is still a topic of research, with several theories, and proposed, including:

1. Cosmological Constant:

Proposed by Albert Einstein, this constant represents a uniform energy density filling space by homogeneously.

2. Quintessence:

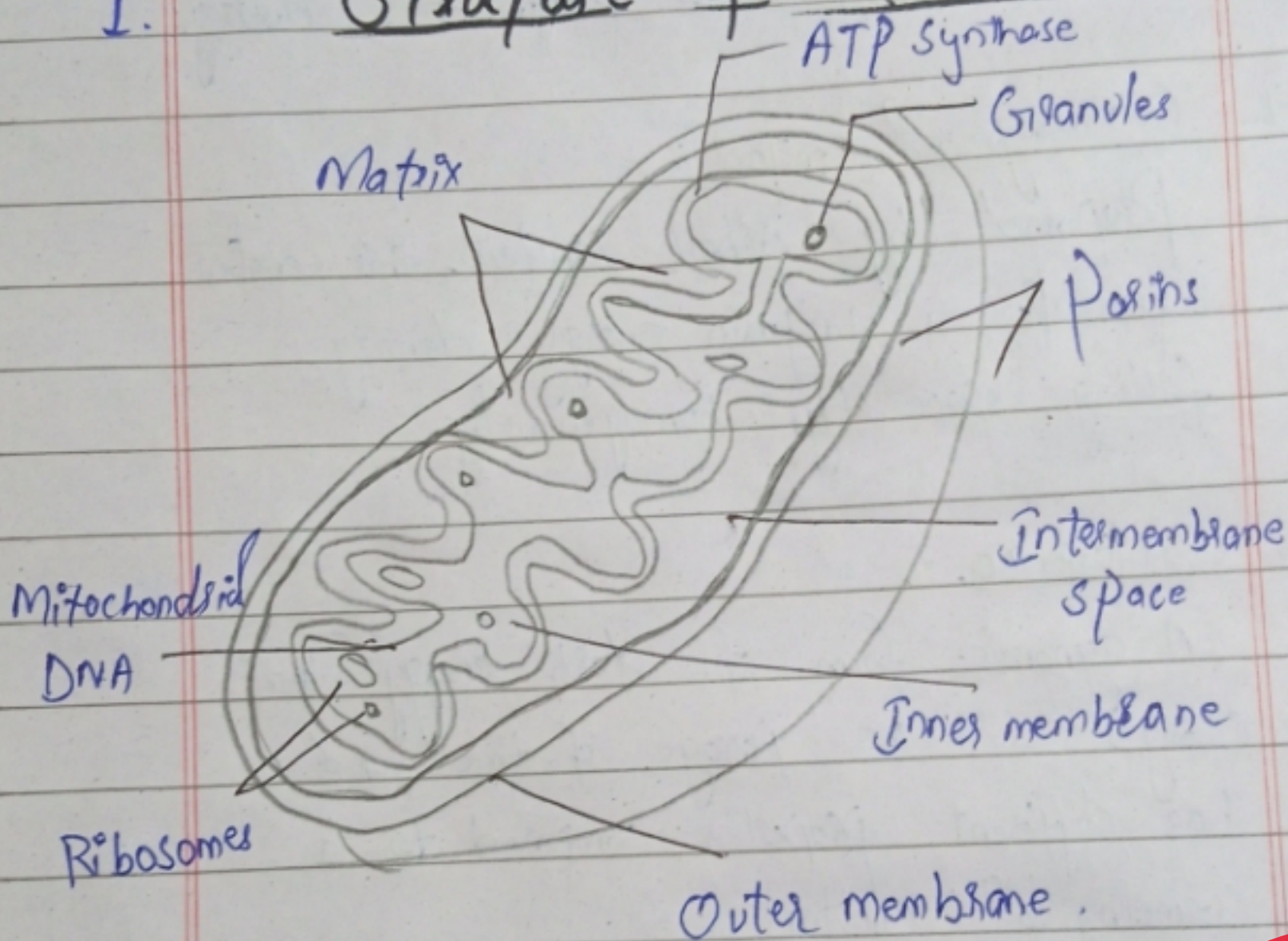
A dynamic form of dark energy that changes with the passage of time and has different properties compared to a cosmological constant.



Q No 2: (c) Discuss Structure and function of mitochondria. How is it the powerhouse?

I.

Structure of Mitochondria



II. Functions of Mitochondria

Mitochondria are often referred to as the "powerhouse of the cell" because they generate adenosine triphosphate (ATP).

The primary energy currency of the cell. This process occurs through oxidation which involves two main stages.

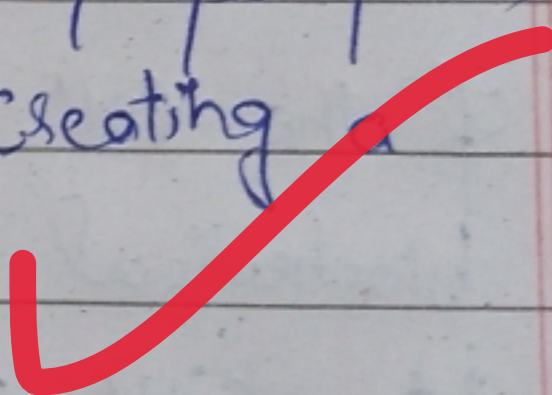
1. Stages of ATP Production:

i- Citric Acid Cycle:

Citric Acid cycle takes place in the matrix where acetyl-CoA is oxidized producing NADH and $FADH_2$ which carry high energy electrons.

ii- Electron Transport Chain (ETC):

It is located in the inner membrane where electrons from NADH and $FADH_2$ are transferred through a series of protein complexes. This transfer pumps protons into the intermembrane space, creating a proton gradient.



2. Regulation of Metabolism:

Mitochondria play a key role in cellular metabolism by regulating the metabolic pathways of carbohydrates, fats and proteins.

3. Apoptosis:

Mitochondria are involved in programmed cell death (apoptosis) by releasing cytochrome c into the cytosol, triggered a cascade that leads to cell death.

4. Calcium Storage of Mitochondria:

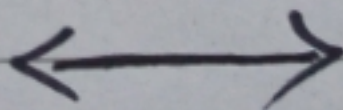
Mitochondria helps to regulate intracellular calcium levels, playing a crucial role in cellular signalling.

III. Mitochondria as the Powerhouse:

Mitochondria are considered the Powerhouse of the cell due to their ability to convert biochemical energy from nutrients into ATP through cellular respiration.

This process is essential for providing energy for various cellular functions including muscle contraction, nerve impulse transmission, and biosynthesis of macromolecules.

The efficient energy production in mitochondria supports the metabolic needs of the cell, ensuring its survival and functionality.



Q No 2: (d) What are covalent bonds?
Explain types along with elaborating structures.

Definition of Covalent Bond:

Covalent bonds are a type of chemical bond that involves the sharing of electron pairs between atoms. This bond formation typically occurs between nonmetals, allowing each atom to achieve a more stable electron configuration, often resembling that of noble gases.

I. Types of Covalent Bonds:

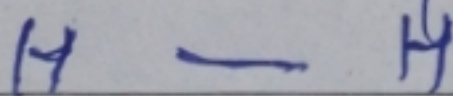
1. Single Covalent Bond:

A single covalent bond is formed when two atoms share one pair of electrons.

Example: In hydrogen molecules H_2 , two hydrogen atoms share one pair of electrons resulting in a single bond.

Structure of Single Covalent Bond:

The bond can be represented as,



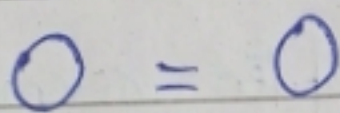
2. Double Covalent Bonds:

A double covalent bond is formed when two atoms share two pairs of electrons.

Example: In an oxygen molecule (O_2) two oxygen atoms share two pairs of electrons.

Structure of Double Covalent Bond:

The bond can be represented as



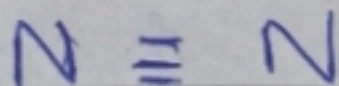
3. Triple Covalent Bonds:

A triple covalent bond is formed when two pairs of atoms share three (3) pairs of electrons.

Example: In a nitrogen molecule (N_2) two nitrogen atoms share three pairs of electrons.

Structure of Triple Covalent Bonds:

The bond can be represented as

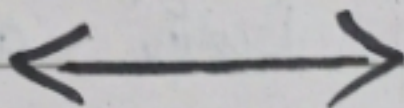
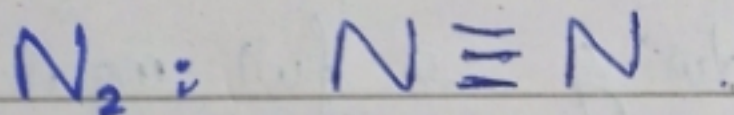
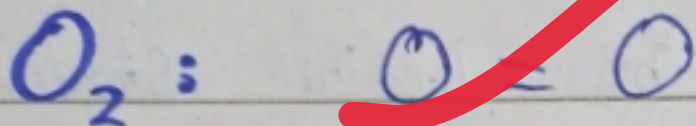
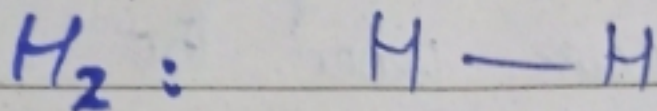


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II. Elaborating on Covalent Bond Structures:



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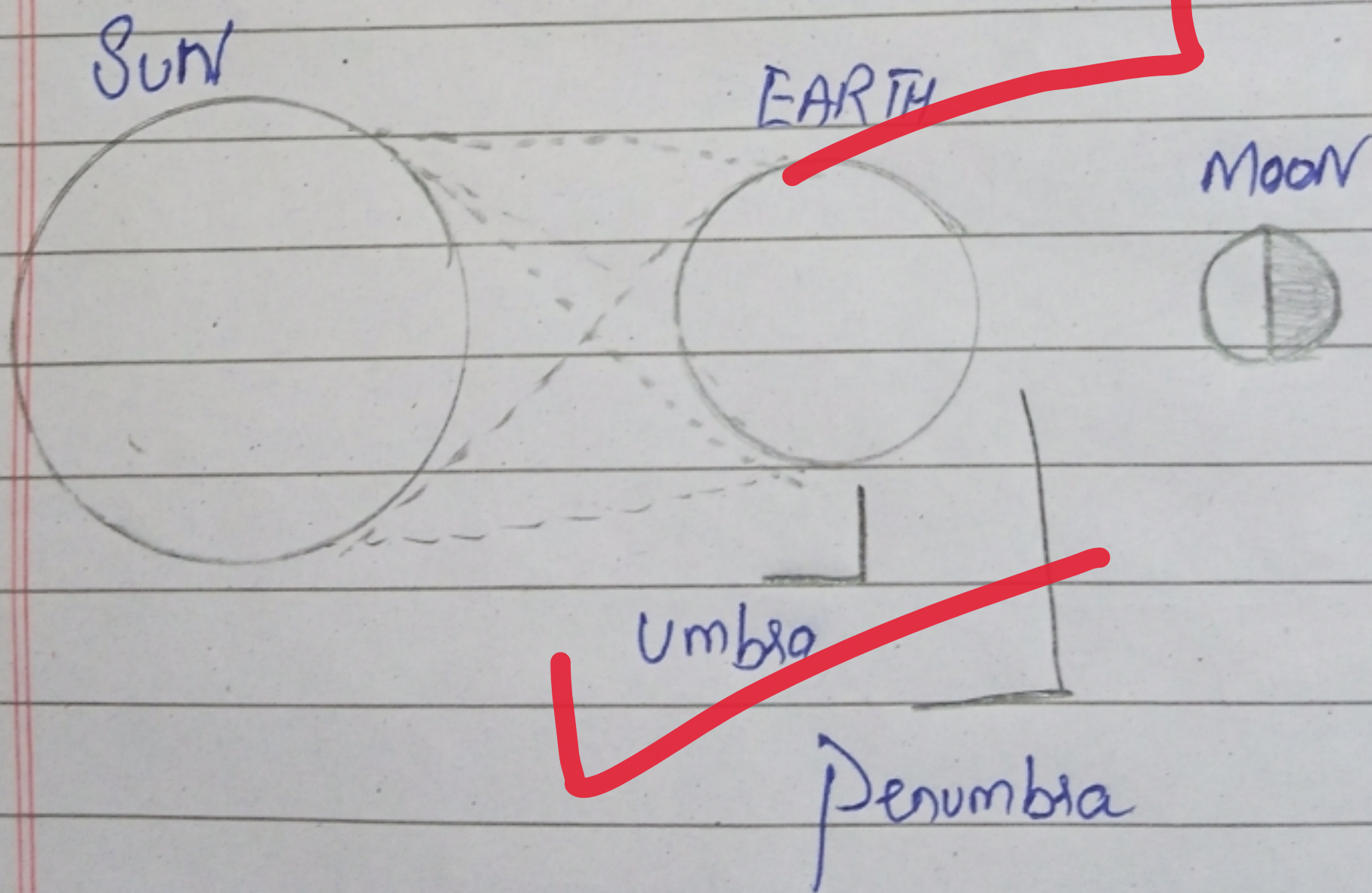
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Q No 3: (a) What is lunar eclipse?

Explain in detail with apt diagram.

Definition of Lunar Eclipse:

A lunar eclipse occurs when the Earth passes between the Sun and the Moon, causing the Earth's shadow to fall on the Moon. This phenomenon can only happen during a full moon when the Sun, Earth and Moon are aligned in a straight line.



II. Types of Lunar Eclipse :

1. Total Lunar Eclipse :

In a total lunar eclipse, the entire Moon enters the Earth's umbra (the central darkest part of its shadow). During this eclipse, the Moon can take on a reddish, often referred to as "Blood Moon".

2. Partial Lunar Eclipse :

In a partial lunar eclipse, only a portion of the Moon enters the Earth's umbra while the rest remains illuminated by direct sunlight. This results in part of the Moon appearing darkened.

3. Penumbral Lunar Eclipse :

A penumbral lunar eclipse occurs when the Moon passes through the Earth's penumbra (the outer part of its shadow). This type of eclipse is subtle and often difficult to observe since the Moon only slightly dims.

III. How a Lunar Eclipse Occurs:

A. Alignment of the Sun, Earth, and Moon:

For a lunar eclipse to take place, the Sun, Earth and Moon must be aligned in a straight line which only happens during a full moon.

B. Shadow Formation:

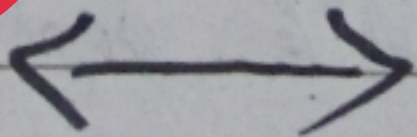
As the Earth blocks sunlight from reaching the Moon, two types of shadows are created:

1. Umbra:

The darkest part of the shadow where the sunlight is completely blocked.

2. Penumbra:

The lighter, outer part of the shadow where the sunlight is partially blocked.



SECTION - II

Q.6: (a) Determine the "k" value if the arithmetic mean of 9, 8, 10, k, 12 is 15.

Solution:

By using formula of Arithmetic Mean

$$\text{Mean} = \frac{\text{Sum of values}}{\text{Number of values}}$$

Now, putting the values in formula:

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

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

$$39 + k = 75$$

$$k = 75 - 39$$

$$\boxed{k = 36}$$



Q6: (c) What will be the volume of a football with a radius of 12 cm?

Solution:

Understand the formula for Volume of a sphere:

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

Where:

V = is the volume

r is the radius of a sphere

π is constant approximately equal to 3.14

Given the radius = 12 cm

Now: Putting the values in the formula.

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

First Calculate:

$$12^3 = 12 \times 12 \times 12 = 1728$$

Now,

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

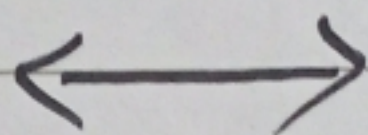
$$V = \frac{4 \times 1728}{3} \pi = \frac{6912}{3} = 2304$$

$$V = \frac{4 \times 1728\pi}{3}$$

$$V = \frac{6912\pi}{3}$$

$$V = 2304 \times 3.14159$$

$$V = 7238.23 \text{ cm}^3$$



Q. Prob: (d) Given a Series

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

Find what numbers would come in place of question mark (?)

Solution:

To find next numbers of the series -10, -8, 6, 40, 102, ?, let's analyze the differences between consecutive terms to identify a pattern.

$$1. \quad -8 - (-10) = 2$$

$$2. \quad 6 - (-8) = 14$$

$$3. \quad 40 - 6 = 34$$

$$4. \quad 102 - 40 = 62$$

The differences we have calculated
are as:

2, 14, 34, 62

Now, let's calculate the difference of
these numbers:

1 $14 - 2 = 12$

2 $34 - 14 = 20$

3 $62 - 34 = 28$

List the Second Differences are:

12, 20, 28

The difference between these numbers
are/is 8

$$28 + 8 = 36$$

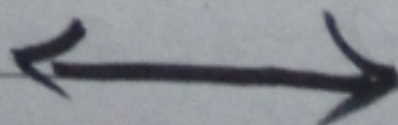
$$62 + 36 = 98$$

$$102 + 98 = 200$$

Thus, the number that comes in place
of the question mark (?) in the
series is

200

Ans



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Q No 7 (a): If 20% of $x = y$, what is the value of $y\%$ of 20 in terms of x ?

Solution:

To find the value of $y\%$ of 20 in terms of x .

From the given equation 20% of $x = y$,

we can express y as

$$y = 0.20x$$

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

$$= \frac{0.20x}{100} \times 20$$

$$= \frac{0.20 \times 20x}{100}$$

$$= \frac{4x}{100}$$

$$= \boxed{0.04x}$$

Thus,

the value of $y\%$ of 20 in terms of x is

$$\boxed{0.04x} \text{ Ans.}$$

Q No 7: (5) Two coins are tossed 500 times, and we get:

Two heads = 105 times

One head = 275 times

No head = 120 times

Find the probability of each event to occur.

Solution:

Total outcomes = 500

From the given data:

Two heads occurred = 105 times

One head occurred = 275 times

No head occurred = 120 times

The probability of an event is calculated by using formula.

$$P(\text{Event}) = \frac{\text{Number of favorable outcomes}}{\text{Total outcomes}}$$

a. Probability of Getting Two Heads

$$P(\text{Two Heads}) = \frac{105}{500}$$

$$= \boxed{0.21}$$

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b. Probability of Getting One Head:

$$P(\text{one Head}) = \frac{275}{500}$$

$$= 0.55$$

c. Probability of Getting No Head:

$$P(\text{No Head}) = \frac{120}{500}$$

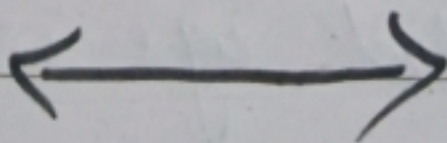
$$= 0.24$$

Thus, the probability of each event are:

Two Heads = 0.21

One Head = 0.55

No Head = 0.24



Q7: (d) Jamie's dad is 4 times older than Jamie. In 14 years time Jamie's dad will be twice the age of Jamie. What is the sum of Jamie's age now and Jamie's dad age now?

Solution:

Let j be Jamie's current age
 Jamie's dad age d , is stated as being 4 times older than Jamie,

$$d = j + 4j = 5j \rightarrow (i)$$

Future Age Relationship

In 14 years:

Jamie's age will be $j + 14$

Jamie's dad age will be $d + 14$

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

$$d + 14 = 2(j + 14)$$

Therefore $d = 5j$

$$5j + 14 = 2(j + 14)$$

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$$\begin{aligned} S_j + 14 &= 2(j + 14) \\ S_j + 14 &= 2j + 28 \\ S_j - 2j &= 28 - 14 \\ 3j &= 14 \rightarrow \textcircled{11} \end{aligned}$$

Solving for Jamie's Age:

$$j = \frac{14}{3}$$

Finding Jamie's Dad Age:

$$d = 5\left(\frac{14}{3}\right) = \frac{70}{3}$$

Sum of Their Ages:

$$\begin{aligned} j + d &= \frac{14}{3} + \frac{70}{3} \\ &= \frac{84}{3} \end{aligned}$$

$$\boxed{= 28} \text{ Ans.}$$



THE END.