DATE: __/__/____

General Science and Ability

Section I

Question No 2

Part (i)

Dengue is a mosquito-born viral disease that has rapidly spread in all regions recently. Dengue virus is transmitted by female mosquito mainly of the species Aedes aegypti.

There are 4 distinct types of virus that cause dengue (DEN 1, DEN 2, DEN 3 and DEN 4.

Causative agent:

The Aedes Aegypti is the primary cause of dengue. The virus is transmitted when this mosquito bites into the skin of humans— After this, the virus enter the blood and make copies of itself.

The Aedes Aegypt ~~virus~~ lives in urban habits and breeds mostly in man-made containers. It is a day-time feeder., its peak biting periods are early in morning.

Symptoms:

Dengue fever is a severe, flu-like illness that affects infants, young children and adults. Dengue symptoms include

1. high fever (40 °C / 104 °F)
2. severe headache
3. pain behind eyes

DATE: __/__/____

4. muscle and joint pain
5. Nausea
6. Vomiting
7. Swollen glands and rash

Symptoms usually last for 2-7 days after an incubation period of 4-10 days after bite from mosquito.

Severe dengue is potentially deadly and include

1. plasma leaking
2. fluid accumulation
3. respiratory distress
4. severe bleeding
5. Organ impairment.

Seven days after the first symptoms with a decrease in temperature, the symptoms include

1. Severe abdominal pain
2. vomiting
3. bleeding gums
4. fatigue
5. bloody vomiting.

The next 24-48 hours of this stage can be lethal.

Treatment and control:

There is no proper treatment available for dengue but the prevention and control can be done by the following ways.

1. Prevent egg-laying habitats
2. Disposing of solid wastes properly

DATE: __/__/____

3 covering, emptying and cleaning of
4 domestic water storage containers
5 Using insecticides and mosquito repellants.

part (ii)

Dark matter:

Dark matter is a mysterious substance that does not interact with light or other forms of electromagnetic radiation. This means its invisible to telescopes. but its gravitational effects are evident in rotation of galaxies.

Scientists believe that dark matter makes up about 27%. of universe's mass-energy.

Dark energy:

Dark Energy is an even more mysterious force that is accelerating the expansion of universe. If is causing the universe to expand. According to scientists it makes up about 68% of universe.

part (iii)

Mitochondria is a very important organelles. They are present only in Eukaryotic cells. They are involved in manufacturing and supply of energy to cell. Therefore they are called "power house of cell".

structure:

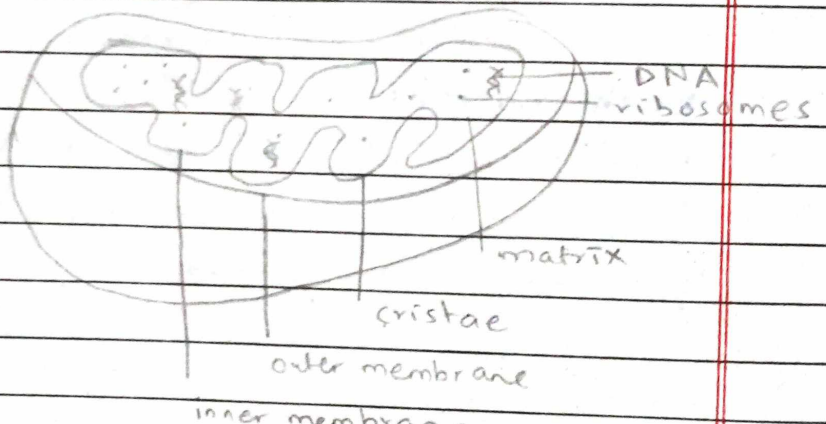
The mitochondria is a filament shaped

DATE: __/__/____

organelle. They are double membrane bounded. The outer membrane is smooth but the inner membrane have foldings called cristae. Inside the cristae, there are small knobs called F1 particles.

Chemical Composition:

The membrane of mitochondria is composed of lipids and proteins. The matrix contains a large number of enzymes, organic and inorganic salts. Mitochondria also have DNA and ribosomes. They synthesize their own Proteins



Function:

Metabolic Processes happen here like Krebs cycle, aerobic respiration etc. Energy released from organic foods during these processes. The energy is transferred to ATP. ATP (Adenosine TriPhosphate) provides energy to cell The ATP is broken into ADP and ADP again changes into ATP.

DATE: __/__/____

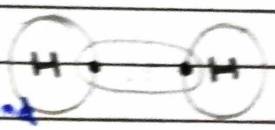
part (iv)

A covalent bond is a chemical bond formed by sharing of electron pairs. This sharing allows atoms to achieve stable electronic configuration.

⇒ **Types based on number of shared electrons:**

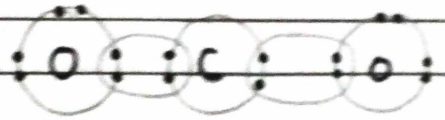
1 **Single bond**

This involves sharing of single pair of electrons between two atoms. For example H_2

H–H  hydrogen H_2

2 **Double bond**

This involves sharing of double pair of electrons between two atoms. For example CO_2.

O=C=O  Carbon dioxide CO_2

3 **Triple bond**

This involves sharing 3 pairs of electrons for example N_2

N≡N 

⇒ **Types based on polarity:**

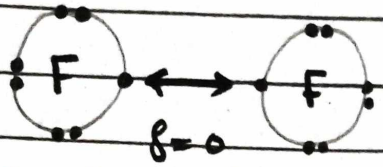
Based on electronegativity difference the bonded atoms, covalent bonds are classified as

1 **Non-polar covalent bond:**

These bonds occur with similar electronegativity.

For example

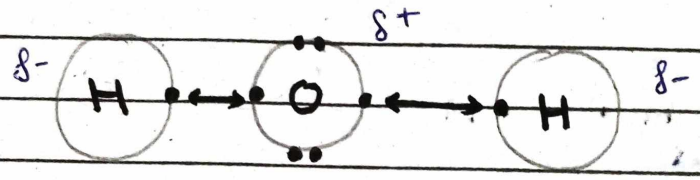
DATE: __/__/____



2 **Polar covalent bond:**

When atoms have different electronegativities, these bonds occur. The electrons are shared unequally and hence have partial positive on one atom and partial negative charge on other.

For example water H_2O



Question No 3

part (i)

An eclipse takes place when one heavenly body moves into the shadow of other heavenly body.

Lunar Eclipse:

The moon moves in orbit around earth and earth orbits around the sun. Sometimes the earth moves between the sun and moon, thus blocking the sunlight that is reflected by moon. Instead of light on moon's surface, Earth's shadow falls on it. This is called lunar eclipse.

It happens when moon is full.

The earth casts a strong conical shadow in space. Surrounding the shadow

DATE: __/__/____

cone, called umbra, is an area of partial shadow called penumbra.

Types:

There are 3 types:

1 **Penumbral Eclipse:**

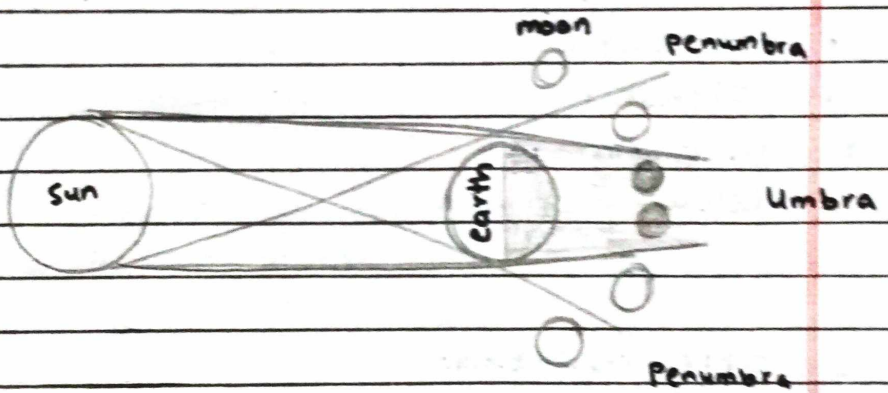
The moon only passes through the penumbra of earth's shadow. It is rarely visible from earth.

2 **Partial Eclipse:**

when part of moon pass through umbra of earth.

2 **Total Lunar eclipse:**

when entire moon pass through umbra of earth



part (ii)

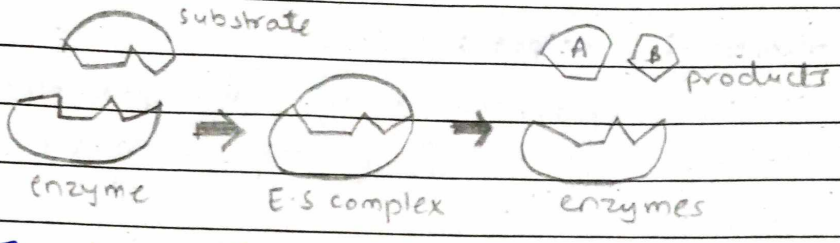
Enzymes are biological catalysts that speed up chemical reactions without being affected in the process.

Working of Enzymes:

Enzymes work by lowering the activation energy required for a chemical reaction. This is done by binding to substrates and forming enzyme substrate complex.

DATE: __/__/____

The enzyme catalyzes the reaction, converting substrate into products. Once the reaction is complete, enzyme is released for another reaction.



Functions of enzymes:

Enzymes are essential for biological processes. These include,

1 **Digestion:**

- **Amylase:** breaks down complex carbohydrates into simple sugars like maltose.
- **Protease:** breaks proteins in amino acids.
- **Lipase:** breaks fatty acids in glycerol.

2 **Metabolism:**

- **Cellular Respiration:** Enzymes catalyze reactions in breaking glucose to energy ATP.

3 **DNA replication:**

- **DNA Polymerase:** Synthesizes new strands of DNA.

4 **Protein Synthesis:**

- **RNA polymerase:** Synthesizes RNA from DNA.
- **Ribosomes:** Complex molecules that uses mRNA to produce proteins.

DATE: __/__/____

Part (iii)

Electromagnetic radiations:

Electromagnetic radiations is a form of energy that propagates in space in form of waves. They travel at the speed of light.

Electromagnetic Spectrum:

The electromagnetic spectrum is the range of all types of electromagnetic radiation. The spectrum includes; from low to high.

1. **Radiowaves:**
   Used for communication, e.g radio and tV.
2. **Microwaves:**
   Used for cooking and in Radars.
3. **Infrared radiation:**
   Used in remote controls and heat transfer.
4. **Visible light:**
   This part, only humans can see consisting of colors from red to violet.
5. **Ultraviolet radiations:**
   It cause skin cancer and sunburn but also used in sterilization.
6. **X-rays:**
   Used in medical imaging
7. **Gamma rays:**
   High energy radiations, used in medical and industrial processes.

Characteristics of EMR:

1. **wavelength: (λ)**
   distance between two consecutive waves.

DATE: __/__/____

Frequency: (f)

Number of waves that pass a given point in certain time.

Speed of light: (v)

All electromagnetic waves travel at the same time in same speed in vaccum i-e approximately 300,000,000 m/s.

Part (iv)

Yes, earthquakes and volcanic eruptions are connected.

Both phenomenons are driven by Earth's tectonic plate movement. These massive plates shift and interact, creating geological activity.

1 **Tectonic plate boundries:**

1 **Convergent plates**

When plates collide, one subducts beneath the other. This trigger earthquakes and volcanic eruptions.

2 **Divergent plates:**

When plates move apart, magma fills the gap, creating new crust thus causing earthquakes and volcanic eruptions.

2 **Magma movement:**

1 The movement of Magma within crust cause earthquakes.

DATE: __/__/____

2 Earthquakes trigger volcanic eruptions by destabilizing magma or creating new pathway for magma to reach the surface.

Section II

Question No 6

Part (i)

Given that

9, 8, 10, k, 12

and their mean is 15

we know

$$\text{mean} = \frac{\text{sum of numbers}}{\text{Total number}}$$

So

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

$$75 = 39 + k$$

$$75 - 39 = k$$

k = 36

Part (ii)

Let quantity of sugar be $4x$ and colored water be $3x$.

Adding 10 Litres of water, the ratio becomes

$$4x : (3x + 10) = 4 : 5$$

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

Cross multiplying

DATE: __/__/____

$$20x = 12x + 40$$

$$20x - 12x = 40$$

$$8x = 40$$

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

$$x = 5$$

So the initial quantity of sugar solution was $4x = 4(5) =$ **20 litres**

part (iii)

Assuming football is a sphere we know that

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

$$V = \frac{4}{3}(3.14)(12)^3$$

$$V = \frac{4}{3}(3.14)(1728)$$

$$V = 7234.5 \text{ cm}^3$$

part (iv)

Given that

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

$-10 \quad -8 \quad 6 \quad 40 \quad 102$

$+2 \quad +12 \quad +14 \quad +20 \quad +34 \quad +28 \quad +62$

$\Rightarrow$ The difference is increasing by 8

So $28 + 8 = 36$ So

$62 + 36 = 98$

So $102 + 98 = 200$.

The next number would be 200.

DATE : __/__/____

Question No 7

part (i)

Given that

20 % of $x = y$

What is y % of 20 in x terms

20% of $x = y$

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

$\frac{1}{5} x = y$

$x = 5y$

Now y % of 20

So $y = \frac{1}{5} x$

$y = \frac{1}{5} x$

part (ii)

Let P's salary is P, Q's salary is Q and R's salary be R.

So from given information,

$\frac{P + Q}{2} = 5050$ — (1)

$\frac{Q + R}{2} = 6250$ — (2)

$\frac{P + R}{2} = 5200$ — (3)

Now

$P + Q = 10100$ — (4)

$Q + R = 12500$ — (5)

$P + R = 10400$ — (6)

DATE: __/__/____

Now if we subtract equation (6) from (4)

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

$R - Q = 300 \quad - (7)$

Now Adding eq (5) and (7)

$(Q+R) + (R-Q) = 12500 + 300$

$2R = 12800$

$R = 6400.$

Now put in eq (5)

$Q + 6400 = 12500$

$Q = 6100$

Now using eq (4)

$P + Q = 10100$

$P + 6100 = 10100$

$P = 4000.$

So **P = 4000 , Q = 6100 , R = 6400**

part (iii)

Given that

2 coins tossed 500 times

two heads = 105 times

One head = 275 times

No head = 120 times

So

Probability of 2 heads = $\frac{105}{500}$

2 heads = 0.21

Probability of 1 head = $\frac{275}{500}$

1 head = 0.55

DATE: __/__/____

Probability of no head $= \frac{120}{500}$

No head = 0.24

Part (iv)

Let Jamie's age be x.

then his dad's age be $4x$.

After 14 years

Jamie's age $= x + 14$

Dad's age $= 4x + 14$

Given that

$$4x + 14 = 2(x + 14)$$

$$4x + 14 = 2x + 28$$

$$4x - 2x = 28 - 14$$

$$2x = 14$$

$$x = 7$$

Hence Jamie's age = 7

His dad's age $= 4 \times 7 = 28$

The sum of their ages is

$7 + 28 = 35$