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Section I

Question No. 2

Part-a

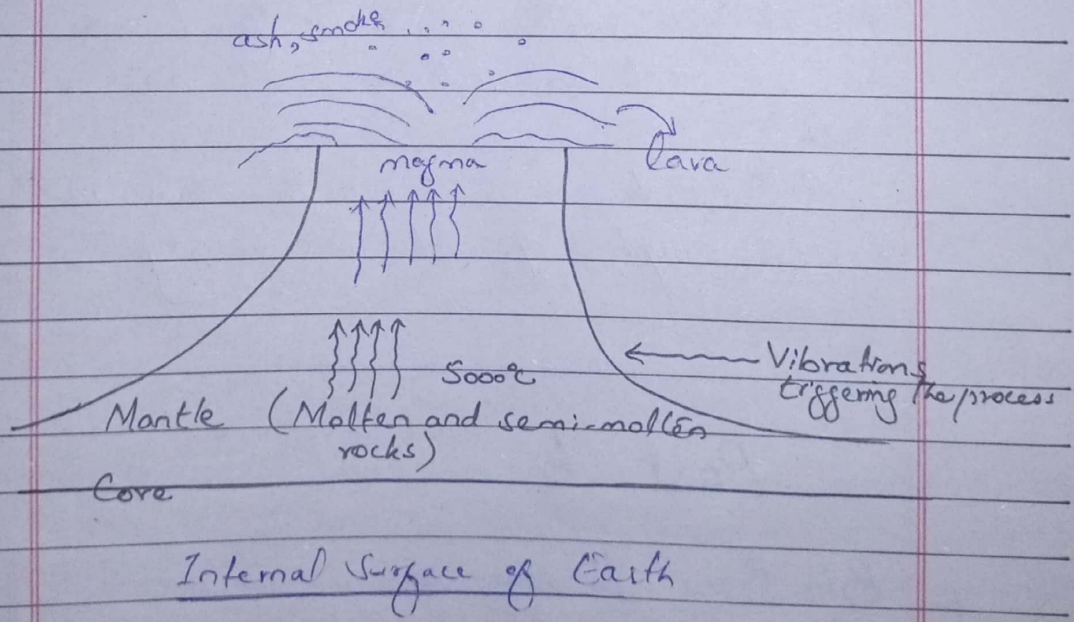
1- Earthquakes and Volcanic Eruption:

Earthquake is defined as:

"vibration or shaking of ground due to release of energy from inside the earth."

These vibrations may lead to different consequences and one of them is volcanic eruption. Volcanic Eruption is defined as:

"process in which magma from inner surface of earth moves upwards towards earth crust and eventualy comes out as lava."



Internal Surface of Earth

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2- Causes of Volcanic Eruption Triggered by Earthquake:

In Iceland, on December 18th, volcano was erupted after series of earthquake due to following reasons:

i- Faultlines and Fractures Inside Earth Surface:

During earthquake, fractures are created inside the earth surface which make it easy for magma to move upward. Additionally, faultlines also triggered the volcanic eruption.

ii- Magma Saturated With Gases:

Gases like SO_2 (Sulphur dioxide) and CO_2 triggered the process and makes the magma explosive. Resultantly, it moves out of vent and release smoke and ash.

These two reasons are the main cause behind eruption of volcanoes in any region.

Part b

1- Big Bang Theory:

Big Bang Theory explains about origin

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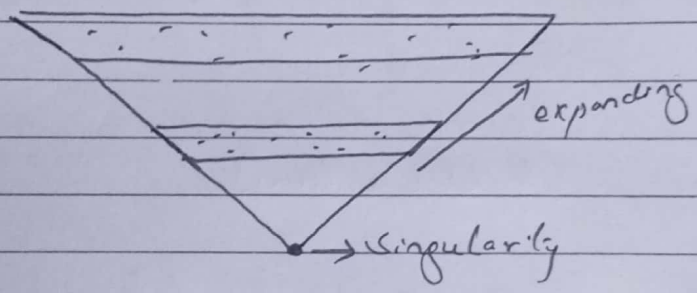
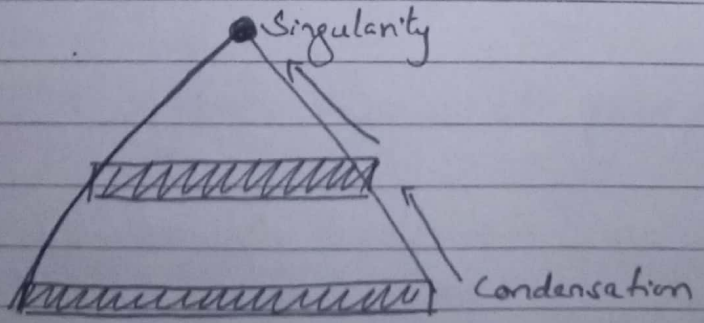
of universe that earth was created around 13.7 billion years ago as a result of sudden explosion due to high temperature. Earth originated from a single point singularity, after explosion, temperature begins to drop and this led to formation of stars and galaxies. It further argues that earth is still expanding and will continue to expand.



2- Big Gunch Theory:

Big Crunch theory explains the "gate of universe." Unlike, Big Bang Theory, this theory argues that a time will come when earth will stop expansion and will start condensation. This will take earth earth to a point of singularity.



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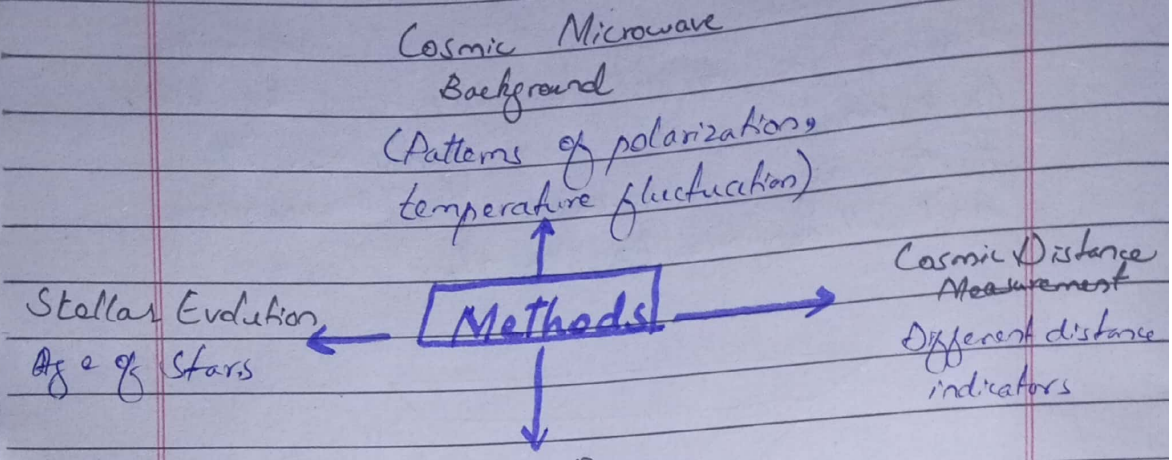
3- Methods for Determining Age of Universe



The age of universe is determined by studying things like cosmic expansion, cosmic background radiation, age of oldest stars and abundance of elements. By putting all these information, scientists have predicted that the age of universe is 13.7 billion years old.

Part - C

1- Defining Renewable Energy:

Renewable Energy is defined as:
"energy source which does not depleted over a period of time."

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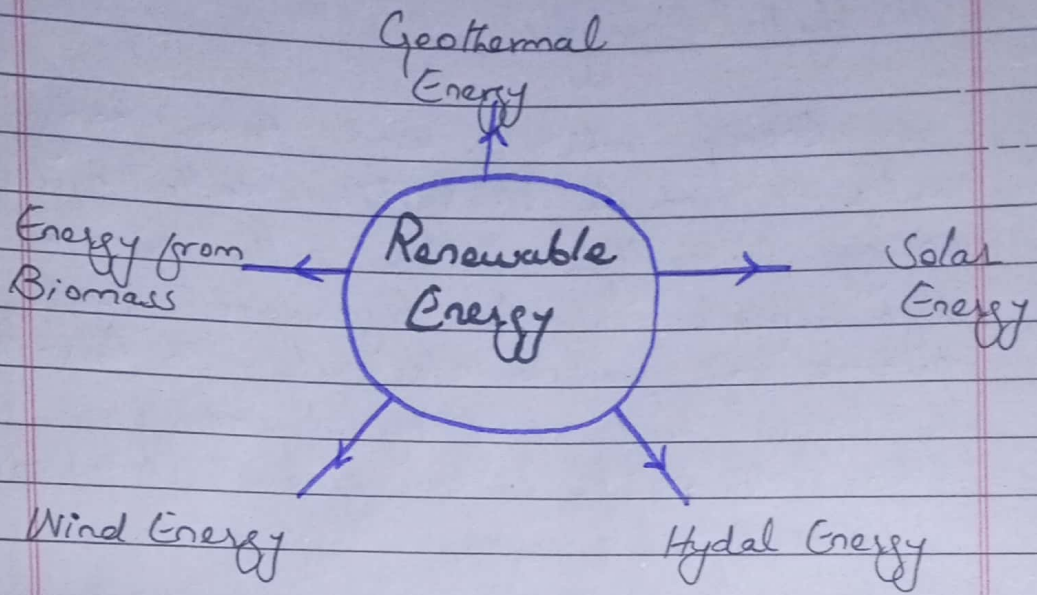
2. Sources of Renewable Energy:



i- Solar Energy:

Solar energy is the most cheapest form of energy. Solar energy is converted into electrical energy directly or indirectly. Photovoltaic cell is generally used to convert solar energy into electrical energy. In Pakistan, Quaid-e-Azam Solar Park has installed capacity of 1000MW.

ii- Geothermal Energy:

Geothermal energy refers to production of heat or electricity by using internal heat of earth. As internal temperature of earth is around 5000°C as it can reach to surface upto 370°C which can be used to run turbines. Top ten producers of geothermal energy in world have

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totals installed capacity of around 16000MW.

iii- Hydal Energy: 1.

Energy which is used from running water to generate electricity is called hydal energy. Generally, water falls from a high surface and its high speed runs turbine and produce electricity. In Asia-Pacific, the largest producer of hydal energy is China. In 2021, it has generated 1.2 million MW of hydal energy.

iv- Wind Energy: 2.

Wind energy is also renewable form of energy where wind farms are installed on high altitude areas or where wind is 90% higher than normal areas. According to an estimate potential of wind is five times of total energy. In Pakistan, Jhimpir Wind power project has generated capacity of 49 MW, which has started operational in 2018.

v- Energy from Biomass:

Biomass is also an important source of renew-able energy in which organic matter is kept for microbial activity in absence of oxygen. For instance, in Bangladesh, a local village Barishal used biogas for cooking and heating purposes.

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Part-d

1- Defining Optical Fibre:

Optical fibre is an:

"flexible, transparent strand made of glass or plastic used for transmitting light signals over long distances."

Optical fibres are used in telecommunication, internet infrastructure, medical services and other applications for their high bandwidth, low attenuation and resistance to electromagnetic interference.

2- Working of Optical Fibre:

Optical fibre works in following ways:

i- Providing High Refractive Index through Core:

The core of optical fibre is a thin strand of glass or plastic, surrounded by a cladding layer. The core has high refractive index than that of cladding.

ii- Total Internal Reflection:

Optical fibre works on principle of total internal reflection. When light enters to

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core, it travels through core due to total internal reflection. Total internal reflection occurs when light travels from a denser medium to less denser medium strikes boundary between them at greater critical angle.

iii - Multiple Reflections:

As, light travels through core it undergoes multiple reflections off core-cladding interface. They bounce back and forth along the length of fibre.

iv- Minimizing Losses:

The refractive index of core is high than cladding which helps to contain the light within core. This minimizes signal loss and ensures that light travels long distance without disturbance.

v- Transmission of Signals:

Optical fibres are used to transmit signal encoded as pulses of light. These signals carry data such as voice, video or internet over long distance. In this way, light signals are transferred to longer distance.

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Question No. 5

Part-a :

1- Food Preservation:

Food preservation is defined as:

"set of processes or techniques which are helpful in storing food over longer period of time and protecting them against microbical organism."

Food preservation is usually done to inhibit growth of microorganisms, slow down enzymatic reactions and prevent spoilage.

2- Methods of Food Preservation:

Some common methods used for preservation of food are as follows:

i- Canning:

Canning involves heating food in jars or cans to destory microorganisms and enzymes which cause spoilage. The sealed cans prevent contamination. For example canned pineapples, seafood and canned cocktails are few examples.

ii- Freezing:

Freezing involves lowering the temperature

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which stop the activities of microorganism. It slows down microbial growth and enzymatic activity.

iii- Drying or Dehydration:

In drying or dehydration moisture from food inhibit growth of microorganisms. As most of bacteria require water to grow. Drying can be done by using specialised dehydrators or under sun.

iv- Pickling:

Immersing food in a mixture of vinegar, salt and spices creates an acidic environment. This inturn inhibit the growth of bacteria, yeasts and molds.

v- Salting:

Salting draws moisture out of food and slow the growth of microorganism. It is commonly used to curing meat and fish.

vi- Fermentation:

Fermentation involves the conversion of sugar and carbohydrates in food to alcohol, acids. For example bacteria, yeast or fungi. This preserves food and enhances its flavour.

vii- Vacuum Packing:

It removes oxygen from packaging and sealing

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and creates oxygen free environment. This inhibits growth of aerobic microorganisms and slows down oxidation reactions.

Part - b

1. Milky Way:

Milkway is defined as:

"The galaxy in which solarsystem resides is milky way."

It is barred spiral galaxy, characterized by central bulge of stars surrounded by a flat disk of stars, gas and dust. The Milky way is estimated to have billion of stars, along with various stellars clusters and other celestrial objects.

2- Dark Matter and Galaxies:

Dark Matter is

"area with strong gravitational force and cluster of stars."

Dark matter constitute 27% of universe. It is believed to play a crucial role in formation and dynamics of galaxies including Milky way. Its gravitational pull help to bind galaxies together and formation of structures in the universe. Without dark matter,

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There would not have enough mass to explain their observed motions and observed structures.

3- Parts of Galaxies:

i- Central Buldge: Black Hole:

The central budge of galaxy contains a dense concentration of stars in ellipsoidal shape. It may host a supermassive black hole inside where gravity is so dense that even light cannot pass through it.

ii- Disk:

It is flat structure where stars, gas and dust orbit the galatic center. Here, active stars formation occur and where most of galaxy visible light is emitted.

iii- Spiral Arms:

Spiral arms extend from central to outwards. It contain clusters of stars, gas clouds and young steller population.

iv- Halo:

It is spherical region where older stars, globular cluster and dark matter is present. It plays significant role in determining overall structure.

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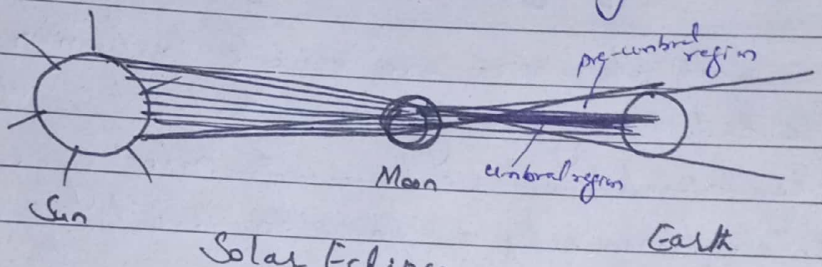
Part-c

1- Differentiate between Solar and Lunar Eclipse:

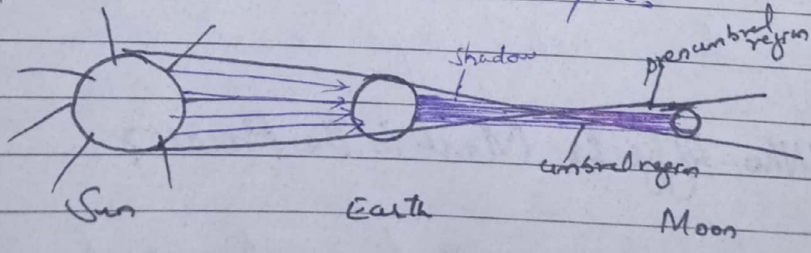
i- Difference in Phenomenas:

In solar eclipse, land (earth) comes under the shadow of moon thereby obstructs light of sun to reach on earth directly.



Solar Eclipse

On the other hand, lunar eclipse involves the process where moon goes in shade of earth. It does not recieves sun light and this pheromena is called lunar eclipse.



Lunar Eclipse

ii- Day and Night Differences:

The process of solar eclipse occurs during day

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time. On the contrary, lunar eclipse happens at night time.

iii- Time Lasting:

Solar eclipse occurs for a short period of time within few minutes. On the other hand, lunar eclipse can last throughout the night.

iv- Visibility for Human Eye:

Both phenomena are visible to human eye but it is generally said that it is not okay to watch solar eclipse with naked eye. While, lunar eclipse poses no threats for human eyes

v- Chance of Rehappening:

Solar eclipse occurs once in a year, on the other hand, lunar eclipse can happen many times within a year.

vi- Who Affects Most in the Process?

In solar eclipse, generally earth impacts as comes under the shade of moon therefore doesnot get enough light. While, during lunar eclipse, moon affects as it goes under the shade of earth.

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Part - d

1. Nuclear Fission :

Nuclear fission is defined as :

"process in which a heavy or large nuclei breaks into two nuclei."

It is a process that doesnot occurs naturally. Moreover, it doesnot need energy to start a process. It is result of different chain reactions. Energy generated as a result of nuclear fission is easy to manage.

2. Nuclear Fusion :

Nuclear fusion is defined as :

"process in which two small nuclei joined and form a larger heavy nucleus."

Nuclear fusion is a natural process, for instance in sun. It requries a large amount of energy to start the process i.e the temperature of sun is 15 million °C. It is very difficult to control the energy generated by nuclear fusion. Nuclear fusion reactors are yet to be established.

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3- Iconic Bond in Table Salt (NaCl):

In NaCl, Cl is highly electronegative and requires a single electron to complete its octet. On the other hand, Sodium can also get stability by losing a single electron in its outer most shell. So, the bond which is formed by complete transfer of electron from one atom to another atom in a molecule is called ionic bond.

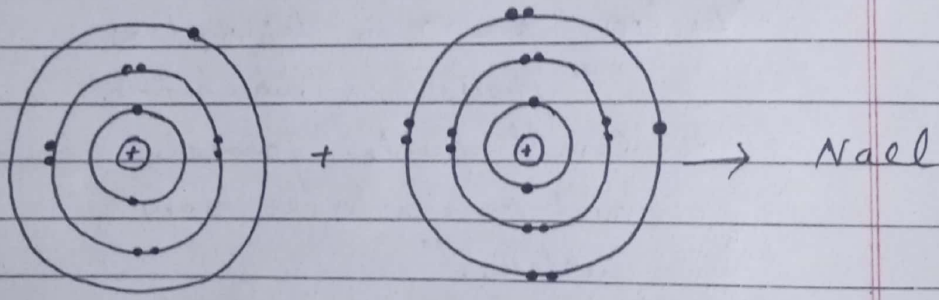
NaCl

Na (11)

K = 2
L = 8
M = 1

Cl (17)

K = 2
L = 8
M = 7



$Na^+ + Cl^- \rightarrow NaCl$

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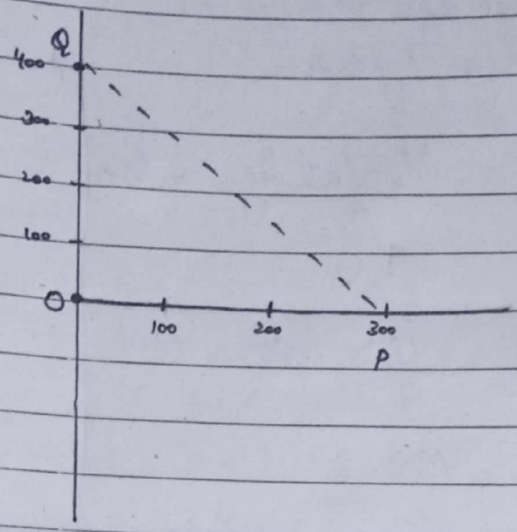
Section II : Question - 7

Part a:



QR = ?

Distance between Q and P

$c^2 = b^2 + a^2$

$c^2 = (300)^2 + (400)^2$

$c^2 = 90000 + 160000$

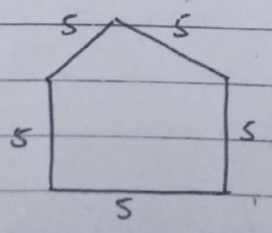
$c^2 = 250000$

$c = 500 km$

R is in middle of P and Q, so his distance will be half of distance between between P and Q.

$QR = \frac{500}{2} = \boxed{250 km}$

Part b:



In pentagon sum of all angle = 540°

so angle of perimeter = $\frac{540}{5}$ = 108° each.

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Part c:

Mental age = 11 years

Age = 9 years

$\because IQ = \frac{\text{Mental Age} \times 100}{\text{Age}}$

$IQ = \frac{11}{9} \times 100$

$IQ = 122.2$

Part d:

Average of 3 boys = 15 years

Let age = x

Ratio of boys age = 3 : 5 : 7

= 3x : 5x : 7x

Let age of first boy = 3x, second = 5x, third = 7x

$\because \text{Average} = \frac{\text{Sum of ages of boys}}{\text{Total number of boys}}$

$15 = \frac{3x + 5x + 7x}{3}$

$45 = 15x$

$\frac{45}{15} = x$

$\boxed{x = 3}$

Age of youngest boy = 3x

= 3 × 3 = $\boxed{9 \text{ years}}$

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Question No. 8

Part a: let first odd number = x

Second = x + 2

third = x + 4

Sum of first three consecutive odd numbers = 273

$x + x + 2 + x + 4 = 273$

$3x + 6 = 273$

$\frac{3x}{3} = \frac{267}{3}$

$\boxed{x = 89}$ first number

Second number = $x + 2 \Rightarrow 89 + 2 \Rightarrow \boxed{91}$

Third number = $x + 4 \Rightarrow 89 + 4$

$= \boxed{93}$

Part b:

i) 4, 16, 36, 64, ____, 144.

$4 \times 4 = 16$

$6 \times 6 = 36$

$8 \times 8 = 64$

$10 \times 10 = 100$

$12 \times 12 = 144$ It is series of square of even numbers starting from four.

ii.

ii- 30, 29, 27 ____, 20, 15.

$30 - 1 = 29$

$29 - 2 = 27$

$27 - 3 = 24$

$24 - 4 = 20$

$20 - 5 = 25$

In this series, the numbers are subtracted from a natural number starting from 1.

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iii. 1, 7, 15, 25, ___, 51.

1+6 = 7
7+8 = 15
15+10 = 25
25+12 = 37
37+14 = 51

In this series, natural numbers starting from 6 are being added in each ~~oth~~ number.

iv. 0, 2, 6, 12, 20, 30, ___?

0 + 2 = 2
2 + 4 = 6
6 + 6 = 12
12 + 8 = 20
20 + 10 = 30
30 + 12 = 42

In this series, even numbers starting from 2 are adding to each number.

v. 48, 24, 72, 35, 108, ___?

$\frac{48}{2} = 24$

$24 \times 3 = 72$

$\left(\frac{72}{2}\right) - 1 = 35$

$(35 \times 3) + 3 = 108$

$\left(\frac{108}{2}\right) - 1 = 53$

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In this series, while following previous steps of dividing by two and then subtracted by 1. new number 53 is obtained.

Part-c

i- Thirst
ii- Garden
iii- Maschot
iv- London
v- Holiday

Part-d

Let Sara's age = x
Her mother's age is 6 times older = 6x
Her brother is twice as old as her = 2x
In three years
x + 3, 6x + 3, 2x + 3

Sum of their ages will be 72

$x + 3 + 6x + 3 + 2x + 3 = 72$

$9x + 9 = 72$

$\frac{9x}{9} = \frac{63}{9}$

$x = 7$ years

Sara is 7 years old.

Mother's age = 6x.

Mother age = 6 x 7 = 42 years

Ali's age = 2x

= 2 x 7

Ali's age = 14 years