Mock Exam
(Aug-2024)

"General Science And Ability"

Section - II

Q7 (a) Solution:

Let the number = x

According to statement:

"A number is divided by 6 and then 50 is added".

Now,

$$\frac{x}{6} + 50 \longrightarrow \text{eq}\,(1)$$

* 2nd part of statement:

"Total is 60"

So eq (1) becomes:

$$\frac{x}{6} + 50 = 60$$

$$\frac{x}{6} = 60 - 50$$

$$\frac{x}{6} = 10$$

$$x = 10 \times 6$$

$$\boxed{x = 60}$$

After simplification we get:

The number = $x = 60$.

(b) In this question we find the odd one.

As we know that:

The term "odd one out" refers to an item in a group or sequence that doesnot fit the pattern shared by others. This "odd one" item stands out because it has different characteristics compared to the rest.

Here,

8, 16, 24, 40 and 48 are all are multiples of 8.

But:

34 is not a multiple of 8

So, The odd one out is 34

(c) Given that:

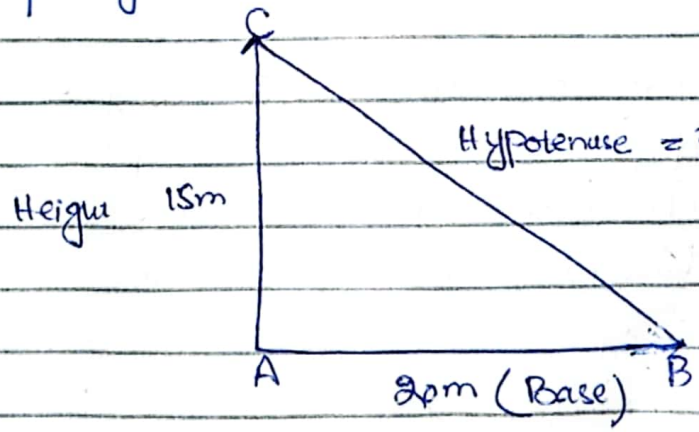
A tower is 15m tall.

A base of tower is 20m (standing here)

Find:

Aerial distance from top of tower.

Graphically:



AB = Base = 20m

AC = Height = 15m

BC = Hypotenuse = Distance from Top to the tower = ?

According to Pythagorean theorem:

$$(\text{Hypotenuse})^2 = (\text{Base})^2 + (\text{height})^2$$

$$(BC)^2 = (AB)^2 + (AC)^2 \rightarrow \text{eq (2)}$$

After putting values in eq (2), we get:

$$(BC)^2 = (20)^2 + (15)^2$$

$$(BC)^2 = 400 + 225$$

$$(BC)^2 = 625$$

Taking square root on Both sides:

$$\sqrt{(BC)^2} = \sqrt{625}$$

$$BC = 25m.$$

So, Aerial distance from top to the tower is 25m.

(d) Given that:

Tariff for odd dates = Rs 1000 per day

Tariff for even dates = Rs 2000 per day.

Total amount paid = Rs 30,000

First Day: The stay begins on the 5th of the month, which is an odd date.

let x be the no of days he stayed on odd dates

let y be the number of days he stayed on even dates.

From the Cost Equation:

As given in statement:

- Rs 1000 for each odd dates
- Rs 2000 for each even dates.

Total amount = $1000x + 2000y$

$30000 = 1000x + 2000y$

Divided by 1000 in order to simplify it.

$$\frac{30000}{1000} = \frac{1000x}{1000} + \frac{2000}{1000}y$$

$$30 = x + 2y$$

OR

$$x + 2y = 30 \longrightarrow \text{eq (1)}$$

The man starts his stay on 5th date (odd date). The sequence of days would then alternate between odd and even dates:

- 5th (odd), 6th (even), 7th (odd) ... so on.

Since the sum: $x + 2y = 30$ must hold.

Let test possible possible values of x and y.

Case 1: Assume $y = 0$

$x + 2(0) = 30$

$\boxed{x = 30}$

Case 2: Asume $y = 1$

$x + 2(1) = 30$

$x + 2 = 30$

$\boxed{x = 28}$

Case 3: Assume $y = 10$

$x + 2(10) = 30$

$x + 20 = 30 \Rightarrow \boxed{x = 10}$

Now let's verify:

* 10 odd days

Since Rs 1000 for each odd day

So = 10 * 1000

= 10,000 for 10 odd days.

* 10 even days

Since Rs 2000 for each even day.

So = 10 * 2000

= 20,000 for 10 even days.

Total cost = 10,000 + 20,000

= 130,000 which is our Total amount paid.

The man stayed in hotel for Total = 20 days.

10 days on odd dates

10 days on even dates.

Q6 (a) Given that:

Jan 2022, enrollment = 850 pupils

Jan 2023, enrollment = 1120 pupils.

Find:-

Increase percentage for enrollment

Since: old value = 850 pupils

new value = 1120 pupils.

Formula:

Increase percentage of a Quantity = $\frac{\text{new value} - \text{old value}}{\text{old value}} * 100\%$

After putting values we get:

$$\text{Increase percentage for enrollment} = \frac{1120 - 850}{850} * 100\%$$

$$= \frac{270}{850} * 100\%$$

$$= 31.7\%$$

$$= 32\%$$

So The Increase percentage for enrollment is 32%.

(b) let present age of son = x years

A man is 5 times as old as his son,

So man's present age = $5x$

According to Statement:

Two years ago the sum of squares of their ages was 114.

So equation becomes:

$$(x-2)^2 + (5x-2)^2 = 114 \rightarrow \text{eq(1)} \quad (a-b)^2 = a^2+b^2-2ab$$

$(x-2)^2$ ↓ Son, $(5x-2)^2$ ↓ Man

Simplification:

$a = x$

$b = 2$

So: Case 1:

$$(x-2)^2 = (x)^2 + (2)^2 - 2(x)(2)$$

$$= x^2 + 4 - 4x$$

Case 2:

$a = 5x$

$b = 2$

$(5x-2)^2 = (5x)^2 + (2)^2 - 2(5x)(2)$

$= 25x^2 + 4 - 20x$

After putting values in eq ①:

$x^2 + 4 - 4x + 25x^2 + 4 - 20x = 114$

$x^2 + 25x^2 - 4x - 20x + 4 + 4 = 114$

$26x^2 - 24x + 8 = 114$

$26x^2 - 24x + 8 - 114 = 0$

$26x^2 - 24x - 106 = 0$

Divided by 2:

$\frac{26x^2}{2} - \frac{24x}{2} - \frac{106}{2} = 0$

$13x^2 - 12x - 53 = 0$

By using Quadratic equation:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Here:-

$a = 13 \quad b = -12 \quad c = -53$

After putting values we get:

$$x = \frac{-(-12) \pm \sqrt{(-12)^2 - 4(13)(-53)}}{2(13)}$$

$$x = \frac{12 \pm \sqrt{144 + 2756}}{26}$$

$$x = \frac{12 \pm \sqrt{2900}}{26}$$

$$x = \frac{12 \pm 53.85}{26}$$

$$x = \frac{12 + 53.85}{26} \; ; \; \frac{12 - 53.85}{26}$$

$$x = \frac{65.85}{26} \; ; \; \frac{-41.85}{26}$$

$$x = 2.53 \; ; \; -1.61$$

Age cannot be negative so;

$x = 2.53$

The present age of son is 2.5 years.

years Months.

(c) let for hens $= x$

let for cows $= y$.

According to Statement:

no of heads = 48 (Both hens and cows)

no of feets = 140 (Both hens and cows)

Both hens and cows have 1 head.

Both hens (have 4 feets) and cows have 4 feets

So Equations becomes:

Heads: $x + y = 48 \longrightarrow$ eq ①

feets: $2x + 4y = 140 \longrightarrow$ eq ②

$x + y = 48 \longrightarrow$ eq ① (Multiplied by 2)

$2(x + y = 48)$

$2x + 2y = 96 \longrightarrow$ eq ③

$2x + 2y = 96 \longrightarrow$ eq ③

$2x + 4y = 140 \longrightarrow$ eq ②

Subtracting eq ③ and eq ②

$+2x + 2y = 96$

$\pm 2x \pm 4y = \pm 140$

$- \quad -$

$7 \quad 2y = +44$

$2y = 44$

$y = 44/2$

$\boxed{y = 22}$

Put $y = 22$ in eq (1)

$x + y = 48$

$x + 22 = 48$

$x = 48 - 22$

$\boxed{x = 26}$

Hence, the no of Hens = 26

(d) let a = average speed for the trip.

let d = half of the distance

Given that:

Case1 -- During the first half of the journey speed is 40 Km/h

Case2 -- The speed is 60 Km/h during the second half of journey.

As we know that:

Time = distance / speed

So for Case1:

For the first half time = $d/40$

Case 2:

For 2nd half time = $d/60$

For Total Distance = $2d/a$.

Hence;

$$d/40 + d/60 = 2d/a$$

↓ ↓ ↓

First half Time | 2nd half Time | For Total Distance

Simplification:-

$$\frac{1}{40} + \frac{1}{60} = \frac{2}{a}$$

$$\frac{(3+2)}{120} = \frac{2}{a}$$

$$\frac{5}{120} = \frac{2}{a} \quad \text{(Cross multiplication)}$$

$$5a = 120 \times 2$$

$$5a = 240$$

$$a = \frac{240}{5}$$

$$a = 48 \text{ km/hr}$$

Hence The average speed of a Car is 48 km/hr

★ ——————— ★

Section # II

Q2 (b) Differentiate b/w food contamination and adulteration?

Characteristics	Food Contamination	Food Adulteration
Definition	Food contamination occurs when harmful substances or microorganisms are introduced into food, either accidentally or due to improper handling or storage.	Food adulteration is the deliberate addition or mixing of inferior, substandard or unauthorized substances into food to increase profit or alter the appearance, taste or texture.
Sources	Sources of food contamination can be broadly categorized into biological, chemical and physical sources. Biological Sources: . Bacteria, Viruses, Fungi etc. Chemical Sources: .- Pesticides, Heavy Metals etc. Physical Sources: Natural Contaminants: Dirt or soil particles Foreign objects: plastic pieces and stones	.- Adding water or other substances to increase volume or weight (e.g diluting milk with water). .- Adding synthetic dyes to enhance appearance (e.g colour additives in candies.
Health Impacts	It can cause food borne illnesses, long-term	It can lead to health issues ranging from

	health effects (like cancer or neurological disorders) and allergic reactions.	mild digestive problems to severe toxicity and long term diseases depending upon the nature and amount of adulterant used.
Causes	.- Improper handling .- Cross Contamination .- Poor hygiene practices .- Use of Contaminated water	.- Fraudulent practices to cut costs or increase profits. .- lack of regulation .- Unethical practices by suppliers or manufacturers.
Examples	.- Heavy metals in soil, which plants take up are present in vegetables and fruits as food Contaminants.	A chemical name melamine is commercially added to milk to increase its protein level.

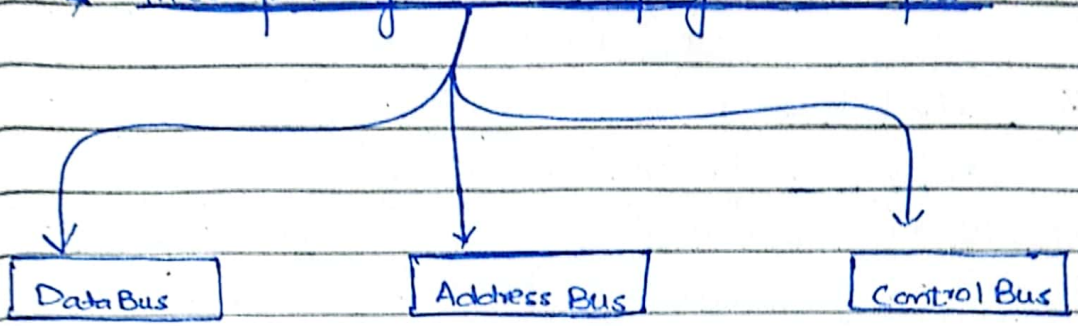
(c) What are computer buses? Differentiate RAM and ROM?

Ans:- Computer Bus:-

Bus is a common path to transfer data and commands between CPU, memory and input/output devices. Computers normally have system bus of 70 – 100 lines. In a computer system, three primary buses are employed to facilitate communication between the

various components.

* Three primary buses employed in computer:-



1- Data Bus:-

a) Function:- The data bus is responsible for transferring actual data between the Processor, memory and peripheral devices. It carries the binary data that is being processed or transferred.

b) Usage:- For instance, when the the CPU needs to read data from RAM, the data bus carries this data from the RAM to the CPU. Similarly, when the CPU sends data to a peripheral device, such as writing a file to a hard drive, the data bus carries this data from the CPU to the device.

2- Address Bus:-

a) Function:- The address bus is used to specify the addresses in memory where data is being read from or written to. It carries the memory addresses that the CPU needs to access in order to retrieve or store data.

b) Usage:- When a CPU wants to read data from or write data to a specific memory location, it sends the address of that location via the address bus.

c) Example:- If the CPU needs to read a piece of data stored at memory location 'AF'

it sends this address over the address bus to the RAM, which then sends the data stored at that location back to the CPU via the data bus.

3) Control Bus:-

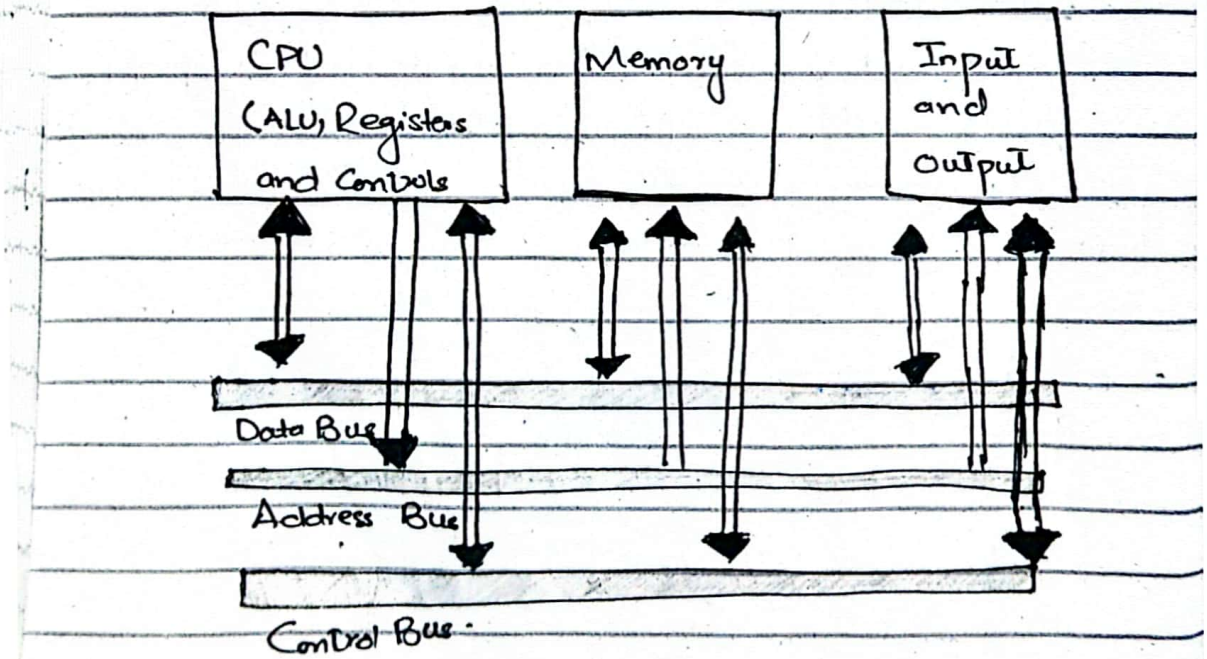
a) Function:- The control bus carries control signals issued by the CPU to coordinate and manage the various operations with in the computer. A control signal contains the following:

* Timing information:- It specifies the time for which a device can use data and address Bus.

* Command signal:- It specifies the type of operation to be performed.

b) usage:- when the CPU wants to read the data from memory it sends a "read" signal over the control bus. The control bus is also used to transmit control signals like ACKs (Acknowledgement signals).

* Diagrametical view:-



Characteristics	RAM	ROM
Data Retention policies.	:- RAM is a volatile memory which could store data as long as the power is supplied.	:- ROM is a non-volatile memory which could retain the data even when power is turned off.
working Type	:- Data stored in RAM can be retrieved and altered.	:- Data stored in ROM can only be read.
Usage	:- Use to store the data that has to be currently Processed by CPU temporarily.	:- It stores the instructions during the bootstrap of the computer.
Speed	:- It is a high speed memory	:- It is much slower than the RAM.
Size and Capacity.	:- large size with higher capacity.	:- Small size with less capacity.
Cost	:- Costly as compared to ROM	:- Cheaper than RAM.

(d) What are geo-stationary satellites? Distinguish natural and artificial satellities, how many artificial satellites of Jupiter are there?

Ans: **Geo-Stationary Satellites:** are a type of satellite that orbits Earth in such a way that they remain fixed over a specific point on the Earth's surface. They achieve this by orbiting at the Earth's equatorial plane at an altitude where their orbital period matches the earth's rotational period.

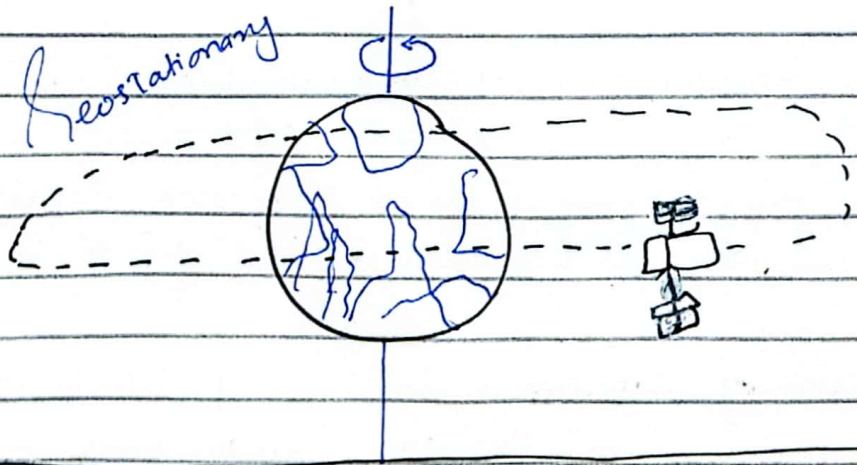
This means they complete one orbit around the Earth in 24 Hours.

* Characteristics.

- **Orbital Altitute** → ≈ 35,786 km above the Earth's equator
- **Orbital Period** → 24 hours
- **fixed position** → The Satellite appears to be stationary over a Specific longitude.

* Applications.

- used in television broadcasting
- provide constant weather observations and monitering
- support global positioning systems and other tracking services



* Jupiter does not have any geo stationary satellites.

Characteristics	Natural Satellites	Artificial Satellites
Definition	Celestial bodies that orbit a planet or other larger body due to gravitational forces. e.g. The Moon which orbits Earth.	Man-made objects deliberately placed into orbit around Earth or other celestial bodies for various purposes. e.g. The International Space Station (ISS), communication satellites.
Origin	Formed naturally through	Created and launched

	cosmic processes, such as the accumulation of debris or gravitational capture. **Example:** The formation of the Moon is believed to result from a giant impact hypothesis, where a Mars-sized body collided with the early Earth.	by humans using rockets and other technologies. **Example:** The launch of Sputnik 1 by the Soviet Union in 1957.
Purpose	Exist as part of natural cosmic phenomena and donot serve a specific function for human activities. **Example:** The Moon affects Earth's tides through its gravitational pull.	Serve specific functions such as communication, weather monitoring, scientific research and navigation. **Example:** GPS satellites provide positioning and timing information for navigation.
Composition	Made of naturally occuring materials like rock, ice and metals. **Example:** The moon is composed mainly of silicate rock and metals.	Constructed from advanced materials and components, including metals, composites, electronic systems and solar panels. **Example:** Communication satellites are equipped with antennas, transponders and solar panels for power.
Size and Shape	Vary widely in size and shape, often irregular but larger ones tend to be more	They are generally smaller and more uniform in shape,

	spherical due to gravity.	often cylindrical or box-like with extended solar panels.
	Example: The Moon is relatively large and spherical whereas smaller moons like Mar's Phobos are irregularly shaped.	**Example:** Weather satellites are designed with instruments for monitoring atmospheric conditions.
Orbits	Have stable, naturally occurring orbits determined by gravitational interactions over long periods.	Placed into specific orbits for desired functionality such as geostationary, polar or low Earth orbit.
	Example: The Moon orbits Earth in a nearly circular path.	**Example:** Geostationary satellites orbit at a fixed position relative to Earth's surface.

Malnutrition: refers to the condition that results from an imbalance diet where certain nutrients are lacking, in excess, or in the wrong proportions. It encompasses both undernutrition, which includes deficiencies in essential vitamins and minerals, and overnutrition, which involves excessive intake of certain nutrients, leading to conditions such as obesity.

* Major Causes of Malnutrition:

(a) Inadequate Dietary Intake:

(i) Lack of Access to Foods: Poverty, Food scarcity and lack of access to nutritious foods can lead to insufficient intake of essential nutrients.

(ii) Poor Dietary Choices: Consumption of calorie-dense but nutrient-poor foods can result in deficiencies despite adequate caloric intake.

(b) Poor Absorption of Nutrients:

(i) Digestive Disorders: Conditions like celiac disease, Crohn's disease, and chronic diarrhea can impair nutrient absorption.

(ii) Infections and illnesses: Chronic infections and diseases such as HIV/AIDS and tuberculosis can interfere with the body's ability to absorb and utilize nutrients.

(c) Socioeconomic Factors:

(i) Poverty: limited financial resources can restrict access to diverse and nutritious foods.

(iii) Education: lack of knowledge about nutrition and healthy eating practices can contribute to malnutrition.

(d) Environmental Factors:

(i) Natural Disasters: Droughts, Floods and other natural disasters can disrupt food production and supply chains.

(ii) War and Conflict: Armed conflicts can lead to food shortages, displacement and disruption of agricultural activities.

(e) Life style Factors:

(i) Sedentary lifestyle: lack of physical activity can contribute to overnutrition and obesity.

(ii) Substance Abuse: Alcoholism and drug addiction can interfere with nutrient absorption and appetite.

(f) Physiological Factors:

(i) Age: Infants, Children, pregnant women, and the elderly have higher nutritional requirements and are more vulnerable to malnutrition.

(ii) Metabolic and Genetic Disorders:

Conditions like metabolic syndrome and genetic disorders can effect nutrient metabolism and absorption.

* Major Consequences of Malnutrition:

(a) Health Consequences:

(i) Impaired Growth and Development: Stunted growth, wasting and developmental delays in children.

(ii) Weakened Immune System: Increased susceptibility to infections and illnesses.

(iii) Risk of Developing Chronic Diseases: Higher risk of developing Chronic diseases such as diabetes, heart disease and osteoporosis.

(iv) Mental Health Disorders: Cognitive impairments, learning difficulties and increased risk of mental health disorders.

(b) Economic Consequences:

(i) Reduced Productivity: Malnourished individuals are often less productive, which can affect economic growth and development which result in loss of human capital.

(ii) Increased Healthcare costs: Greater demand for healthcare services due to malnutrition-related illnesses and complications.

(c) Social Consequences:

(i) Educational Impact: Malnourished children may have lower school attendance and performance, limiting their future opportunities.

(ii) Intergenerational effects: Malnutrition in Pregnant women can lead to low birth weight and long-term health issues for their children.

Q3 (a) What is meant by the term double circulation ----?

* Double Circulation:

The heart has two sides from which the blood flows in and out twice per circuit. This circulation of blood twice per circuit is called double circulation. The right side of the heart pumps the deoxygenated blood from the body into the lungs. On the other hand, the left side of the heart pumps the oxygenated blood from the lungs into the body.

* Brief Description of Blood Flow in Double Circulation in Heart:

The heart is adapted to keep blood flowing in double circulation through its structure and function:

(a) Four Chambers: ⇒ The heart has four chambers – two atria and two ventricles. From the right atrium, the blood goes into the right ventricle through the tricuspid valve from where it further goes into the lungs.

⇒ The venae cavae carries deoxygenated blood from the body into right atrium.

⇒ Now, the lungs oxgenated the blood and take it into the left atrium. From the left atrium, oxygenated blood flows into the left ventricle through the bicuspid valve. Afterwards, blood flows from the left ventricle into the body, and aorta, the largest artery of the body, supplies it to the whole body.

⇒ This separation prevents the mixing of oxygenated and deoxygenated blood, ensuring efficient gas exchange, and nutrient delivery.

(b) Valves:

- Atrioventricular Valves (Tricuspid and Mitral): located b/w atria and ventricles, these valves prevent BACK flow of flood into the atria when the ventricles contract.
- Semilunar Valves (Pulmonary and Aortic): located at the exits of the right and left ventricles, these valves prevent backflow into the ventricles after blood is pumped out to the lungs and body.

(c) Muscular Walls:

- Right ventricle has a moderately thick wall to pump blood to the lungs, a shorter distance requiring less force.
- Left ventricle has a significantly thicker wall to generate the high pressure needed to pump blood throughout the entire body.

(d) Septum:

The interventricular septum is a thick, muscular wall that separates the right and left sides of the heart, preventing the mixing of oxygenated and deoxygenated blood, which is crucial for maintaining the efficiency of double circulation.

(e) Electrical Conduction System:

- Sinoatrial (SA) Node: The heart's natural pacemaker, located in the right atrium initiates electrical impulses that cause the atria to contract and push blood into the ventricles.
- Atrioventricular (AV) Node: located b/w the atria and ventricles, it delays the impulse, allowing the ventricles to fill with body before they contract.
- Bundle of His and Purkinje Fibers: These conduct electrical impulses throughout the ventricles, ensuring coordinated contractions that effectively pump blood out of the heart.

(f) Coronary Circulation: The heart itself is supplied with oxygen and nutrients by the coronary arteries. Efficient Coronary Circulation

ensures the heart muscle remains healthy and capable of sustaining its pumping action.

(g) Elastic Arterial walls: Major arteries, like the aorta, have elastic walls that help to maintain blood pressure and ensure continuous blood flow during the cardiac cycle, smoothing out the pulsatile output from the heart.

⇒These adaptations ensure that the heart can efficiently manage the separate pulmonary and systemic circuits, maintaining the continuous, unidirectional flow of blood essential for effective double circulation.

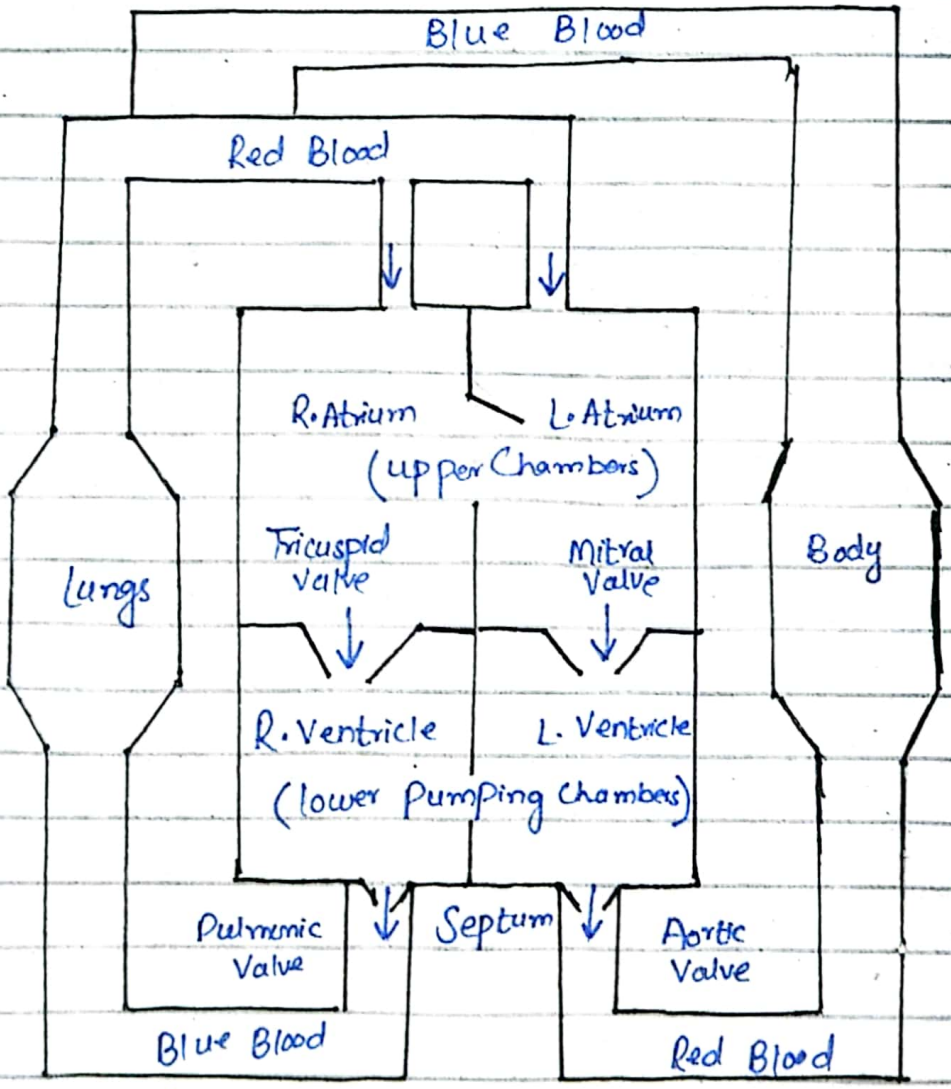


figure: Blood circulation in Heart:

Q3 (c) Comment the green house ----- ?

* Green House effect is a blessing:

=) The greenhouse effect can indeed be considered a blessing, as it plays a crucial role in maintaining the Earth's temperature and supporting life. Without the natural greenhouse effect, the Earth's surface would be too cold for most forms of life, with an average temperature around $-18°C$ ($0°F$) rather than the current average of about $15°C$ ($59°F$).

=) For example, water bodies like oceans and lakes would be frozen, drastically reducing the availability of liquid water, which is essential for life.

=) The greenhouse effect helps to trap some of the

Sun's heat in the atmosphere, creating a stable and habitable environment.

=> This natural process allows for a climate that can sustain a diverse range of ecosystems and supports the existence of life as we know it.

=> Plants, for example, rely on the greenhouse effect to maintain the temperatures necessary for photosynthesis, a process vital for producing the oxygen and food that many organisms, including humans, depend on.

=> Similarly, stable temperatures are crucial for the survival of many animal species that cannot withstand extreme cold.

=> Thus the greenhouse effect is integral to the continuation of life on Earth, providing the conditions necessary for biodiversity and ecological balance.

* Enhanced Green House Effect:

=> The enhanced green house effect is also known as "climate change or global warming". The EGHE refers to the increase in Earth's average due to the accumulation of greenhouse gases (GHGs) in the atmosphere from human activities. While the natural greenhouse effect is essential for maintaining life-supporting temperatures on the planet, the enhanced effect results from additional GHGs, such as carbon dioxide, methane, and nitrous oxide, released primarily through the burning of fossil fuels, deforestation and industrial processes.

=> This accumulation of GHGs intensifies the natural greenhouse effect by trapping more of the Sun's heat in the atmosphere, leading to a rise in global temperatures, commonly referred to as global warming.

=> The consequences of this enhanced green house effect

are far reaching, including more frequent and severe weather events, rising sea levels due to melting polar ice caps and disruptions to ecosystems and biodiversity.
For instance the increased temperature can lead to the loss of habitats for polar bears and other Arctic species, coral bleaching in oceans, and shifts in agricultural zones, affecting food production.

=> Efforts to mitigate the enhanced greenhouse effect involve reducing GHG emissions through transitioning to renewable energy sources, improving energy efficiency, reforestation and promoting sustainable practices. These actions are critical in limiting the extent of climate change and its impact on the environment and human societies.

★ Relation of EGHE with Global Warming

=> EGHE is directly linked to global warming, representing a key driver of this phenomenon. This effects arises when human activities such as burning fossil fuels, deforestation and industrial processes significantly increase the concentration of greenhouse gases in the Earth's atmosphere. These gases - primarily CO_2, methane CH_4 and nitrous oxide (N_2O) - trap more heat from the Sun than usual, amplifying the natural greenhouse effect.

=> As a result, the additional heat trapped by these elevated GHG levels leads to a rise in the Earth's average temperature, a process known as global warming.

=> This warming is evident in the observed increase in global surface temperatures, with an $\approx$ rise of $1.2^{\circ}C$ since pre-industrial times, largely attributed to human-induced

emissions (Intergovernmental PANEL on Climate Change, 2021). The resultant temperature increases disrupt climate systems, leading to more frequent and severe weather events, such as heatwaves, heavy precipitation, and droughts.

=) One significant consequence of global warming driven by the enhanced greenhouse effect is the melting of polar ice caps and glaciers, contributing to rising sea levels. This phenomenon results in coastal flooding and erosion impacting both human communities and natural ecosystems. Furthermore, the enhanced green house effect can trigger feedback mechanisms that exacerbate global warming. For instance as ice melts and reduces the Earth's albedo (reflectivity) more solar energy is absorbed by the ocean and land, which further increases global temperatures and leads to additional ice melt.