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Batch: 119

Part - IISection - AQuestion # 02

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Circulatory System: The Life-line of the Body

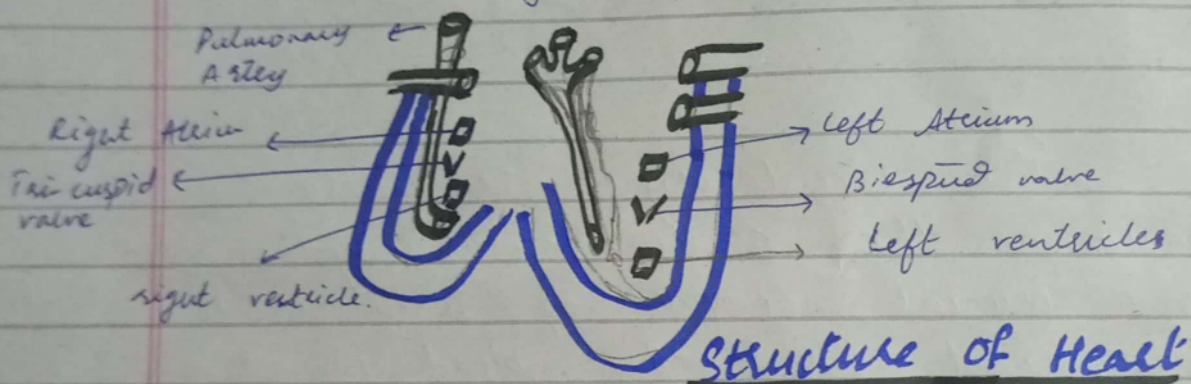
The circulatory system also known as the cardiovascular system, is a crucial network of blood vessels, the heart, and the blood that works tirelessly to transport essential substances throughout the human body. This extensive system ensures the distribution of oxygen, nutrients, hormones of oxygen, nutrients and other vital elements to every cell while removing waste products, thus maintaining the overall health and proper functioning of the body.

The Human Heart: The Pumping Power House

At the core of the circulatory system lies the human heart, a remarkable organ that functions as the central pumping power-

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house - situated slightly to the left of the chest, the heart is about the size of a closed fist and has four chambers - two atria and two ventricles. Its main role is to continuously pump oxygen-rich blood to the rest of the body and return oxygen-poor blood to the lungs for reoxygenation.



## Step 01 :

### Deoxygenated Blood Entry

The journey of blood begins with deoxygenated blood, low in oxygen content, entering the right atrium of the heart from the body's tissues through veins, which act as pathways. These veins merge into superior and inferior vena cava, transporting the deoxygenated blood from the upper and lower body, respectively.



## Step 02 : Artrial Contraction and ventricular Filling

As the right atrium contracts, it pushes the deoxygenated blood into the right ventricle through the tricuspid valve. The tricuspid valve ensures that the blood flows only in one direction, preventing backward flow and ensuring efficient circulation.

## Step 03 : Pumping oxygen-poor Blood to the Lungs.

Once the right ventricle is filled, it contracts, propelling the deoxygenated blood into the pulmonary artery, which leads to the lungs. This blood then receives a fresh supply of oxygen while releasing carbon dioxide through the process of respiration.

## Step 04 : Oxygen Rich Blood Return

The oxygen rich blood, now bright red in color, returns to the heart via the pulmonary veins, specifically into the left atrium.

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## Step 05: Artificial Contraction and Ventricular Filling (Again).

The <sup>left</sup> atrium contracts, pushing the oxygenated blood into the left ventricle through the mitral valve, also known as the bicuspid valve.

## Step 06: Oxygen-Rich Blood to the Body

The left ventricle, being the strongest chamber, contracts forcefully, pushing the oxygenated blood out of the heart through the aortic valve and into the ~~at~~ aorta, the body's largest artery.

## Step 07: Distribution of Oxygen and Nutrients

The aorta branches out into a network of arteries that carry oxygen-rich blood to every part of the body. The smaller arteries further divide into tiny capillaries, where oxygen, nutrients, and other essential substances are exchanged with the body's cells and tissues.



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## Step 08: Returning oxygen-poor blood

After supplying oxygen and nutrients, the now deoxygenated blood, ~~has~~ having given away its vital components, is collected through tiny venules and veins.

## Step 09: Return to the Heart

These veins converge and progressively increase in size as they return the blood back to the right atrium, completing the circulatory cycle.

In a nutshell, the heart continues to pump blood throughout the body non-stop, ensuring that every cell receives the necessary resources and that waste products are efficiently removed. This complex and vital process showcases the incredible role played by the human heart in maintaining overall health and sustaining life.

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## Carbohydrates :

### The Energy Providers

Carbohydrates are essential macro-nutrients, comprising carbon, hydrogen, and oxygen atoms, and serving as a primary source of energy for the human body. They are found in various foods, including grains, fruits, vegetables, and dairy products.

Carbohydrates come in different forms, and their classification is based on their chemical structure and how they affect blood sugar levels.

### ① Simple Carbohydrates: The Quick Fuel.

Simple carbohydrates are also known as sugars, consist of one or two sugar units, making them easy to digest and absorb quickly. They provide a rapid but short-lived burst of energy.

Food - ric



## Sources:-

Foods rich in simple carbohydrates include

- (i) Table sugar (sucrose).
- (ii) Fruit sugar (Fructose)
- (iii) Milk sugar (Lactose).

Processed sweets, sugary beverages, and many desserts are high in simple carbs.

## ② Complex Carbohydrates: The Sustained Powerhouse

Complex carbohydrates, on the other hand, are composed of multiple sugar units ~~like~~ linked together, forming longer chains. Due to their complex structure, they take longer to break-down and release energy gradually. This sustained energy release keeps you feeling fuller for longer and maintain stable ~~and~~ blood sugar levels.

## Sources:-

Food rich in complex carbs include:

- (i) whole grains: oats, brown rice, quinoa.
- (ii) Legumes: beans, lentils
- (iii) Starchy vegetables: Potatoes, sweet Potatoes.

### ③ Dietary Fibers : The Digestive Support

Dietary fiber is a unique type of carbohydrates that the human body can not fully digest - It passes through the digestive system relatively intact, providing bulk to the stool and promoting regular bowel movements.

Fiber plays a crucial role in maintaining digestive system and its health - they may help prevent constipation.

#### Sources:

It is found in fruits, vegetables, whole grains, nuts and seeds.

### ④ Added Sugars : The Sneaky Saboteurs

Added Sugars are simple sugars that manufacturers add to a wide range of processed foods to enhance taste and increase palatability. These sugars provide empty calories without any significant nutritional benefits.



## disadvantages:

Consuming excessive added sugars can lead to weight gain, dental issues, and an increased risk of chronic diseases like type 2 diabetes and heart disease. It's essential to limit the intake of foods and beverages high in added sugars.

## Balancing Carbohydrates

### Intake: The key to Optimal Health

Balancing carbohydrate intake is essential for overall health and well-being. While carbohydrates are a vital source of energy, it is essential to choose wisely. Opt for complex carbohydrates and dietary fiber from whole, unprocessed foods like fruits, vegetables, whole grains, and legumes.

Limit the consumption of food high in added sugars and simple carbohydrates to maintain a balanced diet and support your body's energy needs while promoting good health.

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## Water Pollution: Threatening Aquatic Environments

Water pollution refers to the contamination of water bodies like lakes, rivers, oceans, and groundwater, making the water harmful or unsuitable for various uses including drinking, agriculture, and supporting aquatic life. This environmental concern arises from human activities and natural processes, impacting ecosystems, human health, and overall biodiversity.

### Types of Water Pollution:

#### Unraveling the Complexity

#### (1) Point Source Pollution: The Culprits Revealed

Point-source pollution refers to contamination from specific, identifiable sources. These sources discharge pollutants directly into water bodies.



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through pipes, channels, or outlets, making their origin easily traceable.

### Examples :-

Examples include industrial facilities, sewage treatment plants, and manufacturing units that release pollutants directly into rivers, lakes, or oceans.

## (2) Non-point Sources Pollution:

### The Elusive Contaminators

Non-point-source pollution is more challenging to pinpoint as it arises from diffuse and widespread sources. Rainwater runoff carries pollutants like fertilizers, pesticides and sediment from agriculture fields, urban areas, construction sites, and roads into water bodies.

This type of pollution presents a significant challenge in managing and controlling its diverse origins.

### ③ Nutrient Pollution: Fueling Algal Havoc

Nutrient pollution occurs when water bodies receive excessive nutrients, primarily nitrogen and phosphorus.

These nutrients stem from various sources, including agricultural runoff and sewage discharge. The abundance of nutrients fuels the growth of harmful algal blooms, leading to eutrophication and oxygen depletion in water, severely impacting aquatic ecosystems.

### ④ Toxic Chemicals: Silent Peril

Toxic chemicals in water are a grave concern, stemming from industrial discharges, improper waste disposal, and agricultural runoff. These chemicals pose serious threats to aquatic life and can be bioaccumulative in the food chain, ultimately affecting human health when contaminated water or fish are consumed.



## Causes of Water Pollution:

### Tracing the Origins

#### ① Urbanization and Construction: paving the path for pollution

Rapid urbanization and construction lead to increased water pollution through increased runoff from impermeable surfaces. Construction sites also contribute to sediment and debris entering water bodies.

#### ② Agricultural Practices: fertilizers and Pesticides Gone ~~away~~ Away

The use of fertilizers and pesticides in agriculture contributes to water pollution through runoff, carrying excess nutrients and chemicals into water bodies.

#### ③ Inadequate Waste Management: The looming threat

Improper waste disposal and

a lack of adequate waste management infrastructure result in solid waste, plastics, and debris finding their way into water bodies.

### ④ Industrial Activities: Releasing Unwanted Substances

Industries release various pollutants, including chemicals and heavy metals, directly into water bodies through their discharge.

### ⑤ Deforestation and Land Degradation: Eroding the Balance

Deforestation and land degradation contribute to soil erosion, increasing sediment runoff and negatively impacting water quality.

### ⑥ Climate Change: Altering Water Patterns

Climate change can influence water quality and availability, affecting water pollution levels in different regions.

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## ⑦ Population Growth : Straining Water Resources

The increasing population puts additional pressure on water resources and waste management systems, exacerbating water concerns.

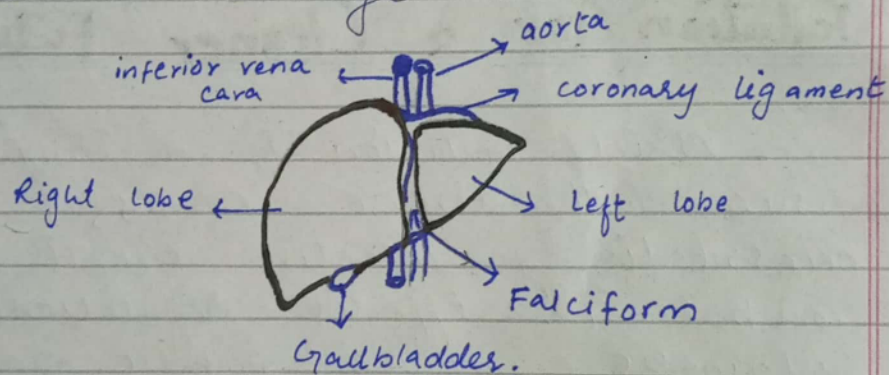
## Conclusion : Addressing Water Pollution For a Cleaner Future

Water pollution is a complex issue with diverse causes, necessitating collective efforts to combat it. Effective regulations, sustainable practices, public awareness, and ~~so~~ community involvement are key to protecting our water resources and preserving the delicate balance of aquatic ecosystems for the well-being of all living beings.

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The liver is often referred to as the **chief chemist** of the body due to its remarkable and multifunctional role in various chemical processes that are vital for overall health and well-being. As one of the largest and most essential organs, the liver performs an array of complex functions, impacting metabolism, digestion, detoxification, and nutrient storage.



## Structure of Liver

### 1) Metabolism Regulation

The liver plays a crucial role in regulating the body's metabolism. It is involved in the breakdown of carbohydrates, proteins and fats, converting them into energy or storing them for future use. Through a process called gluconeogenesis, the liver can



produce glucose from non-carbohydrate sources when the body needs additional energy.

## 2) Detoxification

It is one of the liver's primary responsibilities. It filters, and removes toxins, harmful substances, drugs, and metabolic byproducts from the bloodstream. These toxins are then converted into less harmful compounds and eliminated from the body through urine or bile.

## (3) Bile Production

The liver produces bile, a greenish-yellow fluid that aids in digestion. Bile contains 'bile acids', which help emulsify fats in the small intestine, breaking them down into smaller particles that are easier to digest and absorb.

## (4) Nutrient Storage

The liver acts as a storage facility for various nutrients. It stores and releases glucose to help regulate blood sugar levels.

and ensures a steady supply of energy between meals. Additionally, the liver stores vitamins, such as;

- (i) Vitamin A
- (ii) Vitamin D
- (iii) Vitamin B12

Es minerals like iron and copper.

### (5) Protein Synthesis

The liver is involved in the synthesis of many essential proteins that the body needs for various functions. It produces proteins like albumin, which helps maintain blood volume and transport substances, and clotting factors that play a crucial role in blood coagulation.

### (6) Cholesterol Regulation

The liver is responsible for regulating cholesterol levels in the body. It synthesizes cholesterol and also removes excess cholesterol from the bloodstream, helping to maintain a healthy balance.



## (7) Immune Function

It also plays a role in the body's immune response. It helps remove bacteria and other foreign particles from the bloodstream, contributing to the body's defense against infections.

## (8) Storage of Glycogen

The liver stores glycogen, a complex carbohydrate, which can be broken down into glucose when the body needs an immediate energy supply, such as during intense physical activity or fasting.

The liver's vast range of functions and its ability to perform multiple chemical processes make it a true 'Chief Chemist' of the body.

Maintaining liver health through a balanced diet, regular exercise, and avoiding excessive alcohol and drug consumption is essential to support its optimal functioning and overall wellbeing.

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# Question # 04

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(a)

## Artificial Intelligence: The Revolutionary Force

AI has undoubtedly brought about a revolutionary transformation across the globe. Its impact spans various sectors, changing the way we live, work, and interact with technology. This advanced technology has surpassed traditional computing capabilities, enabling machines to simulate human intelligence & perform tasks that were once deemed impossible.

## Enhanced Efficiency: Powering Productivity

One of the most significant ways AI has revolutionized the world is by enhancing efficiency and productivity across industries. AI-powered automation has streamlined processes, reducing human error and enabling faster and more accurate data analysis. That is why tasks



that used to take hours or days can now be completed in a matter of minutes, leading to increased productivity and cost-effectiveness.

## Smarter Decision-Making:

### The AI Advantage

AI's ability to analyze vast amounts of data quickly has revolutionized decision making processes. Machine learning algorithms can recognize patterns, identify trends, and predict outcomes with remarkable accuracy. This empowers businesses and organizations to make informed decisions, optimize operations, and gain a competitive edge in their respective industries.

## Healthcare Advancements:

### Transforming Lives

In the healthcare industry, AI has ushered in a new era of diagnostics, treatment, and patient care. AI-powered medical imaging systems can detect

diseases and abnormalities with exceptional precision, while predictive analytics aid in early diagnosis and intervention. AI also enables the development of personalized treatment plans and drugs discovery, significantly improving patient outcomes & transforming lives.

### Autonomous Machines: Redefining Industries

AI has led to the development of autonomous machines and vehicles, reshaping various industries. Self-driving cars, drones, and Robotics have the potential to revolutionize transportation, logistics, and manufacturing, offering more efficient and safer operations.

### AI in Education: Personalized Learning

In the field of education, AI has revolutionized the learning experience by enabling personalized learning paths for students.



Adaptive learning platforms can tailor educational content to individual needs and learning styles, fostering better engagement and comprehension.

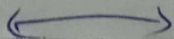
There are many ~~others~~ more such as:

- Ethical & Societal Implications: Addressing challenges.
- Natural language processing: Bridging communication gaps
- Personalization and User Experience: Tailored to perfection.

are also important features of AI.

## Conclusion: Embracing the AI Revolution

AI has undeniably revolutionized the world, offering tremendous opportunities for progress & innovation. Embracing AI's potential while addressing its challenges responsibly is crucial to harnessing this revolutionary force for the betterment of society and shaping a promising future for generations to come.



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## Water Scarcity: Unraveling the Crisis

Water scarcity is a pressing global issue that demands immediate attention. As the proverbial saying goes, we often fail to realize the value of water until it becomes scarce. It affects communities, ecosystems, and economies, underscoring the need for proactive measures to address this critical challenge.

### (1) Water Conservation: A Drops-to-Oceans Approach.

#### Rainwater Harvesting:

Promoting rainwater harvesting at both individual & community levels can help capture and store rainwater for various uses, reducing the burden on freshwater resources.

#### Efficient Water Use:

Encouraging efficient water use practices in households,



agriculture, and industries can significantly reduce wastage and optimize water consumption.

## (2) Sustainable Agriculture: Irrigation Innovations

### Drip Irrigation:

Implementing drip irrigation systems can deliver water directly to plant roots, minimizing water loss and maximizing agricultural productivity.

### Crop Selection:-

Promoting the cultivation of drought-resistant & water-efficient crops can mitigate the impact of water scarcity on agricultural yields.

## (3) Water Recycling and Reuse:

### Closing the Loop

### Greywater Recycling:

Treating and reusing greywater from domestic activities like washing & bathing can reduce freshwater demand for non-potable use.

## (4) Reforestation and watershed

### Management: Protecting water Resources

#### Reforestation Efforts

Planting trees and restoring degraded lands can improve water infiltration & recharge aquifers, safeguarding vital water sources.

#### Watershed Protection

Implementing comprehensive watershed management plans can help preserve water quality & quantity in rivers and lakes.

## (5) Public Awareness and Education:

### A call to Action

#### Community Engagement

Raising awareness about water scarcity & its impact on communities can foster a sense of responsibility & inspire collective action.



## Water-Education programs:

Integrating water conservation education into schools curricula can instill sustainable water practices in the younger generation.

## (6) Water Pricing & Incentives:

Encouraging Responsible Usage

Economic Instruments

Implementing water pricing mechanisms that reflect its true value can encourage responsible water usage & efficient allocation.

## Incentive programs

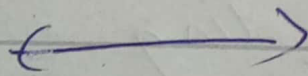
Introducing incentives for water-efficient technologies and practices can motivate individuals and industries to adopt sustainable water management practices.

## Conclusion: toward a water-secure future

Addressing water scarcity requires a multifaceted approach that combines conservation, innovation

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and public engagement. By adopting these measures, governments, communities and individuals can work together to ensure the sustainable use and preservation of this precious resource. With ~~connected~~ mutual and concerted efforts and thoughtful policies, we can build a water-secure future for generations to come, where the well never runs dry.





(C)

## Vaccines : Empowering Immunity

Vaccines are powerful tools in the fight against infectious diseases. They are biological preparations designed to stimulate the immune system to recognize and remember specific pathogens, such as bacteria or viruses, without causing the actual disease. By introducing harmless or weakened versions of these pathogens into the body, vaccines enable the immune system to build immunity, protecting individuals from future infections.

### Types of Vaccines

#### 1) Live Attenuated Vaccines : A weakened strike

#### Definition

These vaccines contain weakened, but still alive, forms of the disease-causing micro-organism.

## How They Work :

Live attenuated vaccines replicate in the body, eliciting a robust immune response similar to that of natural ~~to~~ infections. The immune system learns to recognize and fight off the weakened pathogen, creating long-lasting immunity.

## Examples :

- (i) Measles
- (ii) Mumps
- (iii) Rubella (MMR).
- (iv) Oral Polio vaccine (OPV).
- (v) Varicella (chickenpox).

## (2) Inactivated Vaccines : Tamed

### Intruders

### Definition

These vaccines contain killed or inactivated versions of the pathogen.

### How they work :

Inactivated vaccines can-not replicate in the body.



They stimulate the immune system to recognize the antigens present on the pathogen's surface, prompting an immune response & the production of antibodies.

### Examples:-

- (i) Inactivated Polio vaccine (IPV)
- (ii) Hepatitis A
- (iii) Influenza (Flu vaccine).

## (3) mRNA Vaccines: Unlocking

### Genetic Instructions

#### Definition

mRNA vaccines deliver synthetic genetic material (messenger RNA) that provides instructions to cells to produce a specific viral protein.

#### How they work:

Once the protein is produced, the immune system recognizes it as foreign and mounts a defense, generating immunity against the virus.

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## Examples:

(i) COVID-19 vaccines  
Such as Pfizer - BioNTech  
& Moderna vaccines.

- There are many other types such  
as:

(4) Viral Vector vaccines: Hitchhiking  
Protection

(5) DNA vaccines: Gene-Instructional  
Immunity

(6) Subunit, Recombinant, & Conjugate  
vaccines: Antigen-focused  
precision

## Conclusion:

### Strengthening Immune Defenses

Vaccines have played a crucial role in preventing infectious diseases and saving millions of lives worldwide. By employing various techniques and technologies, scientists continue to innovate & develop new & improved vaccines to combat emerging threats & protect



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global health. Public health efforts in vaccination remain essential in achieving wide spread immunity and safeguarding communities from preventable diseases.

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Section - B

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Question # 06

(a)

Solution:-

Let 'x' be the current age of the father.

Five years ago, the father's age would have been

$$x - 5 \text{ years}$$

5-years ago, the son's age would have been

$$30 - 5 \text{ years}$$

(as the son is currently 30-years' old).

According to the statement given, 5-years ago Father's age was thrice the age of his son:

$$(x - 5) = 3 \times (30 - 5)$$

Now, let's solve for 'x':

$$\Rightarrow x - 5 = 3(25)$$

$$x - 5 = 75$$

+

add 5 to both sides to



isolate 'x' -

$$x = 75 + 5$$

$$x = 80$$

So, the current age of the Father is 80-years old.

### (b) Solution

Let 'x' be his income.

We know that the income tax is calculated as 10% of the income so,

$$\text{Income tax} = 0.10 \times \text{income}$$

Now, ~~let us~~ ~~the~~ ~~income~~ ~~tax~~ ~~is~~ ~~1500~~ ~~for~~ ~~the~~ ~~man~~.

Income tax is RS-1500:

$$1500 = 0.10 \times x$$

$$x = 1500 / 0.10$$

$$x = 150,000$$

So, the man's income is 150,000

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(C) is original

Step 1: Find the sum of the original 6 numbers  
←→

(d)  
(i) 8, 4, 32, 7, 5, 2

We can notice that each number, except for the first & last, can be obtained by subtracting 3 from the previous numbers & then squaring the results.

(ii) 17, 19, 23, 29, 31, 37

The sequence represents a series of consecutive prime numbers. To find the missing number, we need to identify the next prime number after 23.

So, the next number is 29.



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# Question # 07

(a)

Solution:-

As,

$$\text{Circumference} = \pi \times \text{diameter}$$

So,

$$\text{Circumference} = \pi \times 7 \text{ meters}$$

Let's calculate it-

$$\begin{aligned} \text{Circumference} &= 3.14159 \times 7 \text{ meters} \\ &= 21.99115 \text{ meters} \end{aligned}$$

So, the distance a person will walk around the table is approx., 21.99 meters.

(b)

Let :

B = Total no. of Boys

x = Total no. of Girls.

$$18 = (3/4) \times B$$

$$B = 18 \times (4/3)$$

$$B = 24$$

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Now,

$$B = \left(\frac{2}{3}\right) \times (B + x)$$

$$24 = \left(\frac{2}{3}\right) \times (24 + x)$$

Now, we can solve for  $x$ .

Multiplying both sides by  $\left(\frac{3}{2}\right)$   
to isolate  $(24 + x)$ :

$$24 + \cancel{6}x = 24 \times \left(\frac{3}{2}\right)$$

$$24 + x = 36$$

$$x = 36 - 24$$

$$x = 12$$

So, the no. of girls in the  
class is 12.

(C)

**IQ vs. EQ: Unraveling the  
Intelligence Quotient &  
Emotional Quotient.**

(1) Def :-



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## IQ (Intelligence Quotient):

Measuring cognitive abilities.

## EQ (Emotional Quotient)

Gauging Emotional Intelligence.

### Nature

(2) ~~Points~~ :-

**IQ** = Largely inherited and stable over time

**EQ** = Develops & Improves with Effort & Experience.

(3) Focus :-

**IQ** = Analyzes logical & Analytical Thinking

**EQ** = Evaluates Emotional Awareness & Social Skills.

### (4) Factors Affecting IQ

(i) **Genetics** = Inherited Genes play a significant role.

(ii) **Environment** = Quality of education,

nutrition & stimulating experiences.

(iii) Health =

Physical & mental well-being influenced cognitive function.

(iv) Socioeconomic Status =

Access to resources & opportunities.

(5) Factors Affecting EQ

(i) Self-awareness =

Understanding one's emotions & reactions.

(ii) Empathy = Sensing & understanding other's emotions.

(iii) Communication = Effective expression & active listening.

(iv) Stress Management = coping with emotional challenges.