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Hydrogen Fuels -Special



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Hydrogen Education: A Must for Every School Curriculum

As the world accelerates toward a net-zero carbon future, the role of hydrogen fuel has moved from the fringes of scientific speculation to the center stage of global energy strategy.

Green hydrogen, in particular, offers a powerful alternative to fossil fuels – clean, efficient, and versatile. But while nations and industries invest billions in hydrogen infrastructure and innovation, one critical piece of the puzzle remains under-addressed: education.

If hydrogen is to be the fuel of tomorrow, we must start preparing the minds of today. Schools and colleges need to embed hydrogen science, technology, and its real-world applications into their curriculum. The awareness about hydrogen is still low among students, even among those pursuing science and engineering. This knowledge gap threatens to slow down the progress India and the world hope to make in adopting hydrogen as a key component of a clean energy economy.

Why should this matter?

Because the hydrogen economy isn't just about generating and using hydrogen – it spans a vast landscape of disciplines: electrochemistry, materials science, nanotechnology, storage solutions, transportation, infrastructure design, and environmental impact assessments. Without a strong educational foundation, future engineers, researchers, policymakers, and entrepreneurs will struggle to contribute meaningfully.

India's National Hydrogen Mission aims to make the country a global hub for green hydrogen production and export. To achieve this vision, we need more than industrial policy – we need a human capital policy. It is time to encourage students to explore careers in clean hydrogen research and make them stakeholders in the global clean energy revolution.

We urgently need:

Hydrogen modules in science textbooks at the secondary school level.

Dedicated undergraduate and postgraduate courses on hydrogen fuel technologies.

The future of hydrogen begins not in reactors or pipelines, but in the minds of the young.

L.Krishnamoorthy,
scienceparkmagazine@gmail.com

Meet the Indian Minds Behind Science

Prof Shankar Agharkar 18 Nvember 1884 - 01 Septembr 1960

Prof Agharkar's Contributions to Science

Agharkar obtained his PhD degree (1919) from the University of Berlin, Germany. His specialization was in Plant Morphology.



Prof. Shankar Agharkar played a significant role in building scientific institutions as part of the freedom struggle and fought against the British to secure scholarships for bright Indian students.

Shankar Purushottam Agharkar was an Indian Morphologist with a specialization in Plant Morphology.

He explored the biodiversity of the Western Ghats where he came across a species of freshwater jellyfish.

This leading botanist was the Founder and Director of the Maharashtra Association for the Cultivation of Science. The institute ARI, Pune has been named after him. He is one of the groomed and trained patriots by Dr. Ashutosh Mukharjee to fight against colonial science.

He went to IACS for his studies and took inspiration to do science for the nation from the same. He had an idea of replicating IACS, a purely national scientific institution, in Maharashtra; so, he established MACS in Pune. His wife mortgaged her 'Mangalsutra' to get money to establish an institution; such was a sacrifice.

Later C.V.Raman recommended him for the Ghosh professorship at Calcutta (now known as Kolkata)

Fun Physics



1. Touch the inside of 200°C hot oven you burn yourself. But when the 1800°C white hot sparks from a sparkler hit your skin, you are okay. Why?



Touching the inside of a 200°C oven burns you because it transfers a large amount of heat to your skin. However, 1,800°C white-hot sparks from a sparkler do not burn you significantly because they contain very little heat energy despite their high temperature.

Heat Energy vs. Temperature:

Temperature measures how hot something is.

Heat energy depends on temperature, mass, and specific heat capacity “Even though sparkler sparks are much hotter than the oven, they have very little mass and therefore carry very little heat energy.

Thermal Conductivity & Contact Time

The oven’s metal walls have high thermal conductivity and a large heat reservoir, so they transfer heat rapidly and continuously.

Sparkler sparks are tiny bits of burning metal that cool down quickly before they transfer much heat to your skin.

Heat Capacity & Mass Matter:

The oven’s walls store and release a lot of heat energy.

Sparkler sparks, being tiny, don’t have enough heat to cause a burn before they cool down.



The oven burns you because it stores and transfers a large amount of heat over time.

The sparkler sparks are extremely hot but too small to transfer enough heat to cause burns. This is the same reason why molten metal or boiling oil burns much more than a spark of the same temperature—it has more mass and energy to transfer

This is the same reason why molten metal or boiling oil burns much more than a spark of the same temperature—it has more mass and energy to transfer

2. Relative to the ground, an airplane gains speed when it encounters wind from behind and loses speed when it encounters wind head on.

When it encounters wind at a right angle to the direction it is pointing, its speed relative to the ground below is

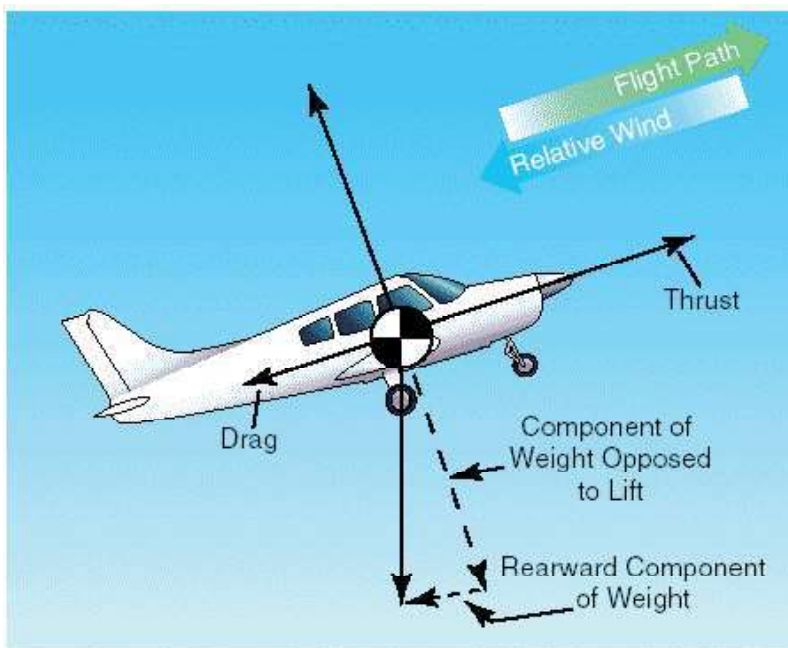
- a. increase b. Decreases c. Is the same as if there were no wind

The correct answer is (c)

When an airplane encounters wind at a right angle to its direction (a crosswind), its speed relative to the ground is affected by vector addition of the airplane's velocity and the wind velocity.

Understanding the Vector Addition

The airplane has its own speed, called airspeed, which is the speed of the plane relative to the air.



2. The wind has its own speed and direction.

3. When the wind is at a right angle (perpendicular) to the plane's direction, it does not slow down or speed up the plane along its original path. Instead, it adds a new velocity component at a right angle

4.The total speed of the airplane relative to the ground is found using the Pythagorean theorem.

Since this results in a larger value than the airplane's original speed, the airplane's speed relative to the ground increases.

Airplane Crosswind Landings



When landing, if a plane encounters a crosswind, the pilot must adjust the aircraft's angle (a technique called crabbing) to ensure it lands on the runway safely. "The crosswind affects the plane's ground speed, making navigation adjustments necessary.

If a boat is moving straight across a river but the current is flowing perpendicular to its direction, the boat's overall speed relative to the riverbank increases due to the combined effect of its forward motion and the current.

Walking in a Strong Wind

If you're walking forward and there's a strong crosswind blowing from the side, you'll feel like you're being pushed diagonally. Your actual speed relative to the ground is faster than your walking speed alone



Cyclists Riding in Crosswinds



A cyclist moving in one direction with a side wind feels the force pushing them sideways. Their actual ground speed is slightly higher because the wind adds an extra velocity component.

Drones Flying in Windy Conditions

When flying a drone, if there's wind blowing from the side, the drone's ground speed is greater than its intended airspeed because it combines its forward movement with the wind's velocity.



SAT – Scholastic Aptitude Test



1. The population of a city increases by 5% in the first year and 10% in the second year. If the current population is 41,000, What will be the population in 2 years.

- a. 47,150 b. 47,355
c. 48,000 d. 46,835

$$41,000 \times \frac{5}{100} = 2050$$
$$\Rightarrow 41,000 + 2050 = 43050$$

$$43050 \times \frac{10}{100} = 4305$$
$$\Rightarrow 43050 + 4305 = 47355$$

In 2 years, the population is 47355

So the answer is (b)

2. The cost price of a shoe is Rs.1800 and its selling Price is Rs.2400. What is the profit percentage.

- a. 25% b. 33.34%
c. 40% d. 30%

$$\text{Profit} = 2400 - 1800 = 600$$

$$\text{Profit \%} = \frac{\text{Profit} \times 100}{\text{C.P}} = \frac{600 \times 100}{1800} = 33.33\%$$

So the answer is (b)

3. Akash was gifted Rs.1500 on his birthday. If he invests in a scheme with a simple interest rate of 12%, how much profit will he make in 4 years.

- a. Rs.2220 b. Rs.1600
c. Rs.720 d. Rs.800

Simple interest

$$= \frac{PRT}{100} \Rightarrow \frac{1500 \times 12 \times 4}{100} = \text{Rs.}720$$

Profit gained = Interest gained

So the answer is (c)

4. Adam has a lot of tennis balls. $\frac{3}{16}$ of the tennis balls are red coloured tennis balls, $\frac{3}{5}$ of the tennis balls are green coloured balls and the remaining 85 are blue coloured balls. Find the total number of tennis balls he has.

- a. 200 b. 400 c. 600 d. 800

Total number of balls = x

Number of red coloured balls = $\frac{3}{16}x$

Number of green coloured balls = $\frac{3}{5}x$

Adding the number of red and green coloured balls =

$$\frac{3}{16}x + \frac{3}{5}x = \frac{63}{80}x$$

$$\text{Remaining balls} = x - \frac{63}{80}x = \frac{17}{80}x \quad (1)$$

$$\text{Number of balls remaining} = 85 \quad (2)$$

$$\text{Equating 1 \& 2 we get, } \frac{17x}{80} = 85$$

$$x = \frac{80 \times 85}{17} = 400$$

Total number of balls = 400,

So the answer is (b)

5. Venkat, Santanu and Siva can do a piece of work in 10, 15 and 30 days respectively. In how many days can Santanu do the work if Venkat and Siva join him on every 4th day?

- a. 10 days b. 15 days
c. 20 days d. 25 days

$$\text{Santanu's 1 day work} = \frac{1}{15}$$

$$\text{Santanu's 3 day work} = 3 \times \frac{1}{15} = \frac{1}{5}$$

Venkat, Santanu and Siva's combined work in 1 day

$$= \frac{1}{10} + \frac{1}{15} + \frac{1}{30} = \frac{6}{30} = \frac{1}{5}$$

Amount of work completed by Santanu in the 3 days = $\frac{1}{5}$

Amount of work completed by Santanu plus Amount of work completed by the three of them

$$\text{Work done in 4 days} = \frac{1}{5} + \frac{1}{5} = \frac{2}{5}$$

Let total work be x

Whole work completed by them

$$= \frac{2}{5}x = 4 \text{ by them in 4 days.}$$

Where x is the total work and $\frac{2}{5}x$ means

$\frac{2}{5}$ th part of total work (x)

$$2x = 20, \quad x = 10$$

Altogether they finish the work in 10 days. **So the answer is (a)**

6. A man can cover 7 metres per sec. How many kilometres will he cover in 2 hrs ?

- a. 25.2 km b. 50.4 km
c. 37.8 km d. 140 km

$$\text{M/sec to Km/hr} \Rightarrow 7 \times \frac{18}{5} = 25.2 \text{ km/hr}$$

In two hours, he will cover $25.2 \times 2 = 50.4 \text{ km}$

So the answer is (b)



SAT – Scholastic Aptitude Test



7. Two pipes A and B can fill a tank in 2 and 3 hrs respectively operating alone. If both the pipes work together, find the time required to fill the tank.

- a. 1.2 hrs b. 1.3 hrs
c. 1.4 hrs d. 1.5 hrs

If two pipes A and B can fill a tank in x and y hrs respectively, the time taken for both of them operating simultaneously is given by

$$\Rightarrow \frac{1}{x} + \frac{1}{y} = \left[\frac{x+y}{xy} \right] \text{ hrs}$$

$$\frac{1}{2} + \frac{1}{3} = \frac{3+2}{6} = \frac{5}{6} \Rightarrow \frac{6}{5} \text{ hrs}$$

The time required to fill the tank is 1.2 hrs. So the option is (a)

8. The ratio of A and B's share is 2:3. If the total amount is Rs.1200, how much money does B have

- a. Rs.400 b. Rs.480
c. Rs.600 d. Rs.720

Let the total amount be $2x + 3x = 5x$

$$\text{B's share} = 1200 \times \frac{3}{5} = 720$$

So, B's share is Rs.720.

Hence the answer is (d)

9. What must be subtracted from the largest 3 digit number so that it can be divided by 33

- a.7 b.8 c.9 d.10

Largest 3 digit number = 999

Largest 3 digit number divisible by 33

$$= \frac{999}{33} = 30 \text{ remainder } 9$$

So 9 must be subtracted from 999 so that it is divisible by 33. **Option C**

10. The area of the rectangle is 864m^2 . If the length of the rectangle and its perimeter are in the ratio of 1: 5

What is its breadth?

- a.12 m b.24 m
c.36 m d. 40 m

Perimeter : length = 5 : 1

$$\frac{l}{2(l+b)} = \frac{1}{5} \Rightarrow 5l = 2l + 2b, 3l = 2b, b = \frac{3l}{2}$$

$$\text{Area of rectangle} = l \times b = 864\text{m}^2$$

Substituting b in the area formula ,

$$\text{we get} = l \times \frac{3l}{2} = 864$$

$$3l^2 = 1728, l^2 = \frac{1728}{3} = l^2 = 576, l = 24\text{m}$$

$$24 \times b = 864, b = \frac{864}{24} = 36\text{m}$$

So the answer is (c)



Every Day Science



1. Which of the following acids is used in car batteries

- a. Nitric acid
- b. Sulphuric acid
- c. Hydrochloric acid
- d. Carbonic acid

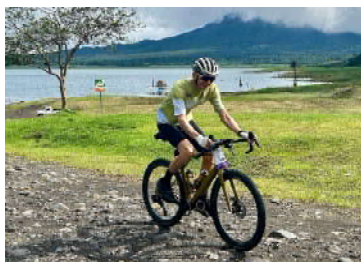


Sulfuric acid

(H₂SO₄) is the acid used in car batteries. It's also known as "battery acid"

2. When a bicycle travels on a rough surface its speed

- a. Increases
- b. Decreases
- c. Remains the same
- d. None



d. None

When a bicycle travels on a rough surface, its speed decreases due to friction

3. Which among the following is called the "Metal of future"

- a. Steel
- b. Copper
- c. Iron
- d. Titanium

it is comparatively more useful and efficient compared to steel, copper, iron

4. The term "Cloning is related with

- a. Environment
- b. Space Technology
- c. Genetics
- d. Trade

5. Which of the following is the hardest substance in the human body

- a. Bone
- b. Nail



- c. Dentine
- d. Enamel

Tooth enamel is made up of crystalline Calcium Phosphate. Tooth enamel is the hard outer surface of the tooth that protects it from tooth decay.

6. The colour of the star depends upon its

- a. Distance from sun
- b. Radius

c. Density

d. Surface temperature

The color of a star is primarily determined by its surface temperature, with hotter stars appearing bluer and cooler stars appearing redder.



7.The function of a fuse wire in a circuit is

a. Minimize the energy loss

b. Prevent the

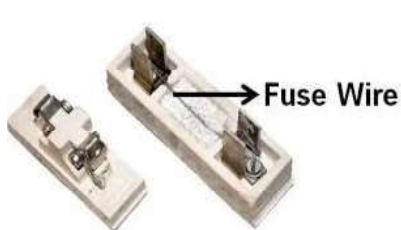
excessive flow of current

c. Maintain

the voltage constant

d. Increase or decrease the current according

to the requirement.



To act as a safety device by breaking the circuit and stopping the flow of current when the current exceeds a certain level.

8.These are found in lady's fingers

a. Phosphorus

b. Vitamin A

c. Vitamin C

d. All the above



Lady finger contains nutrient-rich contents, vitamins C, A and K.

9.Quinine medicine is obtained from



a. Eucalyptus plant

b. Aconite plant

c. Cinchona plant

d. Money Plant

Quinine is a drug that comes from the bark of the cinchona tree. It is used to treat malaria, an infection caused by the bite of a mosquito.

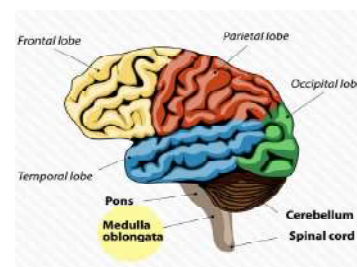
10.Which part of the brain controls respiration

a. Cerebellum

b. Cerebrum

c. Medulla

d. Cerebral cortex



The part of the brain that controls respiration, a vital involuntary function, is the medulla

Answers - Everyday Science

1 – a, 2 – a, 3 – d, 4 – d, 5 – a
6 – d, 7 – b, 8 – d, 9 – c, 10 – c

Elements of the Month

Hydrogen

Atomic Number: 1

Atomic Symbol: H

Atomic Weight: 1.0079

Electronic Configuration: $1s^1$

Oxidation States: 1, -1

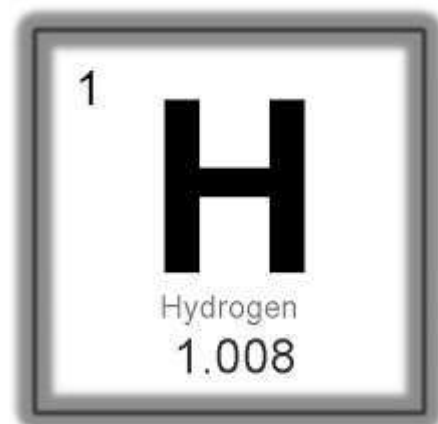
Atomic Radius: 78 pm

Melting Point: -259.34°C

Boiling Point: -252.87°C

Elemental Classification: Non-Metal

At Room Temperature: Colorless & Odorless Diatomic Gas



Hydrogen is a colorless, odorless and tasteless gas that is the most abundant element in the known universe. It is also the lightest (in terms of atomic mass) and the simplest, having only one proton and one electron

Hydrogen comes from Greek meaning “water producer First isolated and identified as an element by Cavendish in 1766

Hydrogen is the first element of the periodic table as its atomic number is one, which means it has only one electron in its atom and thus only one electron is present in its outermost shell. The placement of elements in the periodic table is based on their electronic configuration.

This structure is similar to that of alkali metals (ns^1) which have 1 electron in their outermost shell. It can attain the noble gas configuration of helium, by accepting one electron. This character is very much similar to that of the halogen family ($ns^2 np^5$) which are also short of one electron to complete the octet of electrons in their shells.

When hydrogen loses an electron and forms a cation, it resembles alkali metals but when it gains an electron and becomes a uni-negative ion it shows similarity to halogens.

Moving on to the compound formation, hydrogen forms oxides, halides and sulphides resembling the alkali metals, but unlike the alkali metals it has a very high ionization enthalpy, and so it lacks metallic characteristics under normal conditions

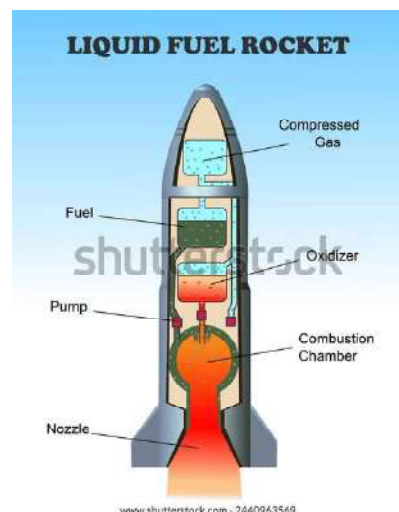
Hydrogen is most often classified as a non-metal, as it has many of the non-metal properties. This is a gas at room temperature.

Hydrogen is the simplest and most abundant element in the universe. It is composed of a single proton and a single electron. Liquid hydrogen is used in the study of the superconductors and makes an excellent rocket fuel when combined with liquid oxygen. Numerous compounds are formed by hydrogen combined with other elements.

In the glass industry hydrogen is used to make flat glass sheets as a protective atmosphere. It is used as a flushing gas in the electronics sector during the manufacture of silicon chips. The low hydrogen density made it a natural choice for one of its first practical applications-filling balloons and airships.

In the human body the most important hydrogen function is to keep you hydrated. Water consists of hydrogen and oxygen, and is absorbed by the body's cells. Therefore, it is a crucial element that is used as a fuel, military weapons, etc., not in our body.

The vast majority of hydrogen produced industrially today is made either from treatment of methane gas with steam or in the production of "water gas" from the reaction of coal with steam. Most of this hydrogen is used in the Haber process to manufacture ammonia.



Did you know

The first element in the periodic table is Hydrogen, and it's also the main fuel in stars like our Sun

Women in Science

Carina Radford

Carina Radford, a prominent partner at White & Case LLP, was born in December 1975.

Recognized in the Projects and Partnerships category for her work on the US\$8.4 billion NEOM Green Hydrogen Project—the world's largest green hydrogen facility.



Carina Radford is a distinguished legal expert in the energy sector, particularly known for her contributions to hydrogen and renewable energy projects. As a partner at White & Case LLP in London, she plays a pivotal role in the firm's Project Development and Finance Group and serves on its global Executive Committee.

Career Highlights:

NEOM Green Hydrogen Project:



Carina led the legal advisory for the US\$8.4 billion NEOM Green Hydrogen Project in Saudi Arabia, the world's largest green hydrogen facility powered by 4GW of solar and wind energy. This groundbreaking project

aims to produce up to 600 tonnes of carbon-free hydrogen daily.

Women in Hydrogen 50:

In 2024, she was honored in the Projects and Partnerships category of the Women in Hydrogen 50 list by Hydrogen Economist, recognizing her significant contributions to the hydrogen economy and her advocacy for diversity and inclusion.

Advisory Board Member:

Carina serves on the advisory board for the Women in Hydrogen 50 initiative, helping to spotlight and support women's achievements in the hydrogen sector.

Expertise and Thought Leadership

Carina's legal practice encompasses a broad spectrum of energy-related projects, including conventional generation, renewables, hydrogen, battery storage, and energy infrastructure. She advises a diverse clientele, such as sponsors, developers, commercial banks, development finance institutions, export credit agencies, and equity investors

Beyond her legal work, she is an active thought leader, frequently speaking at industry events and contributing to publications on topics like green hydrogen's role in Africa's energy transition and the development of sustainable energy projects.

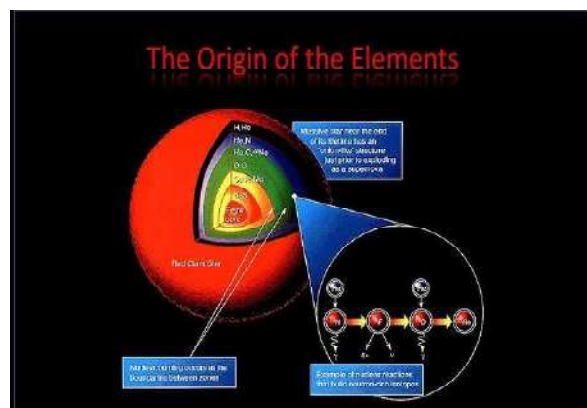
Carina Radford's leadership and expertise continue to shape the future of sustainable energy, making her a prominent figure in the global hydrogen economy.

Do you know Elemental Origin

Hydrogen was formed minutes after the Big Bang during a period called Big Bang Nucleosynthesis.

Hindenburg Disaster (1937)

The German airship Hindenburg, filled with hydrogen, caught fire and exploded, raising awareness about hydrogen's flammability.



What is Mach Number?

An Austrian philosopher and physicist Ernst Mach is after whom the Mach number is named. Due to it being a dimensionless quantity and not a measurable unit, the number is put after the term Mach for instance, Mach 4 and not 4 Mach.



What is Mach Number?

The Mach number is the ratio of flow velocity after a certain limit of the sound's speed. In simple words, it is the ratio of the speed of a body to the speed of sound in the surrounding medium.

We can say the speed of sound can be equated to Mach 1 speed. Thus, Mach 0.75 will be 75% of the speed of sound that is also called subsonic, and Mach 1.65 will be 65% faster than the speed of sound, which is also called supersonic.

The Mach number due to the local speed of sound is dependent on the surrounding mediums in specific temperature and pressure.

Flow can be determined as an incompressible flow with the help of the Mach number.



The medium can either be a liquid or a gas. The medium can be flowing, whereas the boundary may be stable, or the boundary may be travelling in a medium that is at rest. The medium and boundary both may be travelling with a certain speed, but their velocities concerning each other matter. The medium may be channelled through several devices such as wind tunnels or may be immersed in the medium. The Mach number is termed as a dimensionless number because it is a ratio of two speeds.

Speed below the speed of sound is termed as subsonic whereas speed above the speed of sound is termed as supersonic, although scientists practising aerodynamics most of the time use these terms to describe a particular range of Mach values.

What is the difference between heat and temperature?

Temperature tells how hot something is. It can be measured on three different scales – degrees Celsius (°C), degrees Fahrenheit (°F), and Kelvin (K). When something gains heat energy, its temperature rises. When it loses heat energy, its temperature falls.

Heat refers to thermal energy, which is measured in joules. A warm bath is at a lower temperature than a steaming hot mug of tea. However, because the bath is much larger, it contains more heat energy than the tea.

Heat: It is the total energy (both kinetic and potential) of all the particles in a substance due to their motion. It is a form of energy transfer.

Temperature: It is a measure of the average kinetic energy of the particles in a substance.

Heat is energy in transit and flows from a hotter object to a colder object.

Temperature is a measure of how hot or cold an object is.

Heat depends on mass, specific heat capacity, and temperature (more mass means more heat).

Temperature is independent of mass; a small and large object can have the same temperature but different amounts of heat.

A cup of hot water and a bucket of hot water at the same temperature (e.g., 80°C) have the same temperature but the bucket contains more heat because it has more water (more mass).

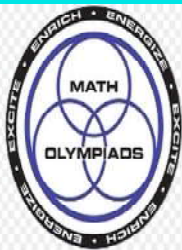
Heat flows from a high-temperature object to a low-temperature object until thermal equilibrium is reached.

Temperature does not flow; it simply indicates how hot or cold something is.

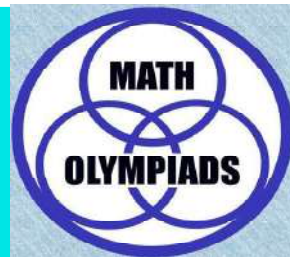
Heat is energy, temperature is a measure of that energy.

Heat flows, temperature does not. Heat depends on mass, temperature does not.

Adults have about six liters of blood in their body. An adult can donate blood once every six months without suffering any ill effects, as the body naturally replaces the lost blood.



One Step Ahead - Mathematics Series



1. A piece of wire in the form of a rectangle with dimensions 12 m by 10 m is bent to form a circle.

Find the diameter of the circle.

Perimeter of the rectangle

$$= 2 (12 + 10) \text{ m} = 44 \text{ m}$$

Let the radius of the circle be r m

We have , perimeter of the rectangle =

Circumference of the circle

$$\Rightarrow 44 = 2\pi r = 2 \times \frac{22}{7} \times r$$

$$\Rightarrow r = \frac{44 \times 7}{22 \times 2} = 7 \text{ m}$$

Hence the diameter of the circle

$$= 7 \times 2 \text{ m} = 14 \text{ m}$$

2. Sanjay sold two cars for Rs.9900 each, making 10% profit on one and losing 10% on the other.

His gain or loss percent on the two cars is

a. No gain , no loss

b. Loss of 1%

c. Gain of 1%

d. Gain of 5%

Cost Price of the first car

$$= \frac{100 \times 9900}{110} = \text{Rs.}9000$$

In second case he loses 10%

Cost price of the second car

$$= \frac{100 \times 9900}{90} = \text{Rs.}11000$$

Total cost of both cars

$$= \text{Rs.}9000 + \text{Rs.}11000 = \text{Rs.}20,000$$

Total Selling Price of both cars

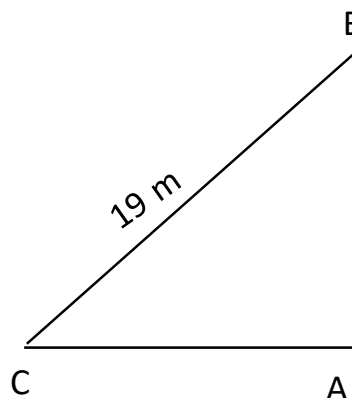
$$= 2 \times 9900 = \text{Rs.}19,800$$

$$\text{Total loss} = 20000 - 19800 = \text{Rs.}200$$

$$\% \text{ of loss} = \frac{200 \times 100}{20000} = 1\%$$

So, he loss 1% on selling the cars. The answer is (b)

3.A ladder leaning against a wall makes an angle of 60° with the ground. If the length of the ladder is 19m, Find the distance of the foot of the ladder from the wall.



Let AB be the wall

BC be the ladder

Then $\angle ACB = 60^\circ$ and $BC = 19$ m

Let $AC = x$ metres

$$\frac{AC}{BC} = \cos 60^\circ$$

$$\Rightarrow \frac{x}{19} = \frac{1}{2}$$

$$\Rightarrow x = \frac{19}{2} = 9.5 \text{ m}$$

So the distance of the foot of the ladder from the wall is **9.5m**

4. Three taps A,B and C can fill up an empty tank in 6 hours, 8 hrs and 12 hrs respectively. After 2 hrs taps B and C are closed.

How much time will take to fill the remaining part of a tank.

Time taken by taps A,B and C to fill an empty tank is 6 hrs, 8hrs and 12 hrs respectively

Work done by (A + B + C) in 2 hrs

$$= 2 \left(\frac{1}{6} + \frac{1}{8} + \frac{1}{12} \right)$$

$$= 2 \left(\frac{4+3+2}{24} \right) = 2 \times \frac{9}{24} = \frac{3}{4}$$

$\frac{1}{4}$ th tank is to be filled by tap A

$$\therefore \text{Time taken by A} = \frac{1}{4} \times 6 = \frac{3}{2} \text{ hr}$$

Hence, the time taken by tap A to fill the remaining tank = 1 hr 30 minutes

5. In a class tests (+ 3) marks are given for every correct answer and (– 2) marks are given for every incorrect answer and no marks for not attempting any questions.

Radha scored 20 marks. If she has got 12 correct answers, how many questions has she attempted incorrectly.

$$\begin{aligned} \text{Radha's marks for 12 correct answers} \\ = 12 \times 3 = 36 \end{aligned}$$

$$\text{Radha's score} = 20$$

$$\begin{aligned} \text{So, Radha's score for incorrect answers} \\ = 20 - 36 = (-16) \end{aligned}$$

$$\begin{aligned} \text{So, number of incorrect answers} \\ = (-16) \div (-2) = 8 \end{aligned}$$

6. The angles of a triangle are in the ratio 2:3:4. Find the angles

$$\begin{aligned} \text{Sum of the terms of the ratio} \\ = 2 + 3 + 4 = 9 \end{aligned}$$

$$\text{Sum of the angles of a triangle} = 180^\circ$$

$$\text{1st angle} = \frac{2}{9} \times 180 = 40^\circ$$

$$\text{2nd angle} = \frac{3}{9} \times 180 = 60^\circ$$

$$\text{3rd angle} = \frac{4}{9} \times 180 = 80^\circ$$

$$\Rightarrow \text{Angles of the triangle are } 40^\circ, 60^\circ, 80^\circ$$

7. On Sunday, 845 people went to the zoo.

On Tuesday only 169 people went.

What is the percent decrease in the people visiting the zoo on Tuesday.

No. of people who went to zoo on Sunday
= 845

No. of people who went to Zoo on
Tuesday = 169

Decrease in number of people visiting the
zoo = $845 - 169 = 676$

$\therefore$ Percent decrease in the number of
people visiting the zoo

$$= \frac{676}{845} \times 100 = 80\%$$

Hence the % decrease in the number of
people visiting the zoo is 80%

**8. Suresh obtained 432 marks out of 600
and Manohar obtained 525 marks out
of 750 in annual examination.**

Whose performance is better?

Marks obtained by Suresh

$$= \left(\frac{432}{600} \times 100 \right) = 72\%$$

Marks obtained by Manohar

$$= \left(\frac{525}{750} \times 100 \right) = 70\%$$

Suresh obtained higher % of marks.

**9. Kamal drives to work every morning. If
he drives at 96 km/h, he will arrive
at his office 5 minutes early. If he
drives at 80 km/h he will be late by 3
minutes. How far is his office from
home?**

$$\text{Excess} = 96 \times \frac{5}{60} = 8 \text{ km}$$

$$\text{Shortage} = 80 \times \frac{3}{60} = 4 \text{ km}$$

$$\text{Difference in speed} = 96 - 80 = 16 \text{ km/h}$$

$$\text{He drives for } \frac{12}{16} = \frac{3}{4} \text{ h}$$

$$96 \times \frac{3}{4} = 72 - 8 = 64 \text{ km}$$

$$80 \times \frac{3}{4} = 60 + 4 = 64 \text{ km}$$

His office is 64 km away from home.

**10. Ramesh borrowed Rs. 10,000 from
AKash at 9% per annum. After 4
years Ramesh cleared the account by
giving Rs. 5,500 and a cycle to Akash.
Find the cost of the cycle.**

Principal = (P) = Rs. 10,000

Interest Rate = 9% P.A

Time = 4 years

Amount = ?

$$\text{Simple Interest} = \frac{P \times R \times T}{100}$$

Ans: Rs. 8100

Bridging Theory and Practice

For Aspiring Researchers in Biology & / NTSE / NEET

Motion

An object is said to be in motion if it changes its position from one place to another place.

Types of motion

1. Linear motion

A body has linear motion if it moves in a straight line or path.

Examples

1. Motion of a moving car on a straight road
2. Motion of a ball dropped from the roof of a building

2. Circular motion

A body has circular motion if it moves around a fixed point.

Examples

1. Motion of an electric fan
2. Motion of a spinning top
3. Vibratory motion

Examples

1. Motion of a pendulum of a wall clock
2. Motion of a child swinging in a swing

Describing motion

To describe the motion of an object, its position, velocity etc, are measured.

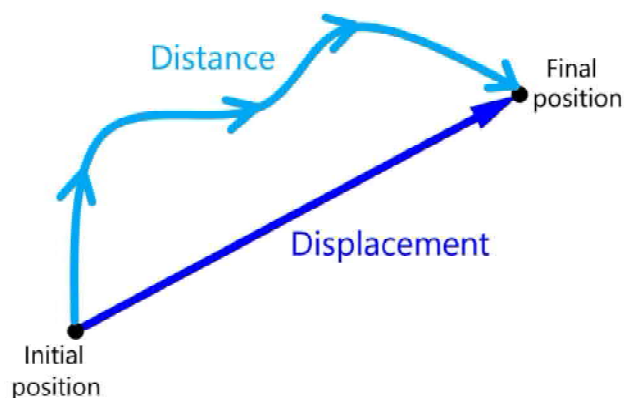
When we measure the position of an object, then it is measured from some fixed

point known as the **reference point**.

A fixed point or a fixed object with respect to which the given body changes its position is known as reference point or origin.

Distance and Displacement

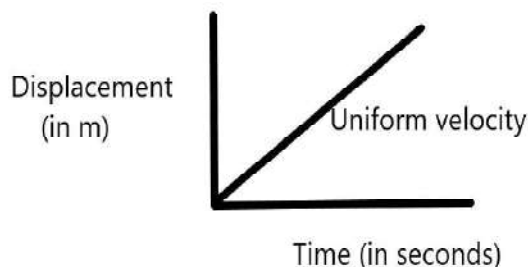
The total path covered by a body during its journey, irrespective of direction, is called distance. Since it has no direction, it is a scalar quantity.



Displacement

The shortest distance between the initial position and the final position of a moving object in the given interval of time from initial to the final position of the object is known as the displacement of object.

Displacement of an object may also be defined as the change in position of the object in a particular direction.



Distance measured in a particular direction is known as displacement. It can be positive, negative, or zero. Since it has direction, it is a vector quantity. Distance travelled has magnitude only, so distance is a scalar quantity.

Relation between distance and displacement

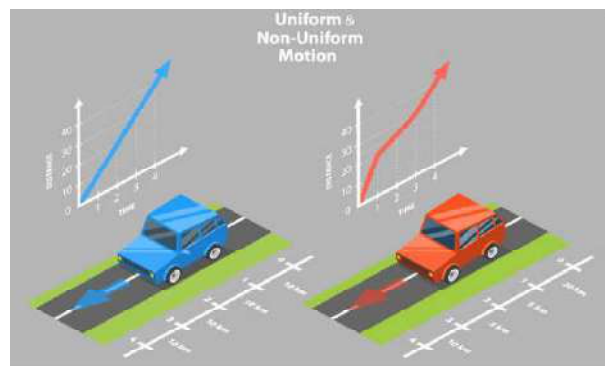
Distance is always greater than or equal to the displacement .i.e $\text{distance} \geq \text{displacement}$

When an object travels along a straight line in a positive direction, its distance and displacement are equal and have the same sign.

This is the condition under which distance and displacement become the same

Uniform and non- uniform motion

The motion of an object is uniform if it moves along a straight line and it covers equal



distances in equal intervals of time.

For uniform motion, distance travelled by a moving object is directly proportional to the time taken.

Non- uniform motion

The motion of an object is said to be non-uniform if it covers unequal distances in equal intervals of time, howsoever, small these intervals may be.

Examples

1. A person jogging on a road
2. A bus moving on a crowded road.
3. A stone dropped from the top of a building
- 4.A ball thrown vertically upwards.

Speed:

The rate of change of distance with respect to time is known as speed. It is a scalar

quantity.

$$\text{Speed} = \frac{\text{Distance}}{\text{Time taken}}$$

SI unit of speed is metre/second



In CGS system, unit of speed is centimetre/second

In our daily life, the speed of moving buses, cars, trains and aeroplanes is expressed in kilometre/hour

1. Uniform speed or Constant speed

If a moving body covers equal distance in equal intervals of time, then the speed of the body is said to be uniform speed.

2. Non-uniform or Variable speed

If a moving body covers unequal distances in equal intervals of time, then the speed of the body is said to be non-uniform or variable speed.

Average speed

The ratio of the total distance travelled to the total time taken is known as average

speed.

$$\text{Average speed} = \frac{\text{Total distance travelled}}{\text{Total time taken}}$$

Instantaneous speed

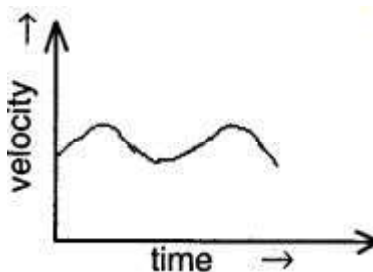
The speed of an object at any instant during its motion is called instantaneous speed.

A meter fitted on the dash board of a vehicle called speedometer indicates the instantaneous speed of the vehicle.

Initial speed

The speed at which a body starts its motion is called initial speed. It is generally denoted by u . When a body is at rest, its value is zero.

Final speed



The speed attained by a body after it starts moving is called final speed. It is represented by v . When a body comes to rest after motion, its value is zero.

Velocity (speed with direction)

The velocity of an object is defined as the ratio of its displacement and the time taken by it in doing so.

$$\text{Velocity} = \frac{\text{Displacement}}{\text{Time}}$$

2. Velocity depends on both magnitude and direction and hence is a vector quantity

Uniform velocity

An object is said to be moving with an uniform velocity, if it undergoes equal displacements in equal intervals of time.

Variable velocity or Non-uniform velocity

An object is said to be moving with a variable velocity, if it undergoes equal displacements in unequal intervals of time or unequal displacement in equal intervals of time or changes direction of motion while moving with a constant speed.

Examples

1. A body moving on a circular path
2. A stone thrown vertically upward
3. Average Velocity

When the speed of an object changes with time along a straight line, then the average velocity of the body is calculated

Velocity of a body can be changed either

(i) by changing the speed of the body while keeping the direction of motion of the body same.

or (ii) by changing the direction of motion of the body but keeping the speed of the body same

or (iii) by changing the speed and direction of motion of the body.

Angular velocity:

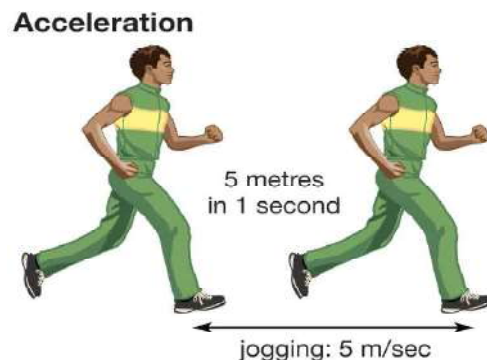
It is defined as the rate of change of angular displacement with respect to time

Acceleration (Rate of change of velocity)

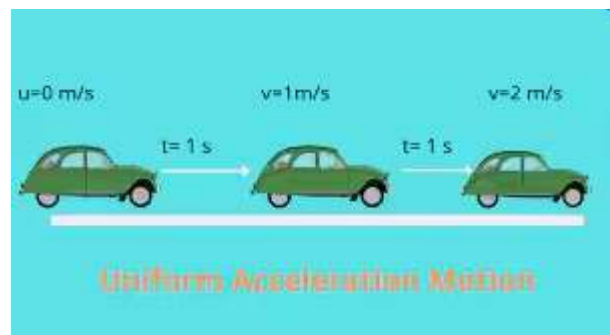
Rate of increase of velocity with respect to time is known as acceleration. Since its magnitude as well as direction, it is a vector quantity. Its SI unit is ms^{-2}

$$\text{Acceleration} = \frac{\text{change in velocity}}{\text{Time taken}}$$

Negative Acceleration or Retardation or deceleration



The body is said to be retarding when the final speed of a body is less than its initial



speed. This is negative of the acceleration and called as retardation.

Uniform acceleration

If velocity increases by equal amounts in equal intervals of time in a straight line, however small the intervals of time may be, the body is said to have uniform acceleration.

Examples of uniformly accelerated motion

1. The motion of an object falling freely from the top of a building

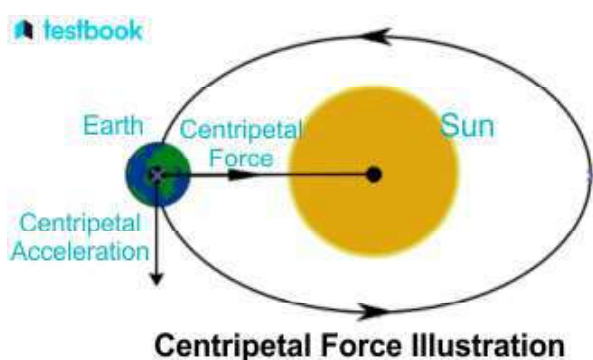
The motion of a ball rolling down a smooth inclined planes.

Non- uniform acceleration

The motion of an object having variable acceleration is known as non- uniformly accelerated motion.

Examples

1. The motion of a bus leaving or entering the bus stop
2. The motion of a bus on a crowded bus
3. The motion of a train leaving the platform.



Angular acceleration

Rate of change of angular velocity with respect to time is called angular acceleration.

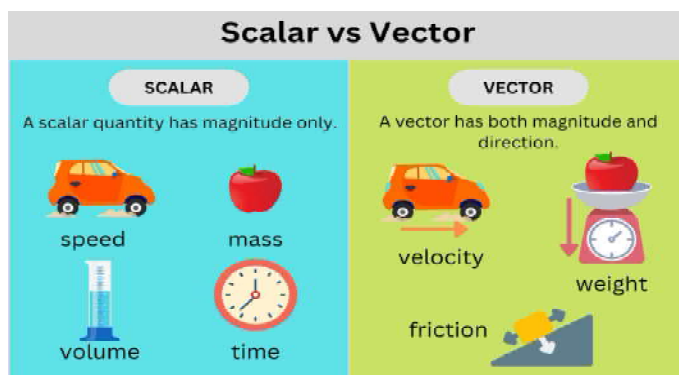
Centripetal acceleration

If a body is moving along the circumference of a circle, then the acceleration produced is directed towards the centre of the circle.

This acceleration is called centripetal acceleration. Force due to centripetal acceleration, acting towards the centre, is called the centripetal force.

Scalar quantities

Physical quantities that have only



magnitude and no direction are called scalar quantities. Examples include time, speed, and distance.

Vector quantities

Those physical quantities which have magnitude as well as direction. Acceleration and force are the examples of vector quantities.

Multiple Choice Questions - Motion

1. Unit of acceleration is

- a. m/s
- b. ms
- c. m/s^2
- d. None of these

2.The speedometer of a car measures

- a. Average speed
- b. Instantaneous speed
- c. Acceleration

3. When body is moving along a circular path then it has

- a. A constant speed
- b. A constant velocity
- c. No tangential velocity

4. A body whose speed is constant

- a. Has a constant velocity
- b. Must be accelerating
- c. Might be accelerating
- d. Cannot be accelerating

5. Which of the following is rate of change in displacement

- a. Velocity
- b. Retardation
- c. Speed
- d. Acceleration

6.Which one is different from others

- a. Displacement
- b. Velocity
- c. Force
- d. Kinetic energy

7.The decrease in velocity per unit time is called

- a. Acceleration
- b. Retardation
- c. Speed
- d. Acceleration

8. Which one of these is a scalar quantity

- a. Momentum
- b. Acceleration
- c. Displacement
- d. Energy

9.The numerical ratio of displacement to the distance covered is always

- a. Less than one
- b. Equal to one
- c. Equal to or less than one
- d. Equal to or greater than one

10.The velocity of a body at rest is always

- a. Unity
- b. Negative
- c. Zero
- d. Infinite

11.The SI unit of velocity is

- a. ms^{-1}
- b. ms^{-2}
- c. ms^{-3}
- d. Nm^{-1}

12.The rate of change of displacement with time is called

- a. Speed
- b. Velocity

Multiple Choice Questions - Motion

- c. Acceleration d. Retaradtion
- 13.The slope of speed time graph gives**
- a. Speed b. Velocity
- c. Acceleration d. Momentum

14.When a graph of one quantity versus another results in a straight line, the quantities are

- a. Both constant b. Equal
- c.Directly proportional
- d.Inversely proportional

15.When the distance that an object travels is directly proportional to the length of time, it is said to travel with

- a. Zero velocity b. Constant speed
- c. Constant acceleration
- d.Uniform velocity

16.The velocity of an object is directly proportional to time elapsed. The object has

- a.Uniform speed
- b. Uniform velocity
- c. Uniform acceleration
- d. Variable acceleration

17.If the distance travelled by an object is zero, then the displacement of the object is

- a. Zero b. Not zero
- c. Negative

18.The velocity of an object can be changed by

- a. Changing the speed
- b. Changing the direction of motion
- c. Changing both the speed and direction of motion
- d. By all (a), (b), (c)

19.Area under velocity- time graph is equal to the

- a.Speed of the body
- b. Magnitude of the displacement of the body
- c. Distance travelled by the body

20.If the displacement of an object is zero, then the distance travelled by the object is

- a. Zero b. Not zero
- c. Negative d. May or may not be zero

MCQ – Answers (Motion)

1– c, 2 – b, 3 – a, 4 – c, 5 – a, 6 – d, 7 – b, 8 – d, 9 – c, 10 – c

11 – a, 12 – b, 13 – c, 14- c, 15 – b, 16 – c, 17 – a, 18 – d, 19 – b, 20 – d

Speed

1. It is the distance travelled by a body in unit time
2. It is a scalar quantity
3. It can be changed by the distance travelled by a body in a particular time
4. It is always positive or zero but can never be negative

Velocity

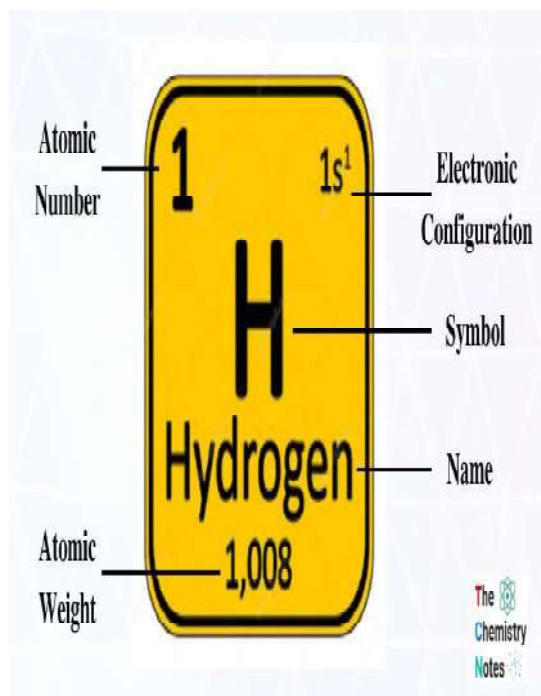
- It is the speed of an object moving in a definite direction
2. It is a vector quantity
 3. It can be changed by changing the speed of a body
 4. It some times may be positive , zero or negative

Do you know

Hydrogen - The Simplest Element

Hydrogen is the simplest element; an atom consists of only one proton and one electron. It is also the most plentiful element in the universe. Despite its simplicity and abundance,

hydrogen doesn't occur naturally as a gas on the Earth--it is always combined with other elements. Water, for example, is a combination of hydrogen and oxygen (H_2O) Hydrogen is also found in many organic compounds, notably the 'hydrocarbons' that make up many of our fuels, such as gasoline, natural gas, methanol, and propane.



Hydrogen is high in energy, yet an engine that burns pure hydrogen produces almost no pollution. NASA has used liquid hydrogen since the 1970s to propel the space shuttle and other rockets into orbit. Hydrogen fuel cells power the shuttle's electrical systems, producing a clean byproduct--pure water,

which the crew drinks. You can think of a fuel cell as a battery that is constantly replenished by adding fuel to it--it never loses its charge.

Fuel cells are a promising technology for use as a source of heat and electricity for buildings, and as an electrical power source for electric vehicles.

Nutrition of this month

Vitamin B12 – The Brain and Body Booster

Vitamin B12 is one of the essential nutrients our body needs to function properly. It plays a crucial role in maintaining a healthy nervous system, producing red blood cells, and keeping our brain sharp and active.

What is Vitamin B12



Vitamin B12, also known as Cobalamin, is a water-soluble vitamin. This means it dissolves in water and is not stored in large amounts in our body, so we need to get it regularly from our diet. It is vital for cell growth, brain development, and energy production.

Why is Vitamin B12 Important?

Supports Brain and Nerve Function

B12 helps maintain the health of our brain and the entire nervous system.

Forms Red Blood Cells“It helps in making red blood cells which carry oxygen throughout the body.

Helps in DNA Synthesis“It is involved in creating our body’s genetic material – DNA.

Boosts Energy Levels“It converts food into usable energy, keeping us active and alert

What Happens if We Don't Get Enough?

Vitamin B12 deficiency can lead to:Constant tiredness and weakness

Poor memory or difficulty focusing

Numbness or tingling in hands and feet

A type of anemia called megaloblastic anemia

If not treated on time, a deficiency can even lead to nerve damage.

Sources of Vitamin B12

Vitamin B12 is mostly found in animal-based foods. Here are some good sources:

(i) Liver (chicken or goat) - B12 content (Very High)

Fish (sardines, tuna, salmon)- B12 content High Milk, Cheese, Yogurt B12 content - Good

For Vegetarians and Vegans:

Since plant foods do not naturally have B12, it's important to eat:

B12-fortified cereals and plant milks (like soy or almond milk)

Fortified nutritional yeast

B12 supplements, if needed (You have to consult a doctor)

How Much Do We Need?

Age Group	Recommended Daily Intake
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9–13 years	1.8 micrograms (µg)
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14+ years	2.4 micrograms (µg)
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Doctors might recommend a supplement if your B12 levels are low, especially for vegetarians.

Who is at Risk of Deficiency

People who eat only plant-based foods (vegetarians/vegans)

People with poor eating habits, Older adults, Individuals with digestive problems

Conclusion

Vitamin B12 is a tiny nutrient with a huge impact. For growing students, it is especially important for mental alertness, energy, and overall growth. By including the right foods or fortified options in our diet, we can make sure we stay healthy, active, and ready to learn.

So remember — a healthy brain needs B12

Science Lab of this month

The Savannah River National Laboratory (SRNL)

South Carolina, USA



The Savannah River National Laboratory (SRNL), situated at the Savannah River Site in South Carolina, stands as a pivotal U.S. Department of Energy (DOE) research facility specializing in hydrogen technologies.

With a legacy spanning over 50 years in hydrogen research, SRNL is at the forefront of

developing innovative solutions for hydrogen production, storage, and utilization, aiming to bolster national energy security and environmental sustainability.

Core Hydrogen Research Areas at SRNL:

1. Solid-State Hydrogen Storage

SRNL emphasizes the development of safe and efficient hydrogen storage methods, particularly solid-state storage. This approach is crucial for applications in defense and transportation, addressing challenges in storing hydrogen onboard vehicles. Research focuses on materials like metal hydrides and nanocarbon composites to achieve reversible hydrogen absorption and desorption at practical temperatures and pressures.

2. Advanced Hydrogen Storage Materials

Scientists at SRNL have pioneered processes that integrate metal hydrides with nanocarbon structures, resulting in high-capacity hydrogen storage materials. These materials demonstrate efficient hydrogen absorption/desorption cycles, operating at lower temperatures and pressures, and are currently under patent consideration.

3. Hydrogen Isotope Management



Leveraging its expertise in tritium (a hydrogen isotope) processing, SRNL has developed advanced methods for the storage, separation, and controlled release of hydrogen isotopes. This includes the creation of multifunctional nanomaterials capable of

managing hydrogen isotopes effectively, which is vital for both energy applications and national security.

4. Hydrogen Fuel Cell Research

SRNL actively supports the advancement of hydrogen fuel cells, particularly for transportation. Notably, SRNL scientist Patrick Ward secured a \$3 million grant from the DOE's Office of Science to explore new hydrogen storage methods, aiming to enhance the viability of hydrogen fuel cells in vehicles.

Center for Hydrogen Research (CHR).

Adjacent to the Savannah River Site, the Center for Hydrogen Research (CHR) serves as a state-of-the-art facility dedicated to hydrogen technology development. This center facilitates collaboration between SRNL scientists, academic institutions, and industry partners, fostering innovation in hydrogen production, storage, and utilization..

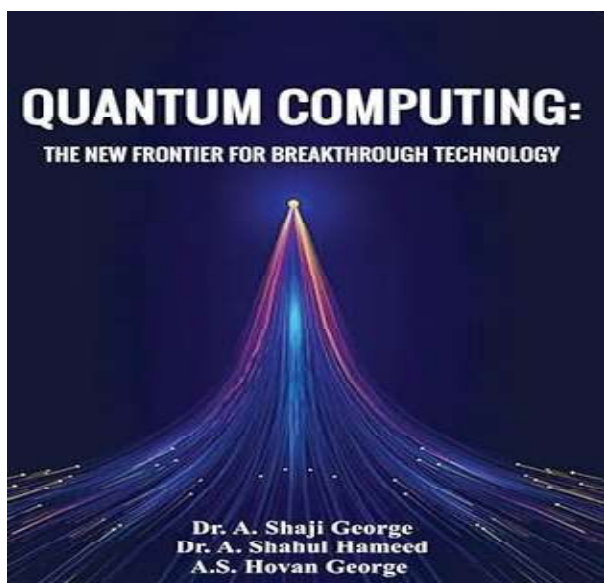
Collaborations and Impact

SRNL is a founding member of the South Carolina Hydrogen & Fuel Cell Alliance (SCHFCA), a public-private partnership aimed at promoting hydrogen and fuel cell technologies within the state. Through collaborations with universities, industry stakeholders, and government agencies, SRNL contributes to the broader goal of establishing a robust hydrogen economy in South Carolina and beyond. .

Quantum Computing: The New Frontier for Breakthrough Technology

About the Authors

Dr. A. Shaji George



Dr. George is a distinguished academic with extensive experience in computer science and emerging technologies. He has contributed significantly to research in quantum computing and has been involved in various educational initiatives to promote understanding of advanced computational methods.

Dr. A. Shahul Hameed

Dr. Hameed specializes in information technology and has a strong background in teaching and research. His work focuses on the practical applications of quantum computing in various industries, aiming to bridge the gap between theoretical concepts and real-world implementations.

A.S. Hovan George

A.S. Hovan George is known for his contributions to the field of computer science education. He has collaborated on multiple projects aimed at integrating advanced computing topics into academic curricula, making complex subjects more accessible to students.



Book Review:

Quantum Computing: The New Frontier for Breakthrough Technology serves as an introductory guide to the rapidly evolving field of quantum computing. The authors

have structured the book to cater to readers who are new to the subject, providing clear explanations of fundamental concepts such as qubits, superposition, and entanglement.

Clarity and Accessibility:

The book breaks down complex topics into understandable segments, making it suitable for beginners.

Practical Insights:

It discusses real-world applications of quantum computing, highlighting its potential impact on industries like cryptography, pharmaceuticals, and finance.

Educational Value:

The authors include illustrative examples and analogies that aid in grasping abstract concepts.

Depth of Content:

While the book is excellent for newcomers, readers seeking in-depth technical details or advanced mathematical formulations may find it lacking.

Scope:

The focus is primarily on foundational knowledge, with limited coverage of recent advancements or experimental implementations in the field.

This book is a commendable starting point for students, educators, and professionals interested in understanding the basics of quantum computing. Its straightforward approach demystifies a complex subject, laying the groundwork for further exploration into more advanced materials.

For students who are looking to build a foundational understanding of quantum computing and appreciate a clear, concise introduction to the topic, this book is a valuable resource.

Title: Quantum Computing: The New Frontier for Breakthrough Technology

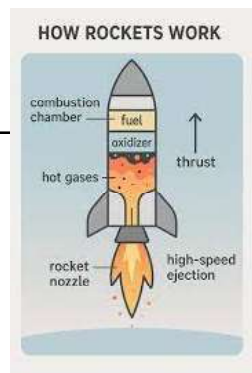
Authors: Dr. A. Shaji George, Dr. A. Shahul Hameed, and A.S. Hovan

George

Publisher: Book Rivers

Do you know : Rocket Fuel

Liquid hydrogen is used as a rocket propellant, often paired with liquid oxygen.

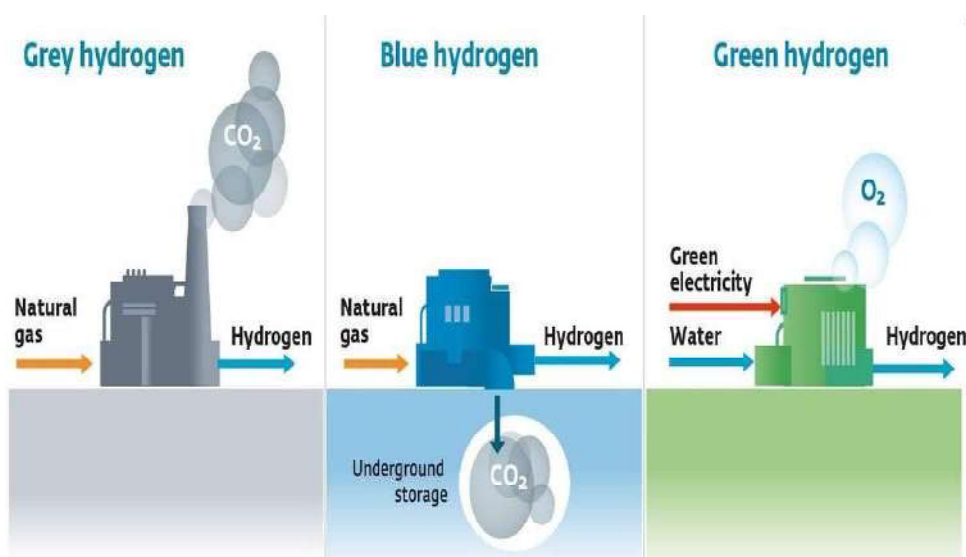


Hydrogen

Hydrogen Fuel – The Clean Power of the Future

Imagine a world where our cars, buses, and even rockets run on a fuel that produces only water as waste. That's what Hydrogen Fuel promises—a clean, green future for all.

What is Hydrogen Fuel



Hydrogen fuel is a clean energy source made from hydrogen gas (H_2). Hydrogen is the lightest and most abundant element in the universe. It is stored as a gas or liquid and used to produce electricity or heat.

How Does It Work?

Hydrogen itself is not an energy source, but it is an energy carrier.

There are two main ways hydrogen fuel is used:

Hydrogen Fuel Cells

These are special devices that combine hydrogen with oxygen to produce:

- (1) Electricity
- (2) Water (H_2O)
- (3) Heat

The best part? No smoke or pollution is created

Burning Hydrogen

Just like LPG or petrol, hydrogen can be burned in engines. When burned, it gives out energy and only water vapor.

Where is Hydrogen Fuel Used?



Hydrogen fuel is used in:

- (1) Cars and buses powered by hydrogen fuel cells
- (2) Trains and trucks for long-distance travel
- (3) Space rockets, like NASA's space shuttles
- (4) Backup power systems in hospitals and data centers

Why is Hydrogen Fuel Important?

(1) Eco-Friendly:

It doesn't release harmful gases like carbon dioxide or smoke.

(2) Abundant:



Hydrogen is everywhere—in water, in plants, and even in our bodies!

(3) Efficient:

Hydrogen fuel cells are more efficient than petrol or diesel engines.

(4) Quiet and Clean:

Hydrogen vehicles make very little noise and no pollution.

Challenges of Hydrogen Fuel

- (1) Production is expensive: It takes a

lot of energy to separate hydrogen from water or natural gas.

- (2) Storage is tricky: Hydrogen is very light and flammable, so it needs special containers.

- (3) Few refueling stations: There are not many hydrogen stations yet.

How is Hydrogen Made?

Hydrogen can be made in different ways

(1) Electrolysis

Splitting water using electricity. Clean if renewable power is used.

(2) Steam Reforming By Using natural gas. It Pollutes unless it is cleaned.

(3) Biomass From organic waste It Can be sustainable.

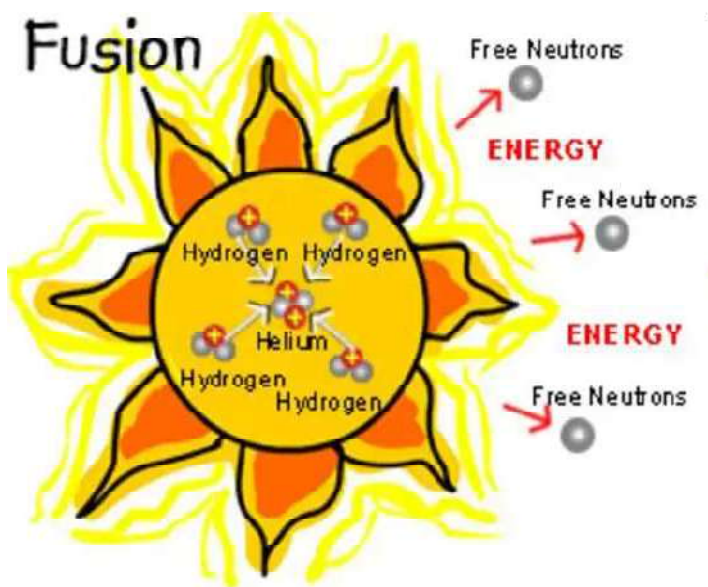
Hydrogen and the Future:

Scientists and engineers are working hard to make hydrogen fuel cheaper, safer, and more available. In the future, hydrogen-powered cities might become real—with buses, trains, and even planes running on clean fuel

Hydrogen fuel is a powerful promise for a cleaner tomorrow. It might take time, but with the help of young minds like yours, we can build a world that runs on clean energy—and hydrogen is leading the way.

Hydrogen in the Sun: The Power Behind the Star.

Have you ever wondered what makes the Sun shine so brightly every day? The answer lies in the most common and lightest element in the universe—Hydrogen!



Let's explore how Hydrogen fuels the Sun, lighting up the sky and giving life to our planet.

What is the Sun Made Of?

The Sun is a giant ball of hot gases, mostly:

(1) Hydrogen (about 74%)

(2) Helium (about 24%)

And tiny amounts of other elements

At its core, the Sun is incredibly hot—over 15 million degrees Celsius! Under this extreme heat and pressure, something magical happens with hydrogen.

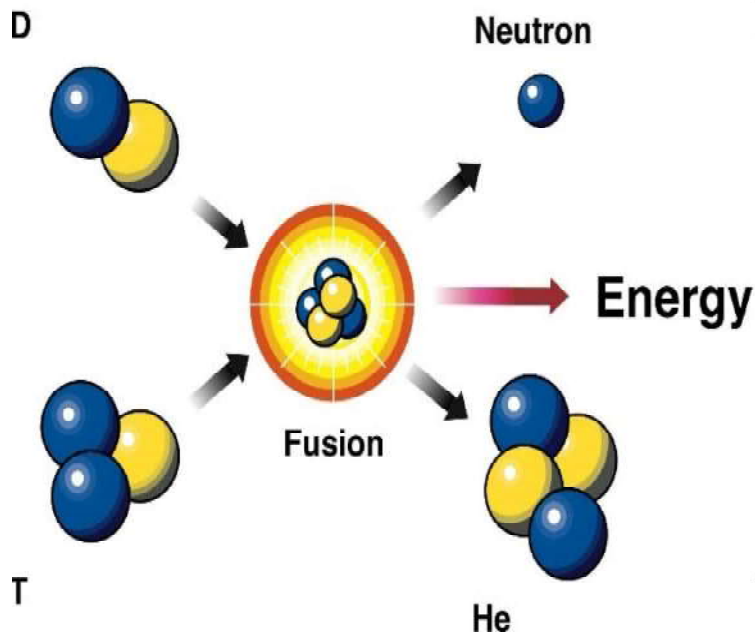
What Happens to Hydrogen in the Sun?

At the Sun's core, Hydrogen atoms fuse together in a process called Nuclear Fusion.

What is Nuclear Fusion?

It is the process where two small hydrogen atoms combine to form a helium atom.

During this fusion, a tiny amount of mass is lost, and it turns into a huge amount of energy (according to Einstein's equation $E = mc^2$).



This energy is what powers the Sun—and sends light and heat to Earth

Step-by-Step: How Hydrogen Fusion Works

(1) Hydrogen nuclei (protons) move at high speeds inside the Sun's core.

(2) They crash into each other and fuse to form helium.

(3) This fusion releases:

- * Light energy
- * Heat energy

* Gamma rays and other radiation

(4) This energy travels from the Sun's core to its surface and eventually reaches Earth.

Why is This Important for Earth?

The energy from the Sun warms our planet

(1) It supports photosynthesis in plants.

(2) It drives our weather and water cycle

(3) It can be used as solar power for electricity

Without hydrogen fusion, the Sun would go dark, and life on Earth would not exist.

(1) The Sun fuses 600 million tons of hydrogen every second!

(2) Only a tiny fraction of that energy reaches Earth—but it's enough to light and heat our entire world!

(3) Scientists are trying to recreate nuclear fusion on Earth to produce clean energy—just like the Sun.

OHMIUM HYDROGEN

Ohmium launches India's first green hydrogen electrolyzer gigafactory.



In response to Hon Prime Minister Shri Narendra Modi's announcement of 'National Hydrogen Mission' from the ramparts of Red Fort on August 15, renewable energy startup Ohmium International through its Indian subsidiary launched today India's first Green Hydrogen Electrolyzer Gigafactory at Bengaluru. The

proton exchange membrane (PEM) hydrogen electrolyzer is at the heart of production of Green Hydrogen as it uses power generated from renewable resources to break water into hydrogen and oxygen

Our mission is to create innovative products and solutions which enable a sustainable way of life.

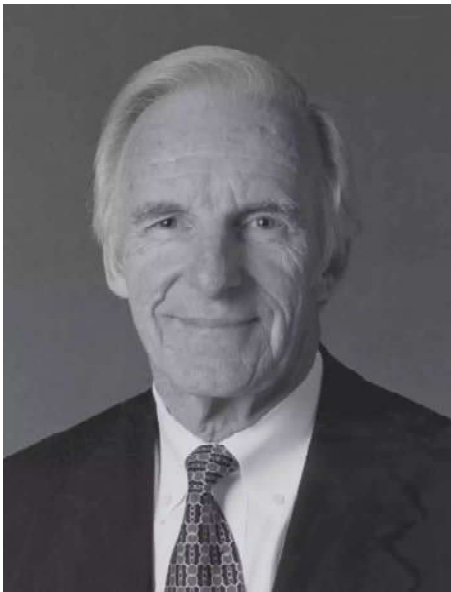
Driven by the passion to create a sustainable world, the Ohmium team, through its innovation and speed of execution, is focused on delivering an efficient, affordable, scalable PEM-based electrolyzer. Ohmium International, Inc. is committed to conducting our business with respect for human rights and in accordance with our human rights policy.

The green hydrogen produced by Ohmium LotusTM electrolyzers is versatile, with applications in small and large industry, transportation, and power. We design modular hydrogen solutions that help your business maximize operational efficiency, energy security, cost reduction, and sustainability.

GM Electrovan – The World’s First Hydrogen Fuel Cell Vehicle 1966 GM Electrovan

The 1966 GM Electrovan is credited with being the first hydrogen fuel cell car ever produced.

Though fuel cells have been around since the early 1800's, General Motors was the first to use a fuel cell to power the wheels of a vehicle.



The GM Electrovan was the brainchild of Dr. Craig Marks who headed up most of General Motors' advanced engineering projects.

Marks, along with a staff of 250, developed the Electrovan for over 2 years before attaining a drivable vehicle.

NASA had previously used fuel cells to power onboard systems in their Gemini spacecraft.



Those hydrogen fuel cells produced water as a byproduct, which the astronauts were then able to drink.

The GM Electrovan used a fuel cell produced by Union Carbide, which was fueled by both super-cooled liquid hydrogen and liquid oxygen.

Today's fuel cells use less pure oxygen that is native in the outside air.

The Electrovan had one large tank for the hydrogen and one for the oxygen and contained 550-feet of piping throughout the rear of the vehicle, turning this 6-seat van into a 2-seater with barely enough room for 2 passengers.

The Union Carbide 5 kw fuel cell (rated at 1,000 hours of use) was able to propel the GM Electrovan for top speeds between 63 – 70 mph. The Electrovan also had a range of 120 miles, which was not too shabby for 1966.

Because of safety concerns, the Electrovan was only used on company property, where it had several mishaps along the way.

From the outset, the idea was to use a Corvair as the first hydrogen fuel cell vehicle and call it Electrovairst.

But, GM soon discovered that a leak with the electrolyte used caused “brilliant fireworks”, plus it weighed 550 lbs. and needed to be housed in a larger vehicle.

There was also the incident of the exploding hydrogen tank, which injured no one but sent pieces flying a quarter of a mile, which was of great concern and extra safety precautions needed to be taken to insure that no one working on the project was injured.

After the GM Electrovan was built, tested and shown off to journalists in 1966, the project was scrapped largely because it was cost-prohibitive.

The platinum used in the fuel cell was enough to buy a whole fleet of vans” and there was absolutely no supporting hydrogen infrastructure in place at that time.

Do you know ?

(1) Fuel cells are a promising clean-energy technology for the hydrogen economy, expected to power homes, industries, and vehicles in a carbon-neutral future.

(2) Fuel cells are costly compared to batteries (as of now).

(3) A fuel cell is a device that converts chemical energy directly into electrical energy through an electrochemical reaction — without combustion.

Alstom's Coradia iLint, the world's first hydrogen-powered train

Canadian Urban Transit Association (CUTA) Awards celebrate the achievements of individuals and organizations that go above and beyond to innovate transit



Alstom's Coradia iLint has won CUTA's 2023 Environmental Sustainability Award

The Coradia iLint is the first hydrogen-powered train to have carried passengers in the Americas.

Using Alstom's green hydrogen-powered train on this route helped save approximately 8,400 liters of diesel and averted 22 tons of CO₂ direct emissions, compared to the diesel trains that normally service this route.

The train can travel up to 140 kilometers per hour.

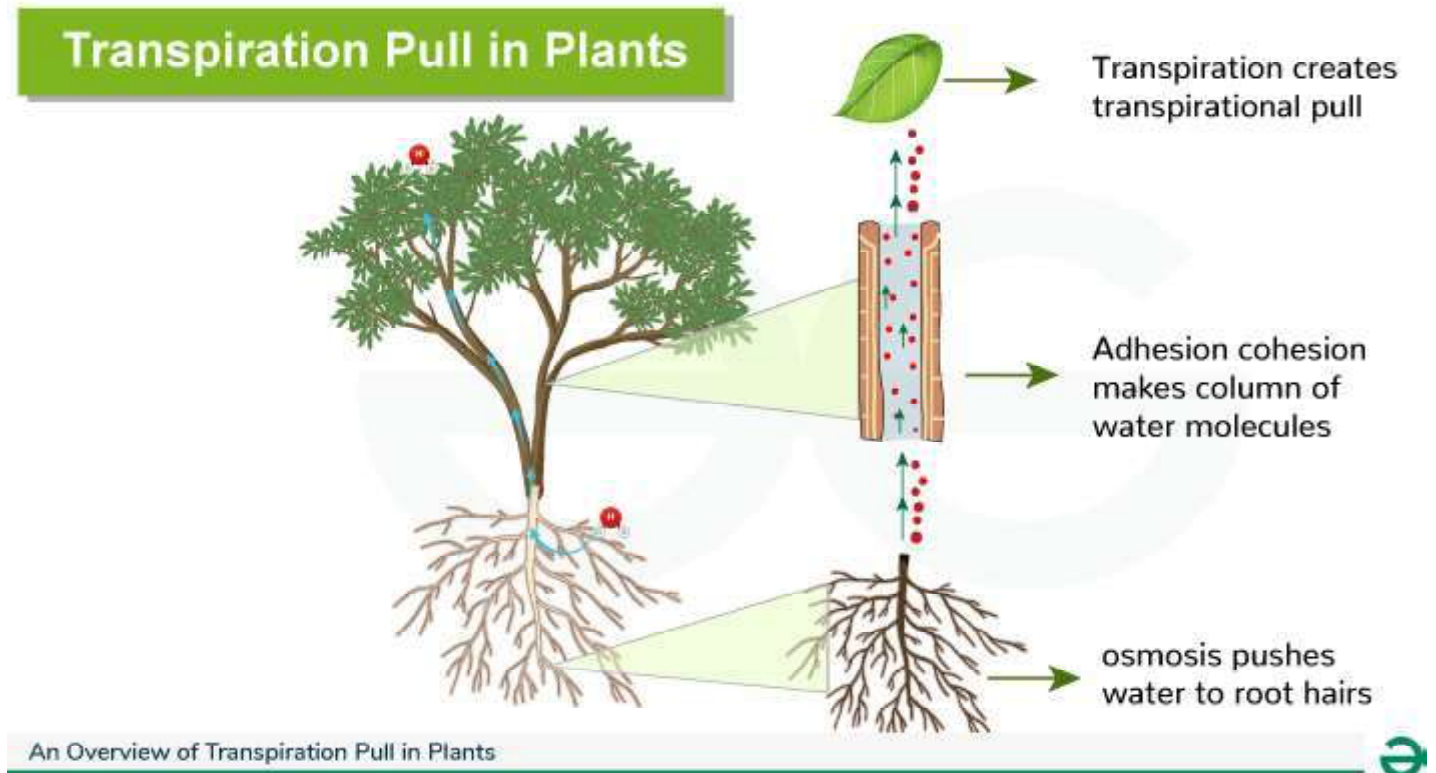
Alstom's Coradia iLint successfully travels 1,175 km without refueling its hydrogen tank

Coradia iLint is the world's first passenger train powered by a hydrogen fuel cell, which produces electrical power for traction.

In operation, this train emits no CO₂ and exhausts only water.

The hydrogen fuel cell-powered train emits only water and can produce its electricity through green hydrogen made from renewable resources.

Why Plants Can't Live Without Transpiration ?



What is Transpiration?

Transpiration is the process by which water is lost as water vapor from the aerial parts of a plant, especially from the leaves, but also from stems, flowers, and fruits. Most of the water is lost through tiny pores called stomata, which are mainly found on the underside of leaves.

This process is essential for the movement of water and nutrients within the plant and helps in temperature regulation.

Transpiration is not just a water-loss process; it plays several vital roles in a plant's survival and growth

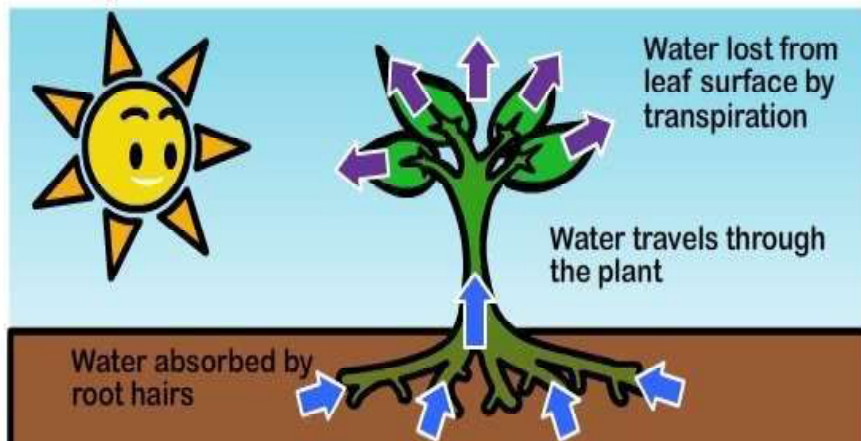
Transpiration must occur in plants so as to maintain homeostatis.

1. Pulling Water Upward (Transpiration Pull)

Water evaporating from the leaves creates a suction force (called transpiration pull) in the xylem tissues. This force pulls water upward from the roots to the leaves. It helps transport water against gravity, especially in tall plants and trees.

2. Transport of Minerals and Nutrients

Along with water, essential dissolved minerals and nutrients from the soil are transported to different parts of the plant. These nutrients are necessary for photosynthesis, growth, and development.



3. Cooling Effect (Temperature Regulation)

As water evaporates from the leaf surface, it removes heat, similar to how sweating cools human skin. This prevents overheating of the plant tissues in hot weather.

4. Maintaining Cell Turgidity (Water Pressure in Cells)

Continuous water movement due to transpiration helps maintain turgor pressure in plant cells.

Turgid cells keep the plant upright and rigid, especially in herbaceous (non-woody) plants.

5. Exchange of Gases When the stomata open for transpiration, carbon dioxide enters the leaf. This is needed for photosynthesis – the way plants make their food

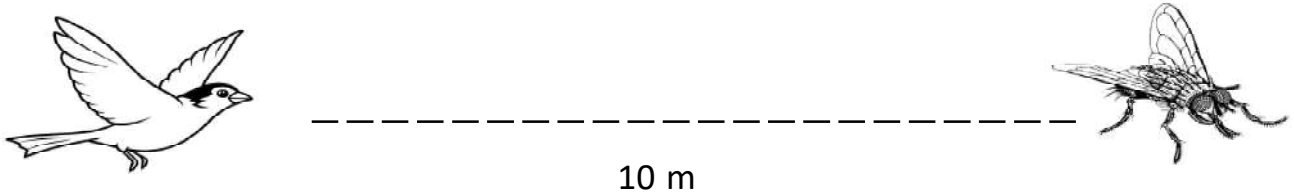
A big tree can lose up to 200 liters of water in a day through transpiration!

Transpiration helps a plant to:

1. Pull water from roots
2. Get nutrients
3. Stay cool
4. Stay firm and upright
5. Take in gases for making food

Physics Olympiad Problems

The Chase in the Sky — A Bird, an Insect, and the Physics of Relative Motion



Imagine an insect buzzing ahead, flying at 1 m/s, while a bird follows from behind at 11 m/s. They are 10 meters apart, and the bird is closing in.

How long will it take for the bird to catch up?

- a. 1.1/s b. 10 s c. 1 s

This scenario is a classic example of relative motion in one dimension, where one object (the bird) moves faster than another (the insect), and both are moving in the same direction.

Let's define:

Speed of the insect (v_i) = 1 m/s

Speed of the bird (v_b) = 11 m/s

Initial distance between them = 10 m

In physics, to find how long it takes for one moving object to catch up to another, we use the relative speed:

$$\text{Relative speed} = V_b - V_i = 11 \text{ m/s} - 1 \text{ m/s} = 10 \text{ m/s}$$

$$\text{Time} = \frac{\text{Distance}}{\text{Relative speed}} = \frac{10 \text{ m}}{10 \text{ m/s}}$$

The bird will catch the insect in just 1 second.

Real-World Insight:

This simple example demonstrates how fast-moving predators, like birds or even jets, can quickly overtake slower targets. It's not just about speed — it's about the difference in speed, which is what physics calls relative velocity.

This principle applies in many real-life areas — from traffic safety to space missions.

Viking, Fincantieri unveil world's first hydrogen-powered cruise ship

The Viking Libra will have a gross tonnage of around 54,300t and 499 staterooms, accommodating up to 998



guests.

It is designed to be the world's first hydrogen-powered cruise ship, using liquefied hydrogen and fuel cells for propulsion

Its operating headquarters are in Basel, Switzerland

Viking and Fincantieri have revealed details of Viking Libra and Astrea, sister vessels that will be the world's first hydrogen-powered cruise ships.

Currently under construction at Fincantieri's Ancona shipyard, the Viking Libra is expected to be delivered in late 2026. The Astrea is scheduled for delivery in 2027.

The Libra, classified as a small ship (the same as the entire Viking fleet), will have a gross tonnage of approximately 54,300t and will feature 499 staterooms, accommodating up to 998 guests. The company has not confirmed which routes the vessels will operate on, but explained they would join its ocean fleet.

True Cinnamon

Cinnamomum verum, also known as True Cinnamon or Ceylon Cinnamon is a small evergreen tree belonging to the family Lauraceae. Native to Sri Lanka and southern parts of India, it is highly valued for its bark, which is used as a spice and herbal remedy.

Botanical Profile:



Scientific Name: *Cinnamomum verum* (syn. *Cinnamomum zeylanicum*)

Family: Lauraceae Common Names: True Cinnamon, Ceylon Cinnamon

Parts Used: Inner bark (most commonly), leaves and essential oil.

Herbal and Medicinal Uses

1. Digestive Health

Carminative: Helps relieve gas and bloating.

Stomachic: Stimulates appetite and aids in digestion.

Used in traditional medicine to treat indigestion, nausea, and flatulence.

2. Blood Sugar Control

Contains cinnamaldehyde and other polyphenols which may improve insulin sensitivity and lower blood sugar levels (especially useful in type 2 diabetes).

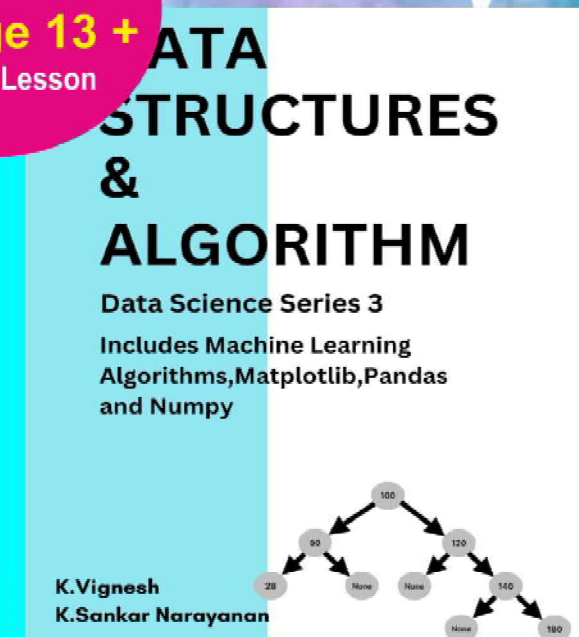
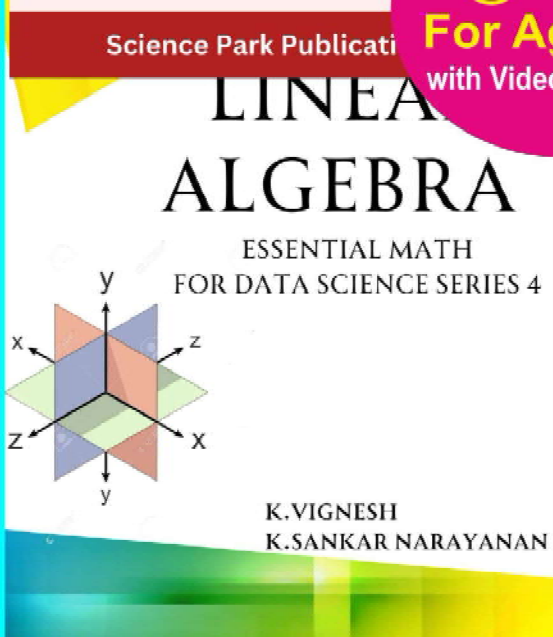
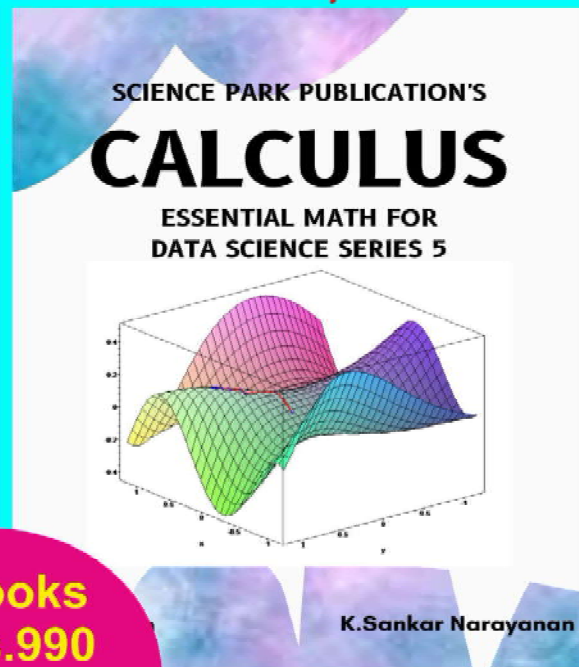
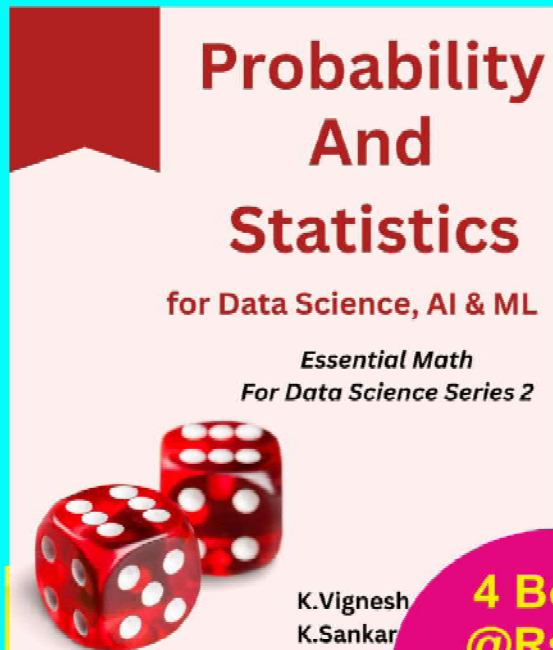
Often used in Ayurvedic and Unani practices for glycemic control.

3. Menstrual Health

Used in traditional medicine to regulate menstrual flow and reduce menstrual cramps.



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