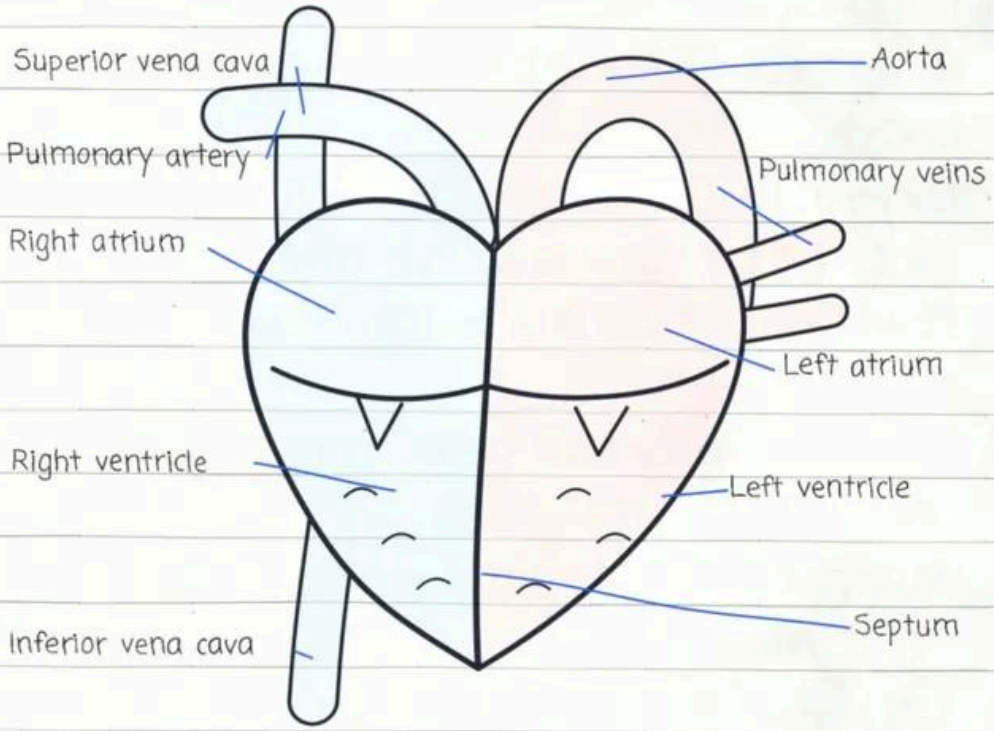
- Blood pressure is the force of blood on vessel walls. Normal about 120 over 80 mm of Hg (systolic over diastolic).

☆ Asked : 2018, 2019, 2022, 2023, 2024, 2025

The human heart



Human heart (simplified, front view): right side drawn on the left

Body (deoxygenated) —vena cava→ Right atrium

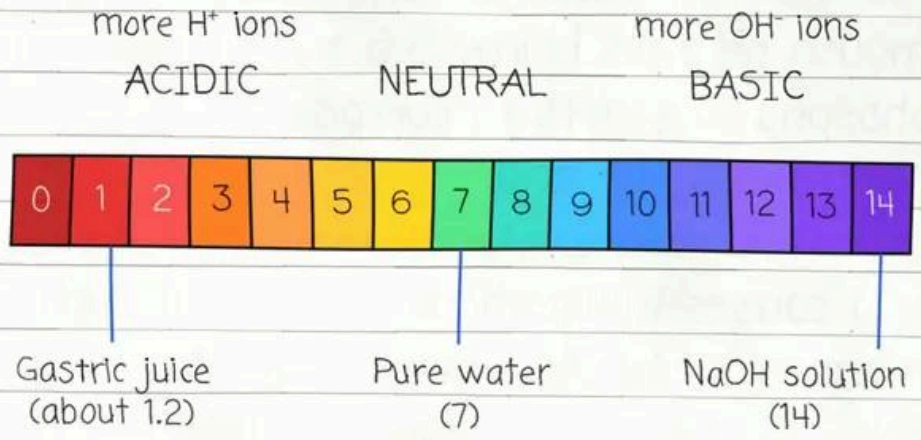
→ Right ventricle —pulmonary artery→ Lungs

pulmonary vein → Left atrium → Left ventricle

aorta → Body (oxygenated)

- Heart has 4 chambers: two atria (receive blood) and two ventricles (pump blood out).

- Scale 0 to 14: below 7 acidic, 7 neutral (pure water), above 7 basic.
- pH is checked with universal indicator (gives a different colour for each pH) or pH paper.
- Strong acid (HCl, H_2SO_4, HNO_3) gives many H^+ ions. Weak acid (CH_3COOH) gives few.
- Strong base: $NaOH$, KOH. Weak base: NH_4OH.
- Mg ribbon fizzes faster in HCl than in CH_3COOH of the same concentration, because HCl gives more H^+.



pH scale with universal indicator colours: red (acid), green (neutral), blue to violet (base)

pH range	Universal indicator colour	Nature
0 to 3	red	strongly acidic
4 to 6	orange to yellow	weakly acidic
7	green	neutral
8 to 10	blue	weakly basic
11 to 14	violet	strongly basic

Chapter - 4

Quadratic Equations

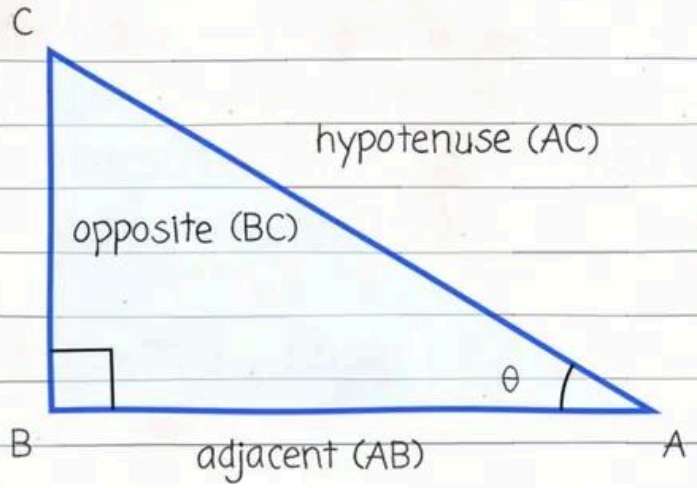
Most asked in boards

- Speed-distance-time word problems (plane delayed, train, boat in stream, return journey)
  - Asked : 2016, 2017, 2018, 2019, 2020, 2024, 2026 (3 to 5 marks)
- Solve a quadratic by factorisation (splitting the middle term) or by the quadratic formula
  - Asked : 2016, 2017, 2019, 2020, 2022, 2023, 2024 (1 to 4 marks)
- Nature of roots using the discriminant; find k for equal / real / no real roots
  - Asked : 2016, 2017, 2019, 2023, 2024, 2025 (1 to 5 marks)
- Area/geometry word problems (rectangle or right-triangle sides, two squares from area and perimeter, tiles)
  - Asked : 2016, 2017, 2019, 2024, 2025, 2026 (4 to 5 marks)
- Number, digit, reciprocal and marks word problems
  - Asked : 2017, 2019, 2022, 2023 (3 to 4 marks)

1. Standard form and roots

Quadratic equation : An equation that can be written as $ax^2 + bx + c = 0$, with a, b, c real and $a \neq 0$.

- A root (solution) is a value of x that makes the equation true.
- A quadratic has at most 2 roots.
- First bring everything to one side so the right side is 0.



Right angle at B. Sides named for the angle θ at A

$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\tan\theta = \frac{\text{opposite}}{\text{adjacent}} = \frac{\sin\theta}{\cos\theta}$$

$$\text{cosec}\,\theta = \frac{1}{\sin\theta}$$

$$\sec\theta = \frac{1}{\cos\theta}$$

$$\cot\theta = \frac{1}{\tan\theta} = \frac{\cos\theta}{\sin\theta}$$

Ratios depend only on the angle, not on the size of the triangle

* Trick : SOH CAH TOA: Sin = Opp/Hyp, Cos = Adj/Hyp, Tan = Opp/Adj

Q2. The sum of the first 6 terms of an AP is 57 and the sum of its first 10 terms is 155. Find the AP and its 15th term.

☆ Asked : 2016, 2017, 2019, 2020, 2022, 2023, 2024 (3 marks)

Ans. $S_6 = \frac{6}{2}(2a + 5d) = 57$, so $2a + 5d = 19$. (1)

$S_{10} = \frac{10}{2}(2a + 9d) = 155$, so $2a + 9d = 31$. Subtracting: $4d = 12$, so $d = 3$ and $a = 2$. (1)

The AP is 2, 5, 8, ... and $a_{15} = 2 + 14 \times 3 = 44$. (1)

Q3. Find the sum of all the multiples of 7 that lie between 100 and 300.

☆ Asked : 2018, 2020, 2022, 2024, 2025, 2026 (3 marks)

Ans. The multiples are 105, 112, ..., 294 ($7 \times 15 = 105$ and $7 \times 42 = 294$). (1)

$294 = 105 + (n - 1) \times 7$, so $n - 1 = 27$ and $n = 28$. (1)

Sum $= \frac{28}{2} \times (105 + 294) = 14 \times 399 = 5586$. (1)

Q4. The sum of three numbers in AP is 27 and their product is 693. Find the numbers.

☆ Asked : 2016, 2018, 2020, 2024 (5 marks)

Ans. Let the numbers be $a - d$, a and $a + d$. (1)

Sum: $3a = 27$, so $a = 9$. (1)

Product: $(9 - d) \times 9 \times (9 + d) = 693$, so $81 - d^2 = 77$. (1)

$d^2 = 4$, so $d = 2$ or $d = -2$. (1)

The numbers are 7, 9, 11 (or 11, 9, 7 when $d = -2$). (1)

History : Chapter 1

The Rise of Nationalism in Europe

⭐ Most asked in boards

- Liberalism and liberal nationalism: freedom of individual, government by consent, voting limits, free markets, Zollverein

  ⭐ Asked : 2016, 2017, 2019, 2020, 2022, 2023, 2024, 2025, 2026 (1 to 5 marks)

- Unification of Germany: Prussia, Bismarck, wars with Austria/Denmark/France, Kaiser proclaimed at Versailles 1871, Zollverein

  ⭐ Asked : 2016, 2017, 2019, 2020, 2022, 2023, 2024 (1 to 5 marks)

- Unification of Italy: Mazzini and Young Italy, Cavour, Garibaldi, Victor Emmanuel II, Sardinia-Piedmont, Venetia 1866

  ⭐ Asked : 2017, 2020, 2022, 2023, 2024, 2025 (1 to 2 marks)

- Conservatism after 1815: Congress of Vienna, Metternich, restoration of monarchies, censorship, balance of power

  ⭐ Asked : 2016, 2017, 2022, 2023, 2024 (1 to 3 marks)

- French Revolution and the idea of the nation: measures creating collective identity (tricolour, Estates General to National Assembly, anthem, uniform laws), spread of nationalism via Jacobin clubs and revolutionary wars

  ⭐ Asked : 2016, 2017, 2019, 2020, 2025 (1 to 5 marks)

- War (1914-18): huge defence spending paid by war loans, higher customs duties, new income tax.
- Prices doubled between 1913 and 1918; villages gave soldiers by forced recruitment.
- Crop failures (1918-19, 1920-21) and the influenza epidemic: 12 to 13 million died (1921 census).
- People hoped the end of war would end hardship; it did not.

☆ Asked : 2016, 2019, 2022, 2023

Idea of Satyagraha

Satyagraha : Method of non-violent mass agitation based on truth and soul force; the satyagrahi wins by appealing to the oppressor's conscience, not by force or revenge.

- Gandhi returned from South Africa in January 1915.
- Champaran (1917), Bihar: peasants against oppressive indigo plantation system.
- Kheda (1918), Gujarat: peasants could not pay revenue after crop failure and plague.
- Ahmedabad (1918): cotton mill workers' dispute; Gandhi used hunger strike.

Rowlatt Act and Jallianwala Bagh

- Rowlatt Act (1919): rushed through the Imperial Legislative Council despite Indian members' opposition.
- Allowed detention without trial for two years and curbs on political activity.
- Gandhi called a hartal on 6 April 1919 (non-violent civil disobedience); shops closed, railway workers struck.

Roadways

- India has the second largest road network in the world: about 62.16 lakh km (2020-21).
- Roads came before railways in India and still have an edge. Why roads are growing in importance:
  - → Lower cost of building than railway lines.
  - → Can cross uneven, broken land and steeper slopes, even the Himalayas.
  - → Best for few people and small loads over short distances.
  - → Door-to-door service; less loading and unloading cost.
  - → Feeder to railway stations, airports and ports.

Class of road	Key points
Golden Quadrilateral Super Highways	Six-lane roads joining Delhi, Kolkata, Chennai, Mumbai; also North-South corridor Srinagar to Kanniyakumari and East-West corridor Silchar to Porbandar; built by NHAI to cut time and distance between big cities
National Highways	Primary road system joining the far ends of the country; run north-south and east-west
State Highways	Join a state capital to district headquarters
District Roads	Join the district headquarters to other places in the district
Other (rural) roads	Link villages to towns; boosted by Pradhan Mantri Gram Sadak Yojana so each village has an all-season road to a town
Border Roads	Built and kept up by the Border Roads Organisation (set up 1960) in the northern and north-eastern border areas