

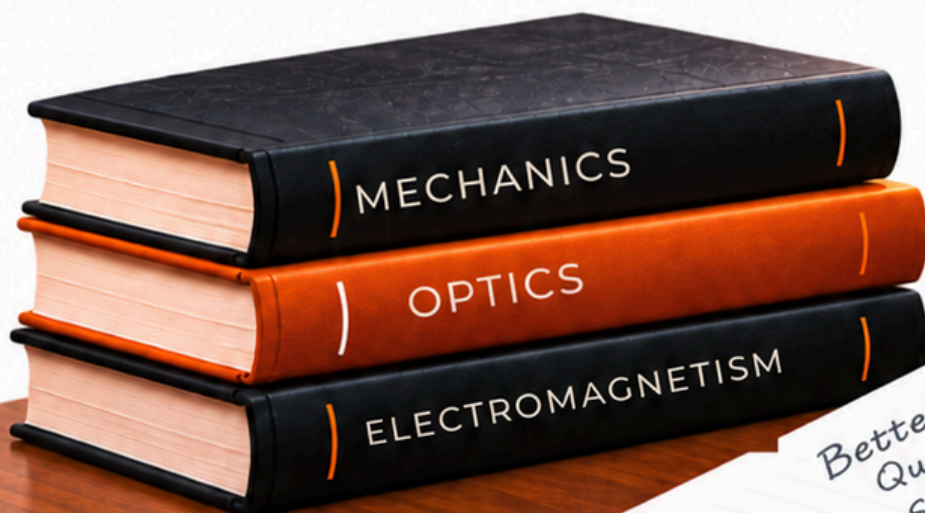
JEE Main Physics

Relative velocity PYQ

$$F = ma$$



$$v = u + at$$



Better
Questions
Stronger
Concepts
Brighter Future

Subject: Physics

Years: 2026-2014

Total Questions: 27

About this PYQ collection

What is inside

A complete topic-wise set of **27 previous year questions** on **Relative velocity** from **JEE Main (2026-2014)**, across **11 exam years**. **24 questions** are from 2019 onwards, so most of the set reflects the recent NTA pattern.

Questions are arranged to reduce unused page space, with newest-first priority and continuous numbering from 1. Each carries an exam date and shift tag to trace the original paper.

Topic-wise questions

TOPIC	QS	%
Relative velocity	27	100%

Question types

TYPE	QS	%
Single-correct MCQ	20	74%
Numerical value	7	26%

Numerical-value questions have no options; all 7 are from 2020 onwards.

How these questions help you

- **Know where the marks are:** relative velocity make up **27 of 27 questions (about 100%)**.
- **Build speed and accuracy:** practice the concepts and question styles used in previous papers.
- **Learn the patterns:** the same question styles return year after year.
- **Strengthen other chapters:** these concepts support further study in Physics.

Questions – Relative velocity

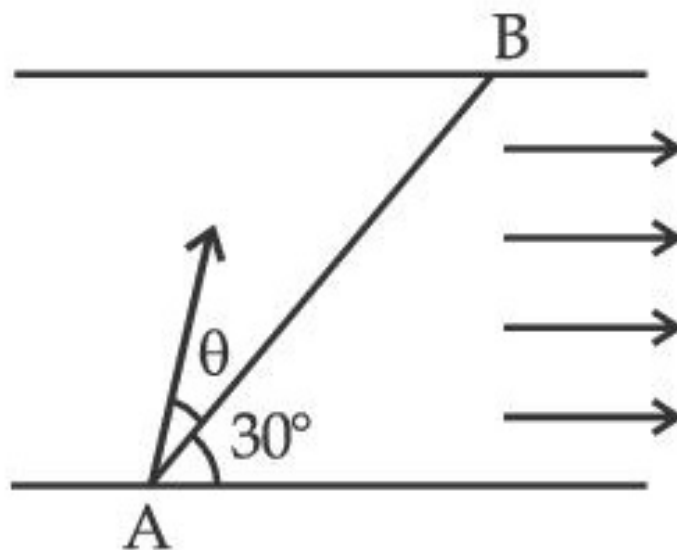
1. Two cars A and B are moving in the same direction along a straight line with speeds 100 km/h and 80 km/h , respectively such that car A is moving ahead of car B . A person in car B throws a stone with a speed v so that it hits the car A with a speed of 5 m/s . The value of v is ____ km/h . (4 Apr 2026 | Shift 2)
- (A) 18 (B) 28
(C) 38 (D) 48
-
2. A river of width 200 m is flowing from west to east with a speed of 18 km/h . A boat, moving with speed of 36 km/h in still water, is made to travel one-round trip (bank to bank of the river). Minimum time taken by the boat for this journey and also the displacement along the river bank are ____ and ____ respectively. (21 Jan 2026 | Shift 2)
- (A) 20 s and 100 m (B) 40 s and 100 m
(C) 40 s and 200 m (D) 40 s and 0 m
-
3. A river is flowing from west to east direction with speed of 9 km h^{-1} . If a boat capable of moving at a maximum speed of 27 km h^{-1} in still water, crosses the river in half a minute, while moving with maximum speed at an angle of 150° to direction of river flow, then the width of the river is : (2 Apr 2025 | Shift 1)
- (A) 112.5 m (B) 75 m
(C) 300 m (D) $112.5 \times \sqrt{3} \text{ m}$
-
4. The maximum speed of a boat in still water is 27 km/h . Now this boat is moving downstream in a river flowing at 9 km/h . A man in the boat throws a ball vertically upwards with speed of 10 m/s . Range of the ball as observed by an observer at rest on the bank is ____ cm . (Take $g = 10 \text{ m/s}^2$) (29 Jan 2025 | Shift 1)
-
5. Two cars P and Q are moving on a road in the same direction. Acceleration of car P increases linearly with time whereas car Q moves with a constant acceleration. Both cars cross each other at time $t = 0$, for the first time. The maximum possible number of crossing(s) (including the crossing at $t = 0$) is _____. (29 Jan 2025 | Shift 2)
-
6. A person is swimming with a speed of 10 m/s at an angle of 120° with the flow and reaches to a point directly opposite on the other side of the river. The speed of the flow is ' x ' m/s . The value of ' x ' to the nearest integer is _____. (18 Mar 2021 | Shift 1)
-

7. Train A is moving along two parallel rail tracks towards north with speed 72 km/h and train B is moving towards south with speed 108 km/h . Velocity of train B with respect to A and velocity of ground with respect to B are (in ms^{-1}): (1 Feb 2024 | Shift 2)
- (A) -50 and -30 (B) -50 and 30
(C) -30 and 50 (D) 50 and -30
-
8. Two trains 'A' and 'B' of length ' l ' and ' $4l$ ' are travelling into a tunnel of length ' L ' in parallel tracks from opposite directions with velocities 108 km/h and 72 km/h , respectively. If train 'A' takes 35 s less time than train 'B' to cross the tunnel then, length ' L ' of tunnel is : (13 Apr 2023 | Shift 1)
- (Given $L = 60l$)
- (A) 900 m (B) 1200 m
(C) 1800 m (D) 2700 m
-
9. A passenger sitting in a train A moving at 90 km/h observes another train B moving in the opposite direction for 8 s . If the velocity of the train B is 54 km/h , then length of train B is: (13 Apr 2023 | Shift 2)
- (A) 80 m (B) 200 m
(C) 120 m (D) 320 m
-
10. The speed of a swimmer is 4 km h^{-1} in still water. If the swimmer makes his strokes normal to the flow of river of width 1 km , he reaches a point 750 m down the stream on the opposite bank.
The speed of the river water is _____ km h^{-1} (31 Jan 2023 | Shift 1)
-
11. A girl standing on road holds her umbrella at 45° with the vertical to keep the rain away. If she starts running without umbrella with a speed of $15\sqrt{2} \text{ kmh}^{-1}$, the rain drops hit her head vertically. The speed of rain drops with respect to the moving girl is : (27 Jun 2022 | Shift 1)
- (A) 30 kmh^{-1} (B) $\frac{25}{\sqrt{2}} \text{ kmh}^{-1}$
(C) $\frac{30}{\sqrt{2}} \text{ kmh}^{-1}$ (D) 25 kmh^{-1}

12. Two buses P and Q start from a point at the same time and move in a straight line and their positions are represented by $X_P(t) = \alpha t + \beta t^2$ and $X_Q(t) = ft - t^2$. At what time, both the buses have same velocity? (25 Jun 2022 | Shift 2)

(A) $\frac{\alpha - f}{1 + \beta}$ (B) $\frac{\alpha + f}{2(\beta - 1)}$
(C) $\frac{\alpha + f}{2(1 + \beta)}$ (D) $\frac{f - \alpha}{2(1 + \beta)}$

13. A swimmer wants to cross a river from point A to point B. Line AB makes an angle of 30° with the flow of river. Magnitude of velocity of the swimmer is same as that of the river. The angle θ with the line AB should be _____°, so that the swimmer reaches point B.



(27 Jul 2021 | Shift 2)

14. A butterfly is flying with a velocity $4\sqrt{2}$ m/s in North-East direction. Wind is slowly blowing at 1 m/s from North to South. The resultant displacement of the butterfly in 3 seconds is : (20 Jul 2021 | Shift 1)

(A) $12\sqrt{2}$ m (B) 20 m
(C) 3 m (D) 15 m

15. A swimmer can swim with velocity of 12 km/h in still water. Water flowing in a river has velocity 6 km/h. The direction with respect to the direction of flow of river water he should swim in order to reach the point on the other bank just opposite to his starting point is _____°. (Round off to the Nearest Integer) (Find the angle in degrees) (16 Mar 2021 | Shift 2)

16. A boy reaches the airport and finds that the escalator is not working. He walks up the stationary escalator in time t_1 . If he remains stationary on a moving escalator then the escalator takes him up in time t_2 . The time taken by him to walk up on the moving escalator will be : (20 Jul 2021 | Shift 2)
- (A) $\frac{t_1 t_2}{t_2 - t_1}$ (B) $\frac{t_1 + t_2}{2}$
(C) $\frac{t_1 t_2}{t_2 + t_1}$ (D) $t_2 - t_1$
-
17. When a car is at rest, its driver sees rain drops falling on it vertically. When driving the car with speed v , he sees that rain drops are coming at an angle 60° from the horizontal. On further increasing the speed of the car to $(1 + \beta)v$, this angle changes to 45° . The value of β is close to : (6 Sept 2020 | Shift 2)
- (A) 0.50 (B) 0.73
(C) 0.37 (D) 0.41
-
18. Train A and train B are running on parallel tracks in the opposite directions with speeds of 36 km/hour and 72 km/hour, respectively. A person is walking in train A in the direction opposite to its motion with a speed of 1.8 km/ hour. Speed (in ms^{-1}) of this person as observed from train B will be close to : (2 Sept 2020 | Shift 1)
(take the distance between the tracks as negligible)
- (A) 30.5 ms^{-1} (B) 29.5 ms^{-1}
(C) 31.5 ms^{-1} (D) 28.5 ms^{-1}
-
19. A particle is moving along the x-axis with its coordinate with the time 't' given by $x(t) = 10 + 8t - 3t^2$. Another particle is moving along the y-axis with its coordinate as a function of time given by $y(t) = 5 - 8t^3$. At $t = 1\text{s}$, the speed of the second particle as measured in the frame of the first particle is given as $\sqrt{v}$. Then v (in m/s) is _____. (8 Jan 2020 | Shift 1)
-
20. The stream of a river is flowing with a speed of 2km/h. A swimmer can swim at a speed of 4km/h. What should be the direction of the swimmer with respect to the flow of the river to cross the river straight ? (9 Apr 2019 | Shift 1)
- (A) 150° (B) 120°
(C) 60° (D) 90°

21. Ship A is sailing towards north-east with velocity $\vec{v} = 30\hat{i} + 50\hat{j}$ km/hr where $\hat{i}$ points east and $\hat{j}$, north. Ship B is at a distance of 80 km east and 150 km north of Ship A and is sailing towards west at 10 km/hr. A will be at minimum distance from B in :

(8 Apr 2019 | Shift 1)

- (A) 2.2 hrs (B) 4.2 hrs
(C) 2.6 hrs (D) 3.2 hrs
-

22. A passenger train of length 60 m travels at a speed of 80 km/hr. Another freight train of length 120 m travels at a speed of 30 km/hr. The ratio of times taken by the passenger train to completely cross the freight train when : (i) they are moving in the same direction , and (ii) in the opposite direction is :

(12 Jan 2019 | Shift 1)

- (A) $\frac{25}{11}$ (B) $\frac{3}{2}$
(C) $\frac{11}{5}$ (D) $\frac{5}{2}$
-

23. A person standing on an open ground hears the sound of a jet aeroplane, coming from north at an angle 60° with ground level. But he finds the aeroplane right vertically above his position. If v is the speed of sound, speed of the plane is :

(12 Jan 2019 | Shift 1)

- (A) $\frac{\sqrt{3}}{2}v$ (B) $\frac{2v}{\sqrt{3}}$
(C) v (D) $\frac{v}{2}$
-

24. A car is standing 200 m behind a bus, which is also at rest. The two start moving at the same instant but with different forward accelerations. The bus has acceleration 2 m/s^2 and the car has acceleration 4 m/s^2 . The car will catch up with the bus after a time of :

(9 Apr 2017 | Shift 1)

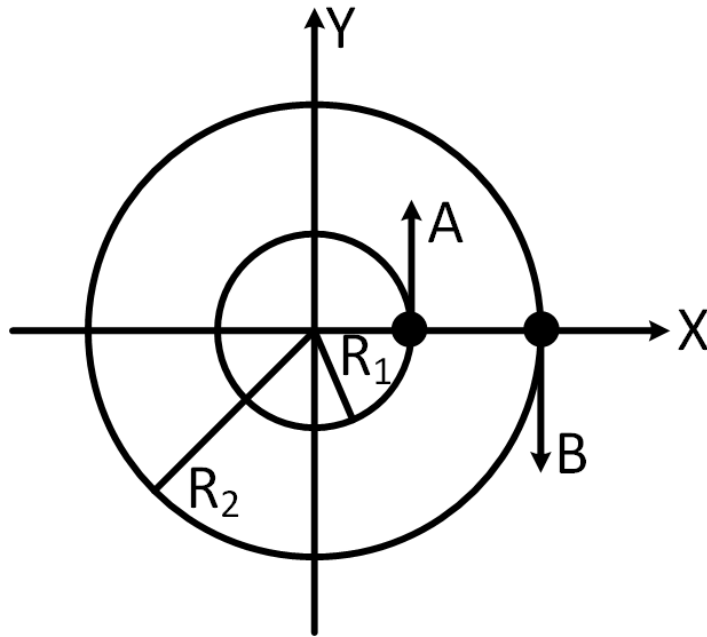
- (A) $\sqrt{110} \text{ s}$ (B) $\sqrt{120} \text{ s}$
(C) $10\sqrt{2} \text{ s}$ (D) 15 s
-

25. A person climbs up a stalled escalator in 60 s. If standing on the same but escalator running with constant velocity he takes 40 s. How much time is taken by the person to walk up the moving escalator?

(12 Apr 2014 | Single slot)

- (A) 37 s (B) 27 s
(C) 24 s (D) 45 s
-

26. Two particles A, B are moving on two concentric circles of radii R_1 and R_2 with equal angular speed ω . At $t = 0$, their positions and direction of motion are shown in the figure. :



The relative velocity $\vec{V}_A - \vec{V}_B$ at $t = \frac{\pi}{2\omega}$ is given by :

(12 Jan 2019 | Shift 2)

- | | |
|-----------------------------------|----------------------------------|
| (A) $-\omega (R_1 + R_2) \hat{i}$ | (B) $\omega (R_2 - R_1) \hat{i}$ |
| (C) $\omega (R_1 + R_2) \hat{i}$ | (D) $\omega (R_1 - R_1) \hat{i}$ |

27. Two stones are thrown up simultaneously from the edge of a cliff 240 m high with initial speed of 10 m/s and 40 m/s respectively. Which of the following graph best represents the time variation of relative position of the second stone with respect to the first ?

(Assume stones do not rebound after hitting the ground and neglect air resistance, take $g = 10\text{ m/s}^2$)

(The figures are schematic and not drawn to scale)

(4 Apr 2015 | Single sitting)

