



SIR PRATEEK JAIN

- . Founder @ Physicsaholics
- . Top Physics Faculty on Unacademy (IIT JEE & NEET)
- . 8+ years of teaching experience in top institutes like FIITJEE (Delhi, Indore) , CP (KOTA) etc.
- . Produced multiple Top ranks.
- . Research work with HC Verma sir at IIT Kanpur
- . Interviewed by International media.

PLUS

ICONIC ^{**}

✓ India's Best Educators

✓ Interactive Live Classes

✓ Structured Courses & PDFs

✓ Live Tests & Quizzes

✗ Personal Coach

✗ Study Planner

24 months

No cost EMI

₹2,333/mo

₹56,000

>

18 months

No cost EMI

₹2,625/mo

₹47,250

>

12 months

No cost EMI

₹3,208/mo

₹38,500

>

6 months

No cost EMI


₹4,667/mo

₹28,000

>

To be paid as a one-time payment

View all plans

 Add a referral code

APPLY

PHYSICSLIVE

PLUS

ICONIC ^{**}

✓ India's Best Educators

✓ Interactive Live Classes

✓ Structured Courses & PDFs

✓ Live Tests & Quizzes

✗ Personal Coach

✗ Study Planner

24 months

No cost EMI

₹2,100/mo

+10% OFF ₹50,400

>

18 months

No cost EMI

₹2,363/mo

+10% OFF ₹42,525

>

12 months

No cost EMI

₹2,888/mo

+10% OFF ₹34,650

>

6 months

No cost EMI


₹4,200/mo

+10% OFF ₹25,200

>

To be paid as a one-time payment

View all plans

 Awesome! PHYSICSLIVE code applied

✗

Use code **PHYSICSLIVE** to get 10% OFF on Unacademy PLUS.

For Video Solution of this DPP, Click on below link

Solution on
Website:-

<https://physicsaholics.com/home/courseDetails/41>

Solution on
YouTube:-

https://youtu.be/8_MuHpKh088

Physics DPP

DPP-7 Relative motion in One-Dimension
By Physicsaholics Team

NEET

Physics DPP

By PRATEEK JAIN SIR

Q) Two trains, each 50m long are travelling in opposite direction with velocity 10 m/s and 15 m/s The time of crossing is: -

(a) 2 s

(b) 4 s

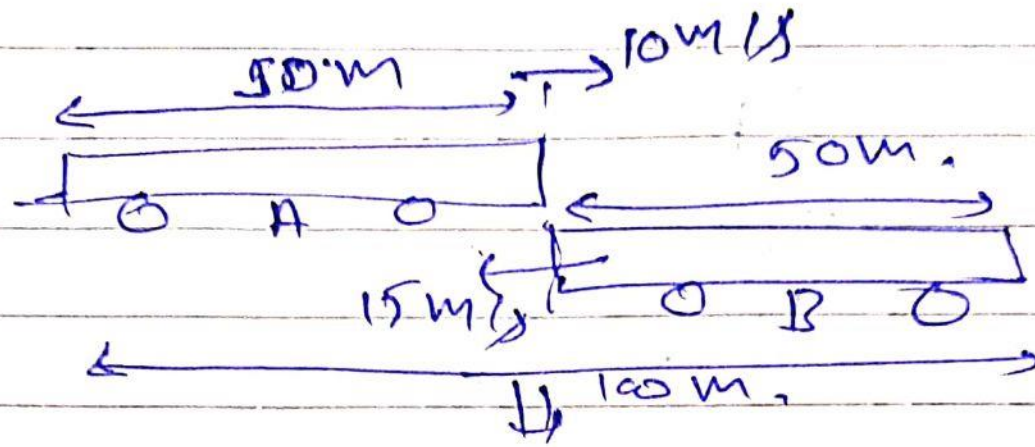
(c) $2\sqrt{3}$ s

(d) $4\sqrt{3}$ s

Join Unacademy PLUS Referral Code :

Physicslive

Ans. b



if B travels with respect to 'A'
then it has to cover 100 m to
cross the train 'A'

$$V_{A/B} = 15 + 10 = 25 \text{ m/s}$$

$$t = \frac{d}{V_{A/B}} = \frac{100}{25}$$

$$\boxed{t = 4 \text{ sec}}$$

Q) A police jeep is chasing with, velocity of 45 km/h a thief in another jeep moving with velocity 153 km/h. Police fires a bullet with muzzle velocity of 180 m/s. The velocity it will strike the car of the thief w.r.t. the car of the thief is:

(a) 150 m/s

(b) 27 m/s

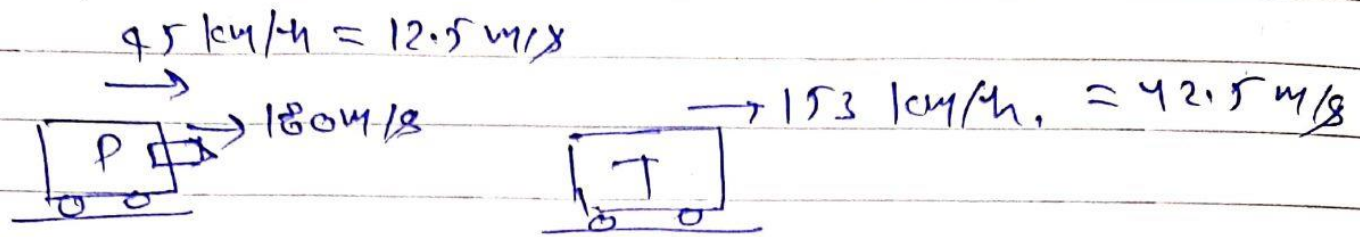
(c) 450 m/s

(d) 250 m/s

Join Unacademy PLUS Referral Code :

Physicslive

Ans. a



velocity of bullet w.r.t. police car

$$V_{b/p} = 180 \text{ m/s}$$

$$V_b - V_p = 180 \text{ m/s}$$

$$\boxed{V_b = 192.5 \text{ m/s}}$$

↳ velocity of bullet w.r.t. ground.

Velocity of bullet w.r.t. Thief's car

$$V_{b/T} = V_b - V_T$$

$$= 192.5 - 42.5$$

$$\boxed{V_{b/T} = 150 \text{ m/s}}$$

Q) An observer moves with a constant speed along the line joining two stationary objects. He will observe the two objects. Then which of the below statements are correct:

- (1) the two objects have the same speed
- (2) the two objects have the same velocity
- (3) the two objects move in the same direction
- (4) the two objects Move in opposite direction

(a) 1, 2, 4

(b) 2, 3, 4

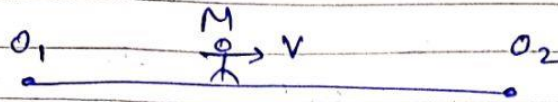
(c) 1, 3, 3

(d) 1, 2, 3

Join Unacademy PLUS Referral Code :

Physicslive

Ans. d



let observer 'M' moves with velocity
 $\vec{V}_m = V\hat{i}$ (w.r.t. ground)

then velocity of object O_1 w.r.t. M

$$\vec{V}_{O_1/M} = \vec{V}_{O_1} - \vec{V}_m = 0 - (V\hat{i})$$

$$\boxed{\vec{V}_{O_1/M} = -V\hat{i}} \quad \& \quad \boxed{V_{O_1/M} = V} \quad \text{--- (1)}$$

velocity. speed

Now; Velocity of object O_2 w.r.t. M

$$\begin{aligned} \vec{V}_{O_2/M} &= \vec{V}_{O_2} - \vec{V}_m \\ &= 0 - V\hat{i} \end{aligned}$$

$$\boxed{\vec{V}_{O_2/M} = -V\hat{i}} \quad \& \quad \boxed{V_{O_2/M} = V} \quad \text{--- (2)}$$

velocity. speed

So; from eqⁿ (1) & (2)

we can say that
 w.r.t. 'M'

O_1 & O_2 moves in same direction
 and with same speed and
 same velocity.

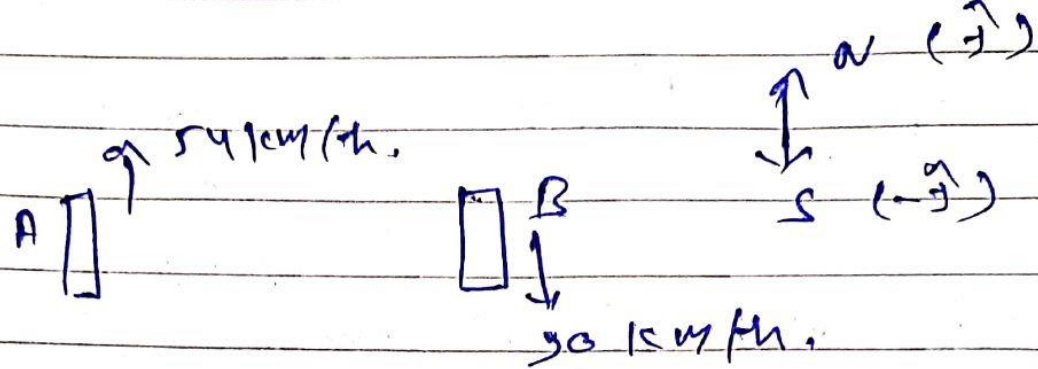
Q) Two parallel rail tracks run north-south. Train A moves north with a speed of 54 km/h and train B moves south with a speed of 90 km/h. The relative speed of B with respect to A is:

- (a) 40 m/s (towards north) (b) 40 m/s (towards south)
(c) 10 m/s (towards north) (d) 10 m/s (towards north)

Join Unacademy PLUS Referral Code :

Physicslive

Ans. b



$$\vec{v}_A = (54 \hat{j}) \text{ km/h} \quad \vec{v}_B = (-90 \hat{j}) \text{ km/h}$$

$$\begin{aligned} \vec{v}_{B/A} &= \vec{v}_B - \vec{v}_A \\ &= (-90 \hat{j}) - (54 \hat{j}) \end{aligned}$$

$$\vec{v}_{B/A} = (-144 \hat{j}) \text{ km/h}$$

or $v_{B/A} = 144 \text{ km/h}$ ^{towards} (in south)

$$\boxed{v_{B/A} = 40 \text{ m/s (towards South)}}$$

Q) When a man stands on a moving escalator (moving with constant speed) he goes up in 50 sec. and when he walks up the moving escalator (with constant speed) he goes up in 30 sec. Then the man walks up the stationary escalator in a time of _____sec

(a) 60 s

(b) 75 s

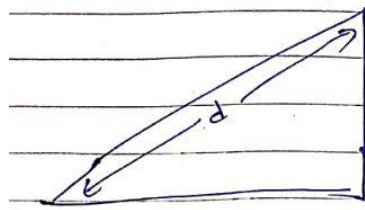
(c) 90 s

(d) 18.75

Join Unacademy PLUS Referral Code :

Physicslive

Ans. b



v_e = speed of escalator
w.r.t. ground.

v_m = speed of man w.r.t.
ground.

$v_{m/e}$ = speed of man w.r.t.
escalator.

$$v_{m/e} = v_m + v_e.$$

$$50 = \frac{d}{v_e} \quad \text{--- (1) } \Rightarrow$$

$$30 = \frac{d}{v_m + v_e} \quad \text{--- (2)}$$

$$\frac{(1)}{(2)} = \frac{5}{3} = \frac{v_m + v_e}{v_e}$$

$$5v_e = 3v_m + 3v_e$$

$$2v_e = 3v_m$$

$$\boxed{\frac{v_e}{v_m} = \frac{3}{2}}$$

$$v_m = \frac{2}{3}v_e$$

$$t = \frac{d}{v_m} = \frac{d}{\frac{2}{3}v_e} = \frac{3}{2} \frac{d}{v_e}$$

& from eqⁿ (1) $50 = \frac{d}{v_e}$

$$t = \frac{3}{2} (50) =$$

$$\boxed{t = 75 \text{ sec}}$$

Q) The distance between two particle is decreasing at the rate of 6 m/sec. If these particles travel with same speeds and in the same direction, then the separation increase at the rate of 4 m/sec. The particle have speed as

(a) 5 m/s, 1 m/s

(b) 4 m/s, 1 m/s

(c) 4 m/s, 2 m/s

(d) 5 m/s, 2 m/s

Join Unacademy PLUS Referral Code :

Physicslive

Ans. a

Let speed of two particles w.r.t.
ground are V_1 & V_2 :

Now.

relative velocity when moving in
same direction; (when ~~start~~ separability
decreases)

$$V_{re} = V_1 - V_2 = 6 \text{ m/s} \quad \text{--- (1)}$$

if relative velocity when both moving
away from each other; (when distance
increases)

$$V_{rel} = V_1 + V_2 = 4 \text{ m/s} \quad \text{--- (2)}$$

$$\textcircled{1} + \textcircled{2} \Rightarrow 2V_1 = 10 \text{ m/s} \Rightarrow 5$$

$$\Rightarrow \boxed{V_1 = 5 \text{ m/s}}$$

$$\& \quad \boxed{V_2 = 1 \text{ m/s}}$$

(\because speed ~~has~~ is
always +ve)

Q) Two trains start a distance of 2000m apart. Train one is moving with a constant speed of 30m/s directly towards train 2 which starts from rest and accelerates with a constant acceleration of 5m/s^2 directly towards train 1. When do the trains meet?

(a) 22.9 s

(b) 34.9 s

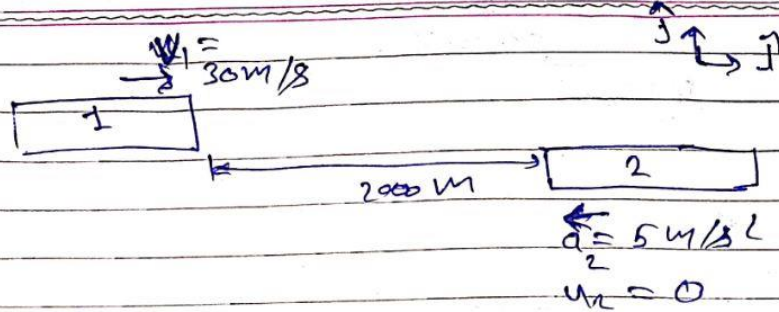
(c) 30 s

(d) 40 s

Join Unacademy PLUS Referral Code :

Physicslive

Ans. a



initial speed of 1 w.r.t. 2

$$\vec{u}_{1/2} = \vec{u}_1 - \vec{u}_2 = 30 \text{ m/s } (\hat{i})$$

acceleration of 1 w.r.t. 2

$$\begin{aligned} \vec{a}_{1/2} &= \vec{a}_1 - \vec{a}_2 \\ &= 0 - (-5\hat{i}) \\ \vec{a}_{1/2} &= 5\hat{i} \text{ m/s}^2 \end{aligned}$$

$$s = ut + \frac{1}{2}at^2$$

$$2000 = u_{1/2}(t) + \frac{1}{2}a_{1/2}t^2$$

$$2000 = 30(t) + \frac{1}{2}(5)t^2$$

$$4000 = 60t + 5t^2$$

$$800 = 12t + t^2$$

$$t^2 + 12t - 800 = 0$$

$$t = \frac{-12 \pm \sqrt{12^2 - 4 \times 1 \times (-800)}}{2 \times 1}$$

$$t = \frac{-12 \pm \sqrt{144 + 3200}}{2}$$

$$t = \frac{-12 + \sqrt{3344}}{2} \Rightarrow \boxed{t = 22.9 \text{ Sec.}}$$

Q) A train starts from rest with constant acceleration $a = 1 \text{ m/s}^2$. A passenger at a distance S (behind the train) from the train runs at this maximum velocity of 10 m/s to catch the train at the same moment at which the train starts. If $S = 25.5 \text{ m}$ and passenger keeps running, find the time in which he will catch the train:

(a) 5 s

(b) 4 s

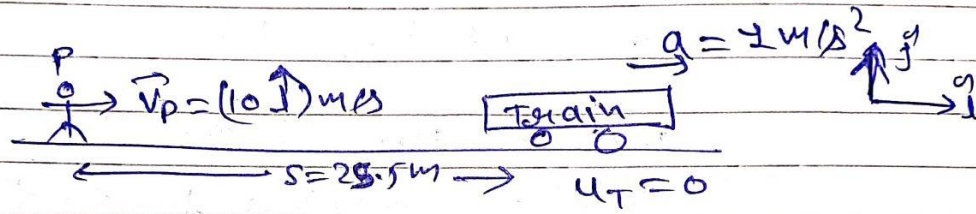
(c) 3 s

(d) $2\sqrt{2} \text{ s}$

Join Unacademy PLUS Referral Code :

Physicslive

Ans. c



initial velocity of passenger w.r.t. train

$$\vec{v}_{P/T} = \vec{v}_P - \vec{u}_T$$

$$= 10\hat{j} - 0$$

$$\vec{v}_{P/T} = (10\hat{j}) \text{ m/s}$$

acceleration of passenger w.r.t. train

$$\vec{a}_{P/T} = \vec{a}_P - \vec{a}_T = 0 - 1 \text{ m/s}^2 \hat{j}$$

$$\vec{a}_{P/T} = -1 \text{ m/s}^2 \hat{j}$$

$$s = ut + \frac{1}{2}at^2$$

$$28.5 = 10(t) - \frac{1}{2}(1)t^2$$

$$28.5 = 10t - \frac{t^2}{2}$$

$$t^2 - 20t + 57 = 0$$

$$t^2 - 3t - 17t + 51 = 0$$

$$t(t-3) - 17(t-3) = 0$$

$$t = 3 \text{ sec} \quad \text{and} \quad t = 17 \text{ sec.}$$

Q) An express train is moving with a velocity V_1 . Its driver finds another train is moving on the same track in the same direction with velocity V_2 . To escape collision, driver applies retardation a on the train. The minimum time of escaping collision will be:

(a) $t = \frac{V_1 - V_2}{a}$

(b) $t = \frac{V_1^2 - V_2^2}{a}$

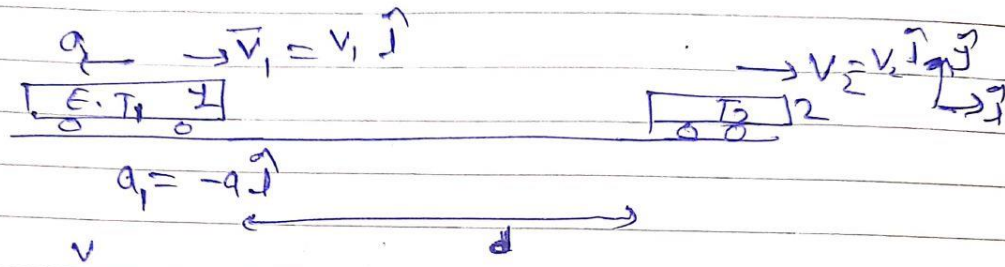
(c) $t = \frac{V_1^2 + V_2^2}{a}$

(d) $2\sqrt{2} \text{ s}$

Join Unacademy PLUS Referral Code :

Physicslive

Ans. a



initial velocity of Train 1 w.r.t. Train 2

$$\vec{v}_{1/2} = \vec{v}_1 - \vec{v}_2 = (v_1 - v_2) \hat{j} \text{ m/s}$$

rel.

acceleration; $\vec{a}_{1/2} = \vec{a}_1 - \vec{a}_2 = -a \hat{j} - 0$

$$\vec{a}_{1/2} = -a \hat{j}$$

after time ' t ' speed of train 2 w.r.t. train 1 should be zero to avoid collision;

$$v = u + at$$

$$0 = (v_1 - v_2) - at$$

$$t = \frac{v_1 - v_2}{a}$$

Q) A train 100m long travelling at 40 m/s starts overtaking another train 200m long travelling at 30 m/s. The time taken by the first train to pass the second train completely is:

(a) 30 s

(b) 40 s

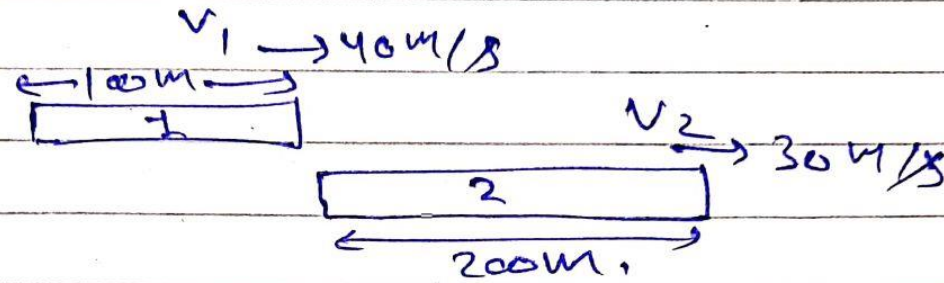
(c) 50 s

(d) 60 s

Join Unacademy PLUS Referral Code :

Physicslive

Ans. a



speed of Train 1 w.r.t. Train 2

$$V_{1/2} = V_1 - V_2 = 40 - 30$$

$$\boxed{V_{1/2} = 10 \text{ m/s}}$$

min: distance traveled by train 1
to overtake the train - 2 is
 $d = 100 + 200 = 300 \text{ m}$,

$$t = \frac{d}{V_{1/2}} = \frac{300}{10}$$

$$\boxed{t = 30 \text{ sec.}}$$

For Video Solution of this DPP, Click on below link

Solution on
Website:-

<https://physicsaholics.com/home/courseDetails/41>

Solution on
YouTube:-

https://youtu.be/8_MuHpKh088

Chalo Niklo