PHYSICS

BOOKS - VGS BRILLIANT PHYSICS (TELUGU ENGLISH)

MOTION

Conceptual Understanding

1. As shown in following figure, a point traverses the curved path. Draw the

displacement vector from given points A to B.

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2. Distinguish between speed and velocity.

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3. A Stone dropped from top of a well reaches the surface of water in 2 seconds, find the velocity of stone while it touches the surface of water and what is the depth of the water

surface from top of well ($g = 10m/s^2$) (Using V = U + at, S = Ut + $1/2at^2$)

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Communication Through Drawing Model Making

1. As shown in following figure, a point traverses the curved path.

Draw the displacement vector from given points A to B.

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2. The shape of distance vs time graph for a body which is in uniform motion is .....

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3. You may have heard the story of the race between the rabbit and tortoise. They started from same point simultaneously with constant speeds. During the journey, rabbit took rest somewhere along the way for a while. But

tortoise moves steadily with lesser speed and reaches finishing point before rabbit. Rabbit woke up and ran, but rabbit realized that the tortoise had won the race. Draw distance vs time graph for this story.

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Application To Daily Life Concern To Biodiversity

1. Two trains each of having a speed of 30 km/h are headed at each other in opposite

direction on the same track. A bird flies off one train to another with a constant speed of 60km/h when they are 60 km apart till before they crash. Find the distance covered by the bird and how many trips the bird can make from one train to the other before they crash.

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Try These

1. A body leaving a certain point "O" moves with a constant acceleration. At the end of the fifth second its velocity is 1.5 m/s. At the end of the sixth second the body stops and then begins to move backwards. Find the distance traversed by the body before it stops. Determine the velocity with which the body returns to point "O". (27m, -9m/s)

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2. Suppose that the three balls shown in figure start simultaneously from the top of the hills. Which one reaches the bottom first ? Explain.

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3. A car travels at a speed of 80 km/h during the first half of its running time and at 40 km/h during the other half. Find the average speed of the car. (60 km/h)

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4. A car covers half the distance at a speed of 50 km/h and the other half at 40 km/h.

Fined the average speed of the car. (44.44 km/h).

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5. A particle covers 10m in first 5 sec and 10m in next 3 sec. Assuming constant acceleration,

find initial speed, acceleration and distance covered in next 2 sec.

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6. A car starts from rest and travels with uniform acceleration a, for some time and then with uniform retardation β and comes to rest. If the total time of car is 't', the maximum velocity attained by it is given by

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7. A man is 48m behind a bus which is at rest. The bus starts accelerating at the rate of $1m/s^2$, at the same time the man starts running with uniform velocity of 10 m/s. What is the minimum time in which the man catches the bus ?

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Activities

1. Draw a graph showing the difference between distance and displacement.

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2. Draw displacement vectors from A to B in the following situations.

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3. Can you measure the average speed and average velocity ?

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4. Show that the direction of velocity is tangent to the path at a point of interest when a body is in uniform circular motion.

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5. Describe an activity to explain the situation that "the speed changes but the direction of motion remains constant".

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6. Explain an activity to observe where speed and direction of motion change continuously.

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7. Describe an activity to find the acceleration and velocity of an object moving on inclined track.

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Think Discuss

1. An ant is moving on the surface of a ball. Does its velocity change or not ? Explain.

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2. Give an example to each situation in daily life.

i) Speed changes when direction remains constant.

ii) Direction of motion changes when speed remains constant.

iii) Speed and direction simultaneously change.

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3. Which has the greater acceleration, an airplane, that goes from 1000 km/h to 1005 km/h in 10s or a skateboard that goes from zero to 5km/h in 1 second ?

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Questions Given In The Lesson

1. If earth is in motion, why don't we directly perceive the motion of the earth ?

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2. Are the walls of your classroom at rest or in motion ? Why ?

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3. Have you ever experienced that the train in which you sit appears to move when it is at rest ? Why ?

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4. Why do we observe these changes ?

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5. Are the terms "longer, shorter, up, down" relative or not ?

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6. What answer may the passenger give to the driver ?

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7. How do we understand motion ?

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8. Can you measure the average speed and average velocity ?

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9. How can you differentiate speed and velocity ?

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10. What is the speed of the car at the instant of time $'t_3'$ for given motion ?

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11. In what direction does an object move ?

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12. Describe uniform motion.

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13. a) What is the shape of the graph ?

b) Is it a straight line or not ? Why ?

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14. Draw velocity vectors in the given figure at times t = 0, 1s, 2s, 3s.

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15. Draw velocity vectors at times t = 1s, 2s, 3s, in the given figure.

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16. Is the direction of motion constant ?

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17. Can you give some more examples where speed and direction simultaneously change ?

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18. At which point is the speed maximum ?

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19. Does the object in motion possess acceleration or not ?

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Worked Out Examples

1. A man standing under a street lamp of height 'H' above the ground starts running with a constant speed 'v' in a constant

direction. The light from the lamp falling on the man forms a shadow of him. Find the velocity with which the edge of the shadow of the man's head moves over the ground if his height is "h".

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2. At a distance L = 400m away from the signal light, brakes are applied to a locomotive moving at a velocity u = 54 km/h. Determine the position of rest of the locomotive relative

to the signal light after 1 min. of the application of the brakes if its acceleration a = $-0.3m/s^2$.

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3. A car travels from rest with a constant acceleration "a" for "t" seconds. What is the average speed of the car for its journey if the car moves along a straight road?

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4. A particle moving with constant acceleration of $2m/s^2$ due west has an initial velocity of 9m/s due east. Find the distance covered in the fifth second of its motion.

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Previous Summative Assessments Questions

1. 

From the above data, what can you say about the motion of the object.

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Essential Material For Examination Purpose

1. Define uniform acceleration.

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2. Draw a displacement vector from Visakhapatnam to Hyderabad to the following diagram.

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3. A table clock has its minutes hand 4 cm long. Find the average velocity of the tip of the minute hand between 6.00 AM to 6.30 AM.

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4. An object reaches other end of a diameter in a circular path of radius 7m in 7s. Find speed and velocity of the object ?

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5. An object completes 1/4th revolution of a circular path of radius r. Then find the ratio of distance and displacement.

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6. a) What is a vector ? Given example.

b) What is a scalar ? Given example.

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7. How does a vector represents ? Explain.

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8. Bhavan did not recognise the difference between displacement and distance. Then Anitha explained the difference by asking some questions to Bhavan.

What would be those questions ?

Note : She used this diagram.

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9. Draw a displacement vector and a velocity to the given path of motion of a body.

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10. Describe the graphical method to calculate the instantaneous speed at a given point.

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11. Distinguish between speed and velocity.

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12. A car travelled from A to E station in 3 minutes. Viewing path given below in the figure., find i) distance ii) displacement iii) speed iv) velocity

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Previous Summative Assessments Bits

1. What happens if we remove mudguard from two wheelers, predict ?

A. Mud moves tangentially in all directions.

B. The look of the two wheeler increases.

C. Mud will stick to the wheels and speed decreases.

D. Mud will not fall on the two wheeler.

Answer: C

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2. The experimental arrangement correct order is :

a. Keep the steel plate on the floor at the bottom of the tube.

b) Mark the readings in cm along the tube.

c. Take a long plastic tube of length nearly 200 cm which is be into half along the length.

d. Place one end of the tube on the book and the other end on the floor.

A. c, d, b, a

B. c, d, a, b

C. c, b, d, a

D. a, b, c, d

Answer: B

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3. The apparatus which is missing in the above question (3) to perform the experiment is

a. Glass marble

b. Digital stop clock

c. Thermocol ball

A. a and b

B. c only

C. b only

D. a, b and c

Answer: A

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4. The distance(s) - time(t) graph which represents rainy drops which are falling from certain height with uniform velocity is

A. 

B. 

C. 

D. 

Answer: D

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5. Which of the following graph indicate uniform velocity ?

A. 

B. 

C. 

D. 

Answer: A

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6. For a vector $A \leftrightarrow B$ which of the following is correct ?

A. length indicates magnitude

B. arrow indicates direction

C. both A and B

D. is a scalar

Answer: C

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Objective Type Questions

1. Both the statements are true.

A. Both the statements are false.

B. Statement - I is true and statement - II is false.

C. Statement - I is false and statement - II is true.

D.

Answer: A

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2. Which of the following is a false statement ?

A. The motion of an object depends on the position of an observer.

B. The rest of an object depends on the position of an observer.

C. Motion is relative.

D. Rest is not relative.

Answer: D

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3. An object may have

a)varying speed without having varying velocity

b)varying velocity without having varying speed

c) nonzero acceleration without having varying velocity

d)nonzero acceleration without having varying speed.

A. varying speed without having varying velocity

B. varying velocity without having varying velocity

C. non-zero acceleration without having varying velocity

D. zero acceleration without having varying speed

Answer: B

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4. A body falling for 2 s covers a distance a which is equal to that covered in next l s. If $g = 10ms^{-2}$, the distance s is

A. 30 m

B. 10 m

C. 60 m

D. 20 m

Answer: A

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5. The average speed between B to C is

A. 1.5 m/s

B. 2.5 m/s

C. 2 m/s

D. 4 m/s

Answer: B

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6. In the above graph speed is high at

A. A

B. B

C. C

D. speed is equal

Answer: B

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7. A particle moves along the side of a square of length 'l' starting from A and reaches the opposite corner 'C' by travelling from A to B and B to C in time the average velocity is

A. $\frac{2l}{t}$

B. $\frac{l}{\sqrt{2}t}$

C. Zero

D. $\frac{\sqrt{2}l}{t}$

Answer: D

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8. A vector can be represented as a directed line segment in which length indicates ..... and arrow indicates .....

A. 

B. 

C. 

D. 

Answer: A

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9. The diagram of the direction of velocity at point 'M' of path when a body moves from P to Q.

A. 

B. 

C. 

D. 

Answer: B

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10. The device that shows the average speed of the vehicle is

A. Speedometer

B. Gear box

C. Odometer

D. A or C

Answer: D

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11. A car was moved from A to B of distance 4800 m in 4 hrs. If its speed is 10 m/s, the ratio of distance and displacement between A to B is

A. $1:2$

B. $2:1$

C. $1:1$

D. $1:5$

Answer: B

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12. An apple is falling from a tree. It has

A. constant speed

B. constant velocity

C. constant direction

D. B and C

Answer: C

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13. A body is moving with initial velocity 30 m/s. After certain time it acquires velocity of 40 m/s, then the velocity in middle of its journey is

A. $25\sqrt{2}$

B. 50

C. 25

D. $\frac{\sqrt{50}}{2}$

Answer: A

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Very Short Answer Questions 2 Marks

1. Write the equation for the horizontal range covered by a projectile and specify when it will be maximum .

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2. The vertical component of a vector is equal to its horizontal component. What is the angle made by the vector with x-axis ?

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3. A vector V makes an angle θ with the horizontal. The vector is rotated through an angle α . Does this rotaion change the vector V ?

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4. Two forces of magnitudes 3 units and 5 units act at 60° with each other. What is the magnitude of their resultant ?

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5. A = $\vec{i} + \vec{j}$. What is the angle between the vector and x-axis ?

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6. When two right angled vectors of magnitude 7 units and 24 units combine, what is the magnitude of their resultant ?

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7. If $\overline{P} = 2i + 4j + 14k$ and $\overline{Q} = 4i + 4j + 10k$, find the magnitude of $\overline{P} + \overline{Q}$.

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8. Can a vector of magnitude zero have non-zero components ?

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9. What is the acceleration of a projectile at the top of its trajectory ?

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10. Can two vectors of unequal magnitude add up to give the zero vector ? Can three unequal vectors add up to give the zero vector ?

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Short Answer Questions 4 Marks

1. State parallelogram law of vectors . Derive an expression for the magnitude and direction of the resultant vector .

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2. Show that a boat must move at an angle with respect to river water in order to cross the river in minimum time .

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3. Define unit vector, null vector and posi-tion vector .

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4. If $|\bar{a}+\bar{b}|=|\bar{a}-\bar{b}|$ then find the angle between $\bar{a}$ and $\bar{b}$.

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5. Show that the trajectory of an object thrown at certain angle with the horizontal is a parabola .

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6. Explain the terms the average velocity and instantaneous velocity . When are they equal ?

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7. Show that the maximum height and range of a projectile are $\frac{U^2 \sin^2 \theta}{2g}$ and $\frac{U^2 \sin 2\theta}{g}$ respectively where the terms have their ragular meanings .

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8. If the trajectory of a body is parabolic in one frame, can it be parabolic in another frame that moves with a constant velocity with respect to the first frame? If not, what can it be?

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9. A force $\left(2\hat{I}+\hat{j}-\hat{k}\right)N$ acts on a body which is initially at rest. At the end of 20 sec the velocity of the body is $\left(4\hat{i}+2\hat{j}-2\hat{k}\right)ms^{-1}$,then mass of the body is

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Problems

1. Ship A is 10 km due west of ship b . Ship A is heading directly north at a speed of 30 km/h, while ship b is heading in a direction 60° west of north at a speed of 20 km/h .

(i) Determine the magnitude of the velocity of ship B relative to ship A .

(ii) What will be their distance of closest approach ?

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2. If θ is the angle of projection, R the range, h the maximum height , T the time of flight , then show that (a) tan θ = 4h / R and (b) h = $gT^2/8$

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3. A Projectile is fired at an angle of 60° to the horizontal with an initial velocity of 800 m / s :

Find the time of flight of the projectile before it hits the ground .

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4. A Projectile is fired at an angle of 60° to the horizontal with an initial velocity of 800 m / s : Find the distance it travels before it hits the ground (range).

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5. A Projectile is fired at an angle of 60° to the horizontal with an initial velocity of 800 m / s : Find the time of flight for the projectile toreach its maximum height .

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6. For a particle projected slantwise from the ground, the magnitude of its position vector with respect to the point of projection, when it is at the highest point of the path is found

to be $\sqrt{2}$ times the maximum height reached by it. Show that the angle of projection is $\tan^{-1}(2)$.

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7. An object is launched from a cliff 20 m above the ground at an angle of 30° above the horizontal with an initial speed of 30m/s. How far horizontally does the object travel before landing on the object travel before landing on the ground ? (g $= 10m/s^2$)

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8. O' is a point on the ground chosen as origin . A body first suffers a displacement of $10\sqrt{2}$ mm North -East, next 10 m Noth and finally $10\sqrt{2}$ North-West . How far it is from origin ?

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9. From a point on the ground a particle is projected with initial velocity u, such that its

horizontal range is maximum. The magnitude of average velocity during its ascent is

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10. A particle is projected from the ground with some initial velocity making an angle of 45° with the horizontal. It reaches a height of 7.5 m above the ground while it travels a horzontal distance of 10 m from the point of projection . Find the initial speed of projection (g = 10 m/s^2) .

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11. Wind is blowing from the south at 5 ms^{-1} . To a cyclist it appears to be blowing from the east at 5 ms^{-1} . Show that the velocity of the cyclist is ms^{-1} towards north-east .

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12. A person walking at 4 m/s finds rain drops falling slantwise into his face with a speed of 4 m/s at an angle of 30° with the vertical . Show

that the actual speed of the rain drops is 4 m/s .

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Additional Problems

1. The ceiling of a long hall is 25 m hight . What is the maximum horizontal distance that a ball thrown with a speed of 40 mn^{-1} can go without hitting the ceiling of the hall ?

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2. A stone tied to the end of a string 80 cm long is whirled in a horizontal circle with a constant speed . If the stone makes 14 revolutions is 25 s, what is the magnitude and direction of acceleration of the stone ?

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3. An aircraft executes a horizontal loop of radius 1 km with a steady speed of 900 km/h .

Compare its centripetal acceleration with the acceleration due to gravity .

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4. An aircraft is flying at a height of 3400 m above the ground . If the angle subtended at a ground observation point by the air-craft positions 10 . 0 s apart is 30° , what is the speed of the aircraft ?

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5. A bullet fired at an angle of 30° with the horizontal hits the ground 3 . 0 km away. By adjusting its angle of projection, can one hope to hit a target 5 . 0 km away ? Assume the muzzle speed to be fixed, and neglect air resestance .

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