PHYSICS

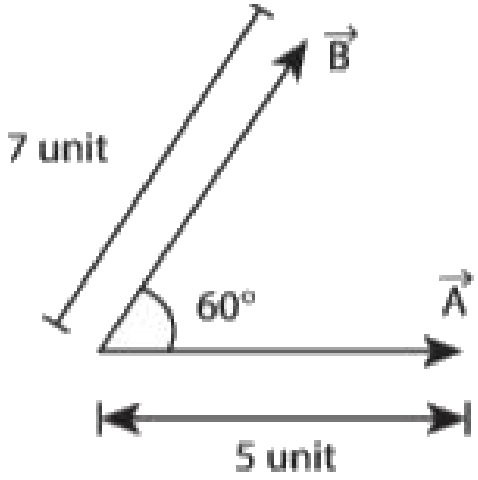
NCERT - FULL MARKS PHYSICS(TAMIL)

KINEMATICS

Example

1. Two vectors $\overrightarrow{A}$ and $\overrightarrow{B}$ of magnitude 5 units and 7 units respectively make an angle 60° with each other as shown below. Find the

magnitude of the resultant vector and its direction with respect to the vector G $\vec{A}$.



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2. Two vectors $\vec{A}$ and $\vec{B}$ of magnitude 5 units and 7 units make an angle 60° with each other. Find the magnitude of the difference

vector $\vec{A} - \vec{B}$ and its direction with respect to the vector $\vec{A}$.

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3. What are the unit vectors along the negative x–direction, negative y–direction, and negative z– direction?

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4. Two vectors $\vec{A}$ and $\vec{B}$ are given in the component form as $\vec{A} = 5\hat{i} + 7\hat{j} - 4\hat{k}$ and $\vec{B} = 6\hat{i} + 3\hat{j} + 2\hat{k}$. Find $\vec{A} + \vec{B}, \vec{B} + \vec{A}, \vec{A} - \vec{B}, \vec{B} - \vec{A}$

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5. Given the vector $\vec{A} = 2\hat{i} + 3\hat{j}$, what is $3\vec{A}$?

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6. A vector $\vec{A}$ is is given as in the following Figure. Find $4\vec{A}$ and $-4\vec{A}$

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7. Given two vectors $\vec{A} = 2\hat{i} + 4\hat{j} + 5\hat{k}$ and $\vec{B} = \hat{i} + 3\hat{j} + 6\hat{k}$, Find the product $\vec{A} . \vec{B}$, and the magnitudes of $\vec{A}$ and $\vec{B}$. What is the angle between them?

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8. Check whether the following vectors are orthogonal.

(i) $\vec{A} = 2\hat{i} + 3\hat{j}$ and $\vec{B} = 4\hat{i} - 5\hat{j}$

(ii) $\vec{C} = 5\hat{i} + 2\hat{j}$ and $\vec{D} = 2\hat{i} - 5\hat{j}$

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9. Two vectors are given as $\vec{r} = 2\hat{i} + 3\hat{j} + 5\hat{k}$ and $\vec{F} = 3\hat{i} - 2\hat{j} + 4\hat{k}$. Find the resultant vector $\vec{\tau} = \vec{r} \times \vec{F}$

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10. Compare the components for the following vector equations

$\overrightarrow{F} = m\overrightarrow{a}$ Here m is positive number

(b) $\overrightarrow{P} = 0$

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11. Determine the value of the T from the given vector equation.

$5\hat{j} - T\hat{j} = 6\hat{j} + 3T\hat{j}$

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12. Compare the components of vector equation $\overrightarrow{F}_1 + \overrightarrow{F}_2 + \overrightarrow{F}_3 = \overrightarrow{F}_4$

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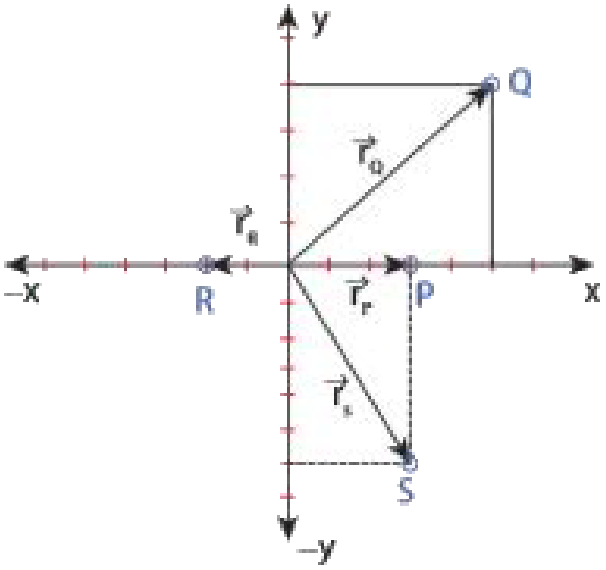
13. Determine the position vectors for the following particles which are located at points

P, Q, R, S.



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14. A person initially at rest starts to walk 2 m towards north, then 1 m towards east, then 5

m towards south and then 3 m towards west. What is the position vector of the person at the end of the trip?

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15. Assume your school is located 2 km away from your home. In the morning you are going to school and in the evening you come back home. In this entire trip what is the distance travelled and the displacement covered?

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16. An athlete covers 3 rounds on a circular track of radius 50 m. Calculate the total distance and displacement travelled by him.

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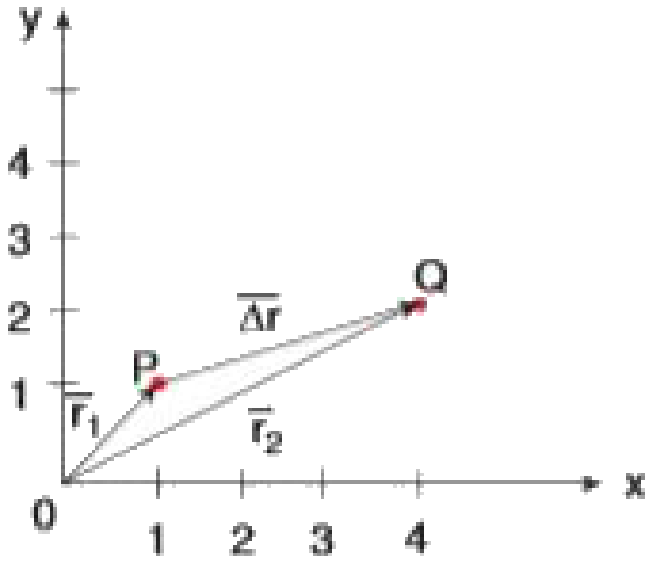
17. Calculate the displacement vector for a particle moving from a point P to Q as shown below. Calculate the magnitude of

displacement.



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18. Consider the function $y = x^2$. Calculate the derivative $\frac{dy}{dx}$ using the concept of limit.

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19. Find the derivative with respect to t, of the function $x = A_0 + A_1 t + A_2 t^2$ where A_0, A_1 and A_2 are constants.

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20. Consider an object travelling in a semi-circular path from point O to point P in 5 second, as is shown in the Figure. Calculate

the average velocity and average speed.

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21. The position vector of a particle is given $\vec{r} = 2t\hat{i} + 3\hat{j} - 5\hat{k}$.

Calculate the velocity and speed of the particle at any instant t

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22. The position vector of a particle is given $\overrightarrow{r} = 2t\hat{i} + 3\hat{j} - 5\hat{k}$.

Calculate the velocity and speed of the particle at time t = 2 s

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23. The velocity of three particles A, B, C are given below. Which particle travels at the greatest speed?

$\overrightarrow{v_A} = 3\hat{i} - 5\hat{j} + 2\hat{k}$

$\overrightarrow{v_B} = \hat{i} + 2\hat{j} + 3\hat{k}$

$\overrightarrow{v_C} = 5\hat{i} + 3\hat{j} + 4\hat{k}$

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24. Two cars are travelling with respective velocities $\overrightarrow{v}_1 = 10ms^{-1}$ along east and $\overrightarrow{v}_2 = 10ms^{-1}$ along west. What are the speeds of the cars?

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25. Consider two masses of 10 g and 1 kg moving with the same speed $10ms^{-1}$. Calculate the magnitude of the momentum.

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26. A particle moves along the x-axis in such a way that its coordinates x varies with time 't' according to the equation $x = 2 - 5t + 6t^2$. What is the initial velocity of the particle?

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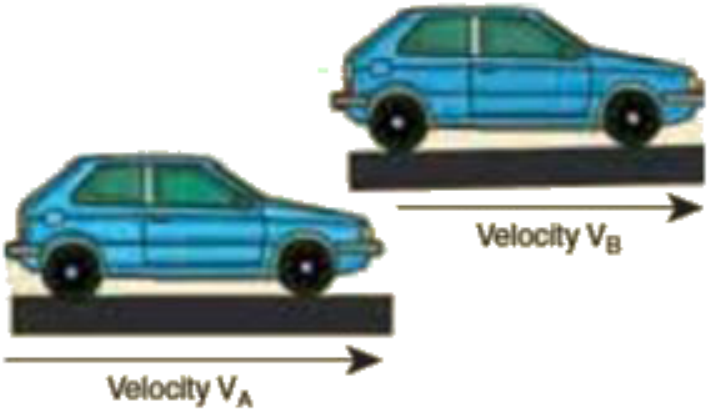
27. Suppose two cars A and B are moving with uniform velocities with respect to ground along parallel tracks and in the same direction. Let the velocities of A and B be $35kmh^{-1}$ due east and $40kmh^{-1}$ due east respectively. What is the relative velocity of car B with

respect to A?



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28. Suppose two trains A and B are moving with uniform velocities along parallel tracks but in opposite directions. Let the velocity of

train A be $40kmh^{-1}$ due east and that of train B be $40kmh^{-1}$ due west. Calculate the relative velocities of the trains

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29. Consider two trains A and B moving along parallel tracks with the same velocity in the same direction. Let the velocity of each train be $50kmh^{-1}$ due east. Calculate the relative velocities of the trains.

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30. How long will a boy sitting near the window of a train travelling at $36kmh^{-1}$ see a train passing by in the opposite direction with a speed of $18kmh^{-1}$. The length of the slow-moving train is 90 m.

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31. A swimmer's speed in the direction of flow of a river is $12kmh^{-1}$. Against the direction of flow of the river the swimmer's speed is

$6kmh^{-1}$. Calculate the swimmer's speed in still water and the velocity of the river flow.

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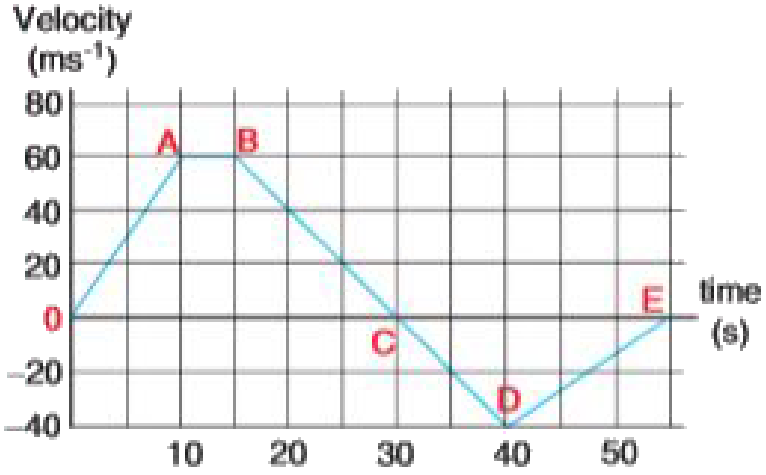
32. A velocity–time graph is given for a particle moving in x direction, as below



Describe the motion qualitatively in the interval 0 to 55 s .

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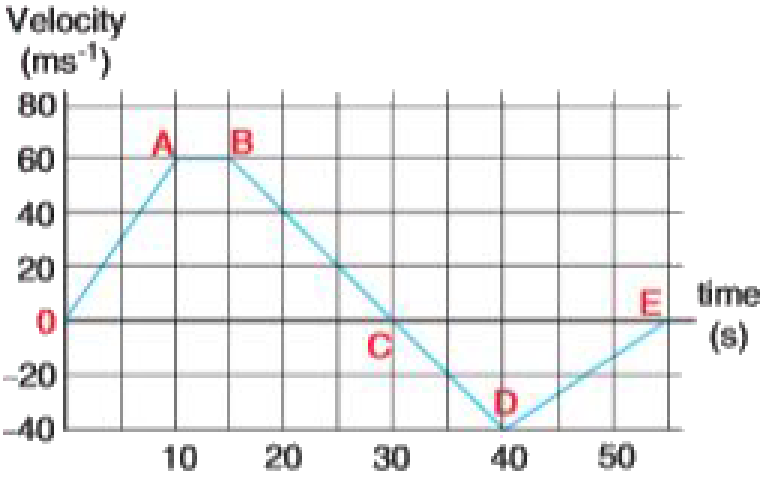
33. A velocity–time graph is given for a particle moving in x direction, as below



Find the distance and displacement travelled from 0 s to 40 s .

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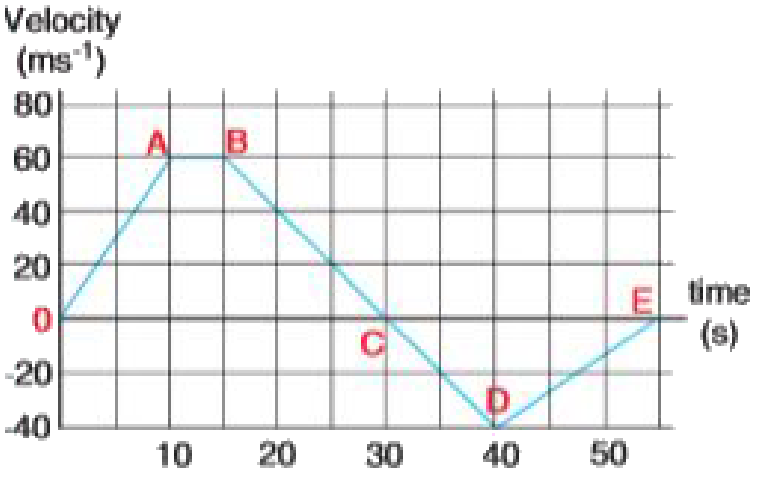
34. A velocity–time graph is given for a particle moving in x direction, as below



Find the acceleration at t = 5 s and at t = 20 s

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35. If the position vector of the particle is given by $\overrightarrow{r} = 3t^2\hat{i} + 5t\hat{j} + 4\hat{k}$, Find the

The velocity of the particle at t = 3 s

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36. If the position vector of the particle is given by $\overrightarrow{r} = 3t^2\hat{i} + 5t\hat{j} + 4\hat{k}$, Find the

Speed of the particle at t = 3 s

View Text Solution

37. If the position vector of the particle is given by $\overrightarrow{r} = 3t^2\hat{i} + 5t\hat{j} + 4\hat{k}$, Find the acceleration of the particle at time t = 3 s

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38. An object is thrown vertically downward. What is the acceleration experienced by the object?

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39. An iron ball and a feather are both falling from a height of 10 m.

What are the time taken by the iron ball and feather to reach the ground?

b) What are the velocities of iron ball and feather when they reach the ground? (Ignore air resistance and take $g = 10ms^{-2}$)

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40. A train was moving at the rate of $54 kmh^{-1}$ when brakes were applied. It came to rest within a distance of 225 m. Calculate the retardation produced in the train.

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41. Suppose an object is thrown with initial speed $10 ms^{-1}$ at an angle $\pi/4$ with the horizontal, what is the range covered? Suppose the same object is thrown similarly in

the Moon, will there be any change in the range? If yes, what is the change? (The acceleration due to gravity in the Moon $g_{\text{moon}} = \frac{1}{6}g$)

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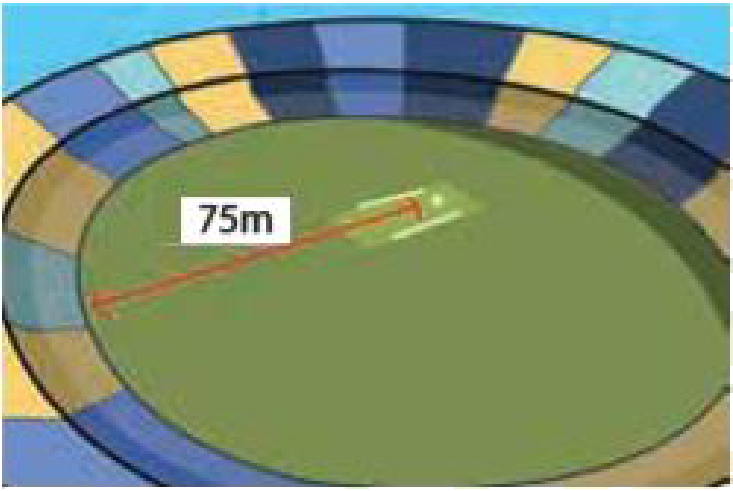
42. In the cricket game, a batsman strikes the ball such that it moves with the speed $30ms^{-1}$ at an angle 30° with the horizontal as shown in the figure. The boundary line of the cricket ground is located at a distance of

75 m from the batsman? Will the ball go for a six? (Neglect the air resistance and take acceleration due to gravity $g = 10ms^{-2}$).



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43. Calculate the angle θ subtended by the two adjacent wooden spokes of a bullock cart wheel is shown in the figure. Express the angle in both radian and degree.

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44. A particle moves in a circle of radius 10 m. Its linear speed is given by vt 3 where t is in second and v is in ms^{-1}.

(a) Find the centripetal and tangential acceleration at t = 2 s.

(b) Calculate the angle between the resultant acceleration and the radius vector.

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45. A particle is in circular motion with an acceleration $\alpha = 0.2 rads^{-2}$.

(a) What is the angular displacement made by the particle after 5 s?

(b) What is the angular velocity at t = 5 s?. Assume the initial angular velocity is zero.

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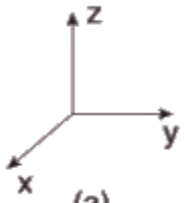
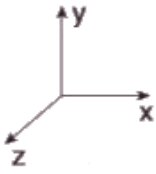
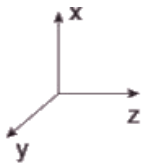
Exercise I Multi Choice Question

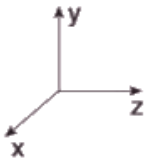
1. Which one of the following Cartesian coordinate systems is not followed in physics?

A. 

(a)

B. 

C. 

D. 

Answer: D

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2. Identify the unit vector in the following.

A. $\hat{i} + \hat{j}$

B. $\frac{\hat{i}}{\sqrt{2}}$

C. $\hat{k} - \frac{\hat{j}}{\sqrt{2}}$

D. $\frac{\hat{i} + \hat{j}}{\sqrt{2}}$

Answer: D

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3. Which one of the following physical quantities cannot be represented by a scalar?

A. Mass

B. length

C. momentum

D. magnitude of acceleration

Answer: C

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4. Two objects of masses m_1 and m_2 fall from the heights h_1 and h_2 respectively. Th e ratio of the magnitude of their momenta when they hit the ground is

A. $\sqrt{\frac{h_1}{h_2}}$

B. $\sqrt{\frac{m_1 h_1}{m_2 h_2}}$

C. $\frac{m_1}{m_2}\sqrt{\frac{h_1}{h_2}}$

D. $\frac{m_1}{m_2}$

Answer: C

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5. If a particle has negative velocity and negative acceleration, its speed

A. increases

B. decreases

C. remains same

D. zero

Answer: A

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6. If the velocity is $\overrightarrow{=} 2\hat{i} + t^2\hat{j} - 9\hat{k}$, then the magnitude of acceleration at t = 0.5 s is

A. $1ms^{-1}$

B. $2ms^{-2}$

C. zero

D. $-1ms^{-2}$

Answer: A

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7. If an object is dropped from the top of a building and it reaches the ground at t = 4 s , then the height of the building is (ignoring air resistance) $\left(g = 9.8ms^{-2}\right)$

A. 77.3 m

B. 78.4 m

C. 80.5 m

D. 79.2 m

Answer: B

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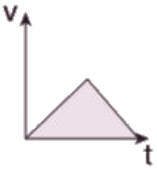
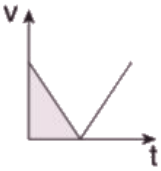
8. A ball is projected vertically upwards with a velocity v. It comes back to ground in time t. Which v-t graph shows the motion correctly?

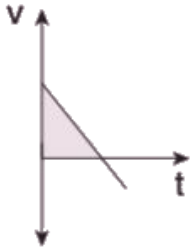
A.



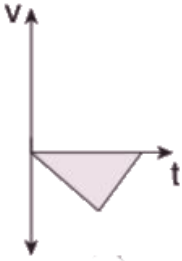
B.



C.



D.



Answer: C

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9. If one object is dropped vertically downward and another object is thrown horizontally from the same height, then the ratio of vertical distance covered by both objects at any instant t is

A. 1

B. 2

C. 4

D. 0.5

Answer: A

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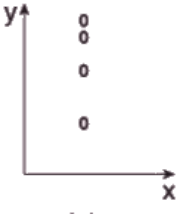
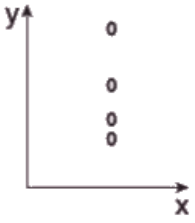
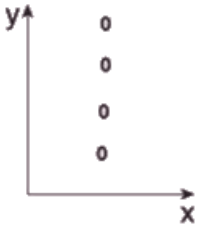
10. A ball is dropped from some height towards the ground. Which one of the following represents the correct motion of the ball?

A.



B.



C. 

D. 

Answer: A

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11. If a particle executes uniform circular motion in the xy plane in clock wise direction,

then the angular velocity is in

A. $+y$ direction

B. $+z$ direction

C. $-z$ direction

D. $-x$ direction

Answer: C

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12. If a particle executes uniform circular motion, choose the correct statement

A. The velocity and speed are constant.

B. The acceleration and speed are constant

C. The velocity and acceleration are constant

D. The speed and magnitude of acceleration are constant.

Answer: D

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13. If an object is thrown vertically up with the initial speed u from the ground, then the time taken by the object to return back to ground is

A. $\frac{u^2}{2g}$

B. $\frac{u^2}{g}$

C. $\frac{u}{2g}$

D. $\frac{2u}{g}$

Answer: d

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14. Two objects are projected at angles 30° and 60° respectively with respect to the horizontal direction. The range of two objects are denoted as R_{30° and R_{60°. Choose the correct relation from the following

A. $R_{30^\circ} = R_{60^\circ}$

B. $R_{30^\circ} = 4R_{60^\circ}$

C. $R_{30^\circ} = \frac{R_{60^\circ}}{2}$

D. $R_{30^\circ} = 2R_{60^\circ}$

Answer: a

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15. An object is dropped in an unknown planet from height 50 m, it reaches the ground in 2 s . The acceleration due to gravity in this unknown planet is

A. $g = 20ms^{-2}$

B. $g = 25ms^{-2}$

C. $g = 15ms^{-2}$

D. $g = 30ms^{-2}$

Answer: b

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Exercise Iv Exercises

1. The position vectors particle has length 1m and makes 30° with the x-axis. What are the lengths of the x and y components of the position vector?

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2. A particle has its position moved from $\vec{r}_1 = 3\hat{i} + 4\hat{j}$ to $\vec{r}_2 = \hat{i} + 2\hat{j}$. Calculate the displacement vector $\left(\Delta\vec{r}\right)$ and draw the

$\vec{r}_1$, $\vec{r}_2$ and $\Delta\vec{r}$ vector in a two dimensional Cartesian coordinate system.

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3. Calculate the average velocity of the particle whose position vector changes from $\vec{r}_1 = 5\hat{i} + 6\hat{j}$ to $\vec{r}_2 = 2\hat{i} + 3\hat{j}$ in a time 5 second.

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4. Convert the vector $\overrightarrow{r} = 3\hat{i} + 3\hat{j}$ into a unit vector.

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5. What are the resultants of the vector product of two given vectors given by $\overrightarrow{A} = 4\hat{i} - 2\hat{j} + \hat{k}$ and $\overrightarrow{B} = 5\hat{i} + 3\hat{j} - 4\hat{k}$?

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6. An object at an angle such that the horizontal range is 4 times of the maximum height. What is the angle of projection of the object?

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7. A particle is projected at an angle of θ T with respect to the horizontal direction. Match the following for the above motion.

v_x – decreases and increases

(b) v_y – remains constant

(c) Acceleration – varies

Position vector – remains downward

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8. A water fountain on the ground sprinkles water all around it. If the speed of the water coming out of the fountain is v. Calculate the total area around the fountain that gets wet.

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9. The resultant of two vectors A and B is perpendicular to vector A and its magnitude is equal to half of the magnitude of vector B. Then the angle between A and B is

(a) 30° (b) 45°

(c) 150° (d) 120°

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10. Compare the components for the following vector equations

$T\hat{j} - mg\hat{j} = ma\hat{j} = ma\hat{j}$

(b) $\overrightarrow{T} + \overrightarrow{F} = \overrightarrow{A} + \overrightarrow{B}$

(c) $\overrightarrow{T} - \overrightarrow{F} = \overrightarrow{A} - \overrightarrow{B}$ (d) $T\hat{j} + mg\hat{j} = ma\hat{j}$

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11. Calculate the area of the triangle for which two of its sides are given by the vectors $\overrightarrow{A} = 5\hat{i} - 3\hat{j}, \overrightarrow{B} = 4\hat{i} + 6\hat{j}$

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12. If Earth completes one revolution in 24 hours, what is the angular displacement made by Earth in one hour. Express your answer in both radian and degree.

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13. A object is thrown with initial speed $5ms^{-1}$ with an angle of projection 30b . What is the height and range reached by the particle?

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14. If an object is thrown horizontally with an initial speed $10ms^{-1}$ from the top of a building of height 100 m. what is the horizontal distance covered by the particle?

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15. An object is executing uniform circular motion with an angular speed of $\frac{\pi}{12}$ radian per second. At t = 0 the object starts at an

angle $\theta = 0$ What is the angular displacement of the particle aft er 4 s ?

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16. Consider the x–axis as representing east, the y–axis as north and z–axis as vertically upwards. Give the vector representing each of the following points.

5 m north east and 2 m up

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17. Consider the x–axis as representing east, the y–axis as north and z–axis as vertically upwards. Give the vector representing each of the following points.

4 m south east and 3 m up

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18. Consider the x–axis as representing east, the y–axis as north and z–axis as vertically upwards. Give the vector representing each of

the following points.

2 m north west and 4 m up

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19. Th e Moon is orbiting the Earth approximately once in 27 days, what is the angle transversed by the Moon per day?

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20. An object of mass m has angular acceleration $\alpha = 0.2 rads^{-2}$ What is the angular displacement covered by the object aft er 3 second? (Assume that the object started with angle zero with zero angular velocity).

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