

9 A boat takes two hours to travel 8 km and back in still water. If the velocity of water 4 kmh^{-1} , the time taken for going ups tream 8km and coming back is

- a) 2h
- b) 2 h 40 min
- c) 1 h 20 min
- d) Cannot be estimated with the information given

1 The speed of a boat is 5 km/h in still water. It crosses a river of width 1 km along the shortest possible path in 20 minutes. The velocity of the river water is :

- (a) 1 km/h (b) 3 km/h
- (c) 4 km/h (d) 5 km/h

1 A person moves 30 m north and then 20 m towards east and finally $30\sqrt{2} \text{ m}$ in south-west direction. The displacement of the person from the origin will be

- a) 10 m along north (b) 10 m along south
- c) 10 m along west (d) Zero

1 Rain drops fall vertically at a speed of 20 ms^{-1} . At what angle do they fall on the wind screen of a car moving with a velocity of 15 ms^{-1} , if the wind screen velocity inclined at an angle of 23° to the vertical?

$$\left(\cot^{-1} \left[\frac{4}{3} \right] \approx 36^\circ \right)$$

- a) 60° (b) 30°
- c) 45° (d) 90°

1 A body is moving with velocity 30 m/s towards east. After 10 seconds its velocity becomes 40 m/s towards north. The average acceleration of the body is

- (a) 1 m/s^2 (b) 7 m/s^2
- (c) $\sqrt{7} \text{ m/s}^2$ (d) 5 m/s^2

1 Two forces, each of magnitude F , have a resultant of the same magnitude F . The angle between the two forces is

- a) 45° (b) 120°
- c) 150° (d) 180°

15. If the magnitudes of scalar and vector products of two vectors are 6 and $6\sqrt{3}$ respectively, then the angle between two vectors is

- a) 15°
- b) 30°
- c) 60°
- d) 75°

16. A force is inclined at 60° to the horizontal. If its rectangular component in the horizontal direction is 50 N, then magnitude of the force in the vertical direction is

- a) 25 N
- b) 75 N
- c) 87 N
- d) 100 N

17. Rain is falling vertically downwards with a speed of 4 kmh^{-1} . A girl moves on a straight road with a velocity of 3 kmh^{-1} . The apparent velocity of rain with respect to the girl is

- a) 3 kmh^{-1} (b) 4 kmh^{-1}
- c) 5 kmh^{-1} (d) 7 kmh^{-1}

18. A car is moving towards east with a speed of 25 kmh^{-1} . To the driver of the car, a bus appears to move towards north with a speed of $25\sqrt{3} \text{ kmh}^{-1}$. What is the actual velocity of the bus?

- a) 50 kmh^{-1} , 30° E of N
- b) 50 kmh^{-1} , 30° N of E
- c) 25 kmh^{-1} , 30° E of N
- d) 25 kmh^{-1} , 30° N of E

19. A bird is flying towards north with a velocity 40 kmh^{-1} and a train is moving with velocity 40 kmh^{-1} towards east. What is the velocity of the bird noted by a man in the train?

- a) $40\sqrt{2} \text{ kmh}^{-1} \text{ N} - \text{E}$
- b) $40\sqrt{2} \text{ kmh}^{-1} \text{ S} - \text{E}$
- c) $40\sqrt{2} \text{ kmh}^{-1} \text{ N} - \text{W}$
- d) $40\sqrt{2} \text{ kmh}^{-1} \text{ S} - \text{W}$

20. If $\vec{P} = 2\hat{i} - 3\hat{j} + \hat{k}$ and $\vec{Q} = 3\hat{i} - 2\hat{j}$, then $\vec{P} \cdot \vec{Q}$ is

- a) Zero
- b) 6
- c) 12
- d) 15

21. Rain is falling vertically with a velocity of 25 ms^{-1} . A woman rides a bicycle with a speed of 10 ms^{-1} in the north to south direction. What is the direction (angle with vertical) in which she should hold her umbrella to save herself from rain?
 a) $\tan^{-1}(0.4)$ b) $\tan^{-1}(1)$
 c) $\tan^{-1}(\sqrt{3})$ d) $\tan^{-1}(2.6)$
22. Identify the vector quantity among the following.
 (a) distance
 (b) angular momentum
 (c) heat
 (d) energy.
23. If particle is moving eastwards with a velocity of 5 m/s . In 10 s the velocity changes to 5 m/s northwards. The average acceleration in this time is :
 (a) zero
 (b) $1/\sqrt{2} \text{ m/s}^2$ towards north- east
 (c) $\frac{1}{\sqrt{2}} \text{ m/s}^2$ towards north - west
 (d) $\frac{1}{2} \text{ m/s}^2$ towards north
24. The sum of the magnitudes of two forces acting at a point is 16 N . the resultant of these forces is perpendicular to the smaller force has a magnitude of 8 N . If the smaller force is magnitude x , then the value of x is
 a) 2 N b) 4 N
 c) 6 N d) 7 N
25. A man holds an umbrella at 30° with the vertical to keep himself dry. He, then, runs at a speed of 10 ms^{-1} , and find the rain drops to be hitting vertically. Study the following statements and find the correct options
 I. Velocity of rain w.r.t. Earth is 20 ms^{-1}
 II. Velocity of rain w.r.t. man is $10\sqrt{3} \text{ ms}^{-1}$
 III. Velocity of rain w.r.t. Earth is 30 ms^{-1}
 IV. Velocity of rain w.r.t. man is $10\sqrt{2} \text{ ms}^{-1}$
 a) Statements (i) and (ii) are correct
 b) Statements (i) and (iii) are correct
 c) Statements (iii) and (iv) are correct
 d) Statements (ii) and (iv) are correct
26. The position vector of a particle is $\vec{r} = (a \cos \omega t)\hat{i} + (a \sin \omega t)\hat{j}$. The velocity of the particle is
 (a) directed towards the origin
 (b) directed away from the origin
 (c) parallel to the position vector
 (d) perpendicular to the position vector.
27. The angle between the two vectors $\vec{A} = 3\hat{i} + 4\hat{j} + 5\hat{k}$ and $\vec{B} = 3\hat{i} + 4\hat{j} - 5\hat{k}$ will be
 (a) 90° (b) 180°
 (c) zero (d) 45°
28. The magnitude of vectors \vec{A} , \vec{B} and \vec{C} are $3, 4$ and 5 units respectively. If $\vec{A} + \vec{B} = \vec{C}$, the angle between \vec{A} and \vec{B} is
 (a) $\pi/2$ (b) $\cos^{-1}(0.6)$
 (c) $\tan^{-1}(7/5)$ (d) $\pi/4$
29. A girl starts from her home and walk 3 m east then 4 m south and then 5 m vertically upwards. what is her magnitude of displacement from home ?
 (a) $\sqrt{10} \text{ m}$ (b) $5\sqrt{2} \text{ m}$
 (c) 12 m (d) 4 m
30. If the angle between the vectors \vec{A} and \vec{B} is θ , the value of the product $(\vec{B} \times \vec{A}) \cdot \vec{A}$ is equal to
 (a) $BA^2 \sin \theta$ (b) $BA^2 \cos \theta$
 (c) $BA^2 \sin \theta \cos \theta$ (d) zero.
31. If a vector $2\hat{i} + 3\hat{j} + 8\hat{k}$ is perpendicular to the vector $4\hat{j} - 4\hat{i} + \alpha\hat{k}$, then the value of α is
 (a) $1/2$ (b) $-1/2$
 (c) 1 (d) -1
32. The width of river is 1 km . The velocity of boat is 5 km/hr . The boat covered the width of river in shortest time 15 min . Then the velocity of river stream is
 (a) 3 km/hr (b) 4 km/hr .
 (c) $\sqrt{29} \text{ km/hr}$ (d) $\sqrt{41} \text{ km/hr}$.

33. The magnitudes of the two vectors \vec{a} and \vec{b} are a and b respectively. The vector product of \vec{a} and \vec{b} cannot be
- a) equal to zero
 - b) less than ab
 - c) equal to ab
 - d) greater than ab

34. The position vector of a particle is $\vec{r} = at^2\hat{i} + bt\hat{j}$ where a and b are constants and t is in sec. The path of particle is :
- (a) straight line
 - (b) parabola
 - (c) hyperbola
 - (d) none of these
35. If a unit vector is represented by $0.5\hat{i} - 0.8\hat{j} + c\hat{k}$ then the value of c is
- (a) $\sqrt{0.01}$
 - (b) $\sqrt{0.11}$
 - (c) 1
 - (d) $\sqrt{0.39}$

SPACE FOR ROUGH WORK