PHYSICS

BOOKS - JEEVITH PUBLICATIONS PHYSICS (KANNADA ENGLISH)

MOTION IN PLANE

One Marks Questions And Answers

1. What is a physical quantity ?

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2. What is a scaler quantity ?

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3. What is a vector physical quantity ?

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4. Name the type of physical quantity which can be multiplied or divided or added or

subtracted by simple arithmetic rules.

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5. Name the physical quantity which requires vector addition and special laws for multiplication.

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6. What are polar vectors ?

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7. What are axial-vectors ?

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8. What are co-initial or concurrent or coincidental vectors ?

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9. What are coplanar vectors ?

10. What is a unit vector ?

11. What is a null vectors ?

12. What are parallel vectors ?

13. What is meant by position vector ?

14. State the law of parallelogram of addition of two vectors ?

15. State the law of triangle of addition of two vectors ?

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16. State the law of polygon of addition of vectors.

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17. Find the magnitude of vector $\vec{A} = 2\hat{i} - 3\hat{j} + 4\hat{k}$

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18. What is the angle between the two vectors whose dot product is zero ?

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19. What is the angle between the two whose cross product is zero ?

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20. Pick the axial vector from the following : velocity, acceleration, force and angular momentum.

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21. Pick the polar vector from the following : angular velocity, torque, angular momentum, force.

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22. Linear speed of a particle is given by $v = r\omega$. Represent velocity in the vector form.

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23. Linear acceleration of partcle is given by $a = r \propto$. Represent acceleration in vector from.

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24. Represent angular momentum of a particle in terms of linear momentum in a vector form.

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25. Write the horizontal component of a vector that makes $'\theta'$ with respect to the horizontal .

26. Write the vertical component of a vector that makes $'\theta'$ with respect to the horizontal.

27. Find the unit vector $\vec{A} = -3\hat{i} + 4\hat{j} + 5\hat{k}$

28. Say whether $\vec{A} \cdot \vec{B}$ is commulative.

29. Say whether $\vec{A} \times \vec{B}$ is commulative.

30. Give an example for scaler product of two vectors.

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31. Give an example for vector product of two vectors.

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32. What is meant by resolution of a vector ?

33. Represent scalar product of two vectors mathematically.

34. Represent vector product of two vectors mathematically

35. Why is $\hat{i} \times \hat{i} = \hat{j} \times \hat{j} = \hat{k} \times \hat{k} = 0$?

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36. Why is $\hat{i} \cdot \hat{j} = \hat{j} \cdot \hat{k} = \hat{k} \cdot \hat{i} = 0$

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37. If $\vec{A} \cdot \vec{B} = \left| \vec{A} \times \vec{B} \right|$ then fibnd the angle between $\vec{A}$ and $\vec{B}$

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38. The resultant of two vectors of equal magnitude is equal to the magnitude of either of the two vectors. What is the angle between the two vectors ?

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39. Represent cross product of two vectors pictorially.

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40. Represent dot product of two vectors pictorially.

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41. What is the net force acting on a body in a state of static equillibrium ?

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42. What are concurrent coplanar forces ?

43. Define resultant force.

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44. Define equlibrant force.

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45. Which of the following forces maintains the static equilibrium of a body, resulant or equilibrant ?

46. State lami's theorem.

47. State converse law of triangle of forces.

48. If P and Q are two concurrent coplanar forces than find the maximum and minimum of the resultant of the two.

49. What is meant by resolution of a vector ?

50. Mention the two rectangular components of a vector 'A'

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51. The resultant of two vectors of equal magnitude is equal to the magnitude of either of the two vectors. What is the angle between the two vectors ?

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52. If P and Q are two force vectors acting at right angle to each other from a single point on a body then express the magnitude of their resultant.

53. If a stronger force is twice as that of the weaker and their resultant acts a right angles to the weaker force then find the angle b/w the two forces.

54. State the law of parallelogram of addition of two vectors ?

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55. Give the formula for direction of the resultant of two concurrent coplanar forces.

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56. If the angle between two forces is greater than $90°$ then given the formula for their resultant.

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57. If the angle b/w the two forces is greater than $90°$ then give the the formula to find the direction of their resultant.

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58. If a number of concurrent coplanar forces are acting on a point body, then give the condition for its static equilibrium.

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59. If P_x, P_y and P_z are the magnitudes of forces on a body actin mutually at right angles to each other, then represent the resultant force on the body in (1) a scaler and (2) vector form.

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60. A force of 10N acts at $45°$ with X-axis,. What will be the x and y components of force ?

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61. What is a projectile ?

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62. What is a projectile motion ?

63. What is meant by trajectory ?

64. What is the angle of projectile ?

65. What is time of flight of a projectile ?

66. What is the range of the projectile ?

67. Say whether there exists tangential acceleration for a particle describing uniform circular motion.

68. Say whether there exists tangential acceleration for a particle describing non-uniform circular motion.

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69. Write the expression for the time of flight where terms have their usual notations.

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70. Obtain an expression for Horizontal Range of a projectile.

71. Derive an expression for maximum height of a projectile .

72. Give the horizontal and vertical components of velocity of projection

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73. Which of the two rectangular components of velocity remains constant throughout the time of flight ?

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74. Relate range of the projectile in terms of the maximum height.

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75. Relate maximum height in terms of time of flight.

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76. Relate range of the projectile in terms of time of flight.

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77. What is meant by uniform circular motion ?

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78. Give the expression for centripetal force on the particle executing uniform circular motion.

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79. What is centripetal force ?

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80. What is centrifugal force ?

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81. Give the relation between linear speed and angular speed (ω).

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82. Give the relation between linear acceleration and angular acceleration.

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Two Marks Questions And Answers

1. Represent vector addition of two vectors graphically

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2. Represent vector substraction of two vectors graphically.

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3. What is meant by resolution of a vector ?

4. Show that maximum range $= \dfrac{u^2}{g}$.

5. Show that for angles of projection θ and $90° - \theta$, the range of the projectile is the same.

6. Write a neat and labelled diagram showing angle of banking and resolution of normal reaction force.

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7. Represent resultant acceleration of a particle executing non-uniform circular motion by means of vector diagram

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8. Show that $v = r\omega$.

9. Show that $a = r\omega$.

10. Define instantaneous velocity of a particle?

11. Define average velocity of a particle. Represent the same in vector form.

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12. Define average acceleration of a particle. Represent average acceleration in a vector form.

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13. Define instantaneous acceleration and represent the same in vector form.

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14. Give the expression for instantaneous displacements of a projectile along 'x' and 'y' direction .

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15. Give the expression for the time of flight and the maximum height reached by the projective.

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16. Give the expression for the range of the particle. For what value of angle of projection of the particle is the range maximum ?

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17. Represent the direction of velocity and acceleration of a particle travelling in a curved path.

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Three Marks Questions With Answers

1. Distinguish between resultant and equilibrant forces.

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2. State converse law of triangle of forces.

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3. Define cross-product of two vectors.

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4. Define cross-product of two vectors.

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5. Write a note on banking of roads.

6. If v_x and v_y are the components of instantaneous velocity, then represent the velocity vectorially. Express the magnitude and direction of velocity.

7. Represent position vector of a particle in terms of velocity and acceleration vectors.

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Five Marks Questions With Answers

1. Obtain an expression for the magnitude and direction of the resultant of two concurrent and coplanar forces.

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2. Show that a projectile traces a path of a parabola.

3. Derive an expression for maximum height of a projectile .

4. Obtain an expression for time of flight

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5. Obtain an expression for Horizontal Range of a projectile.

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6. Show that $a = \dfrac{v^2}{r}$ and hence obtain an expression for centripetal force.

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Numericals With Solutions

1. Two forces 8N and 5N are acting at a point on a body at an angle $120°$ then find the (i) magnitude and (ii) direction of their resultant.

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2. Concurrent coplanar forces 10N, 15N, 20N, 25N are acting on a body at $0°$, $30°$, $45°$, $120°$ w.r.t the x-axis respectively. Calculate the magnitude and direction of their resultant.

3. Two forces P and 2P act at a point. If the first force is increased by 5N and the other trebled,

the direction of the resultant is not altered then find 'P'

4. Two forces P=5N and Q=10N are acting at a point making an angle of $30°$ with each other. What is the value of the dot product of P and Q ?

5. Two forces 7 kgwt and 4 kgwt act at a point making an angle of $60°$ with each other. Find the magnitude and direction of the resultant.

6. Two concurrent forces 30N and 40N are acting at an angle of $60°$ with respect to each other. Calculate the magnitude and direction of the resultant.

7. A body of mass 1 kg is suspended by means of a string. It is then pulled aside by a horizontal force so that the string makes an angle of $30°$ with the vertical. Find the horizontal force.

8. The greatest and least resultant of two forces acting at a point are 29N and 5N. If each force is increased by 3N, find the magnitude of

the resultant of the two new forces when they act at right angles to each other.

9. Two forces 12N and 5N are acting at right angles to each other. Find the magnitude and direction of the resultant force.

10. Simple pendulum of mass 3 Kg is pulled aside through an angle of $60°$ to the vertical. Calculate the horizontal force and tension in the string.

11. When two forces are acting along the same direction, their resultant is 10N. When the same two forces are acting opposite to each other, their resultant is 8N. Find the forces and

their resultant when the angle between them is $45°$

12. The square of the resultant of two equal forces acting at a point is equal to three times their product. Find the angle between them.

13. If a vector $\vec{A}$ makes an angle of $60°$ with respect to the X-axis, then write the two rectangular components of the vector.

14. Find the cross product of $\vec{A} = 3\hat{i} + 4\hat{j}$ and $\vec{B} = \left(-3\hat{i} + 4\hat{j} \right)$

15. If a force $\vec{F} = \left(-3\hat{i} + 4\hat{j} + 2\hat{k} \right)$ acts on a body and displaces it such that $\vec{s} = \left(4\hat{i} - 3\hat{j} - 2\hat{k} \right)$ then calculate the amount of work done by the force.

16. Find the angle between $2\left(\hat{i} + \hat{j} \right)$ and $\hat{i}$

17. If $\vec{A} = 3\hat{i} + 2\hat{j}$ and $\vec{B} = 4\hat{j} - 5\hat{k}$ then

find

$\left| \vec{A} + \vec{B} \right|$

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18. If $\vec{A} = 3\hat{i} + 2\hat{j}$ and $\vec{B} = 4\hat{j} - 5\hat{k}$ then

find

$\left| \vec{A} - \vec{B} \right|$

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19. Find the sum of $\hat{i}$ and $\hat{k}$ and the angle between the resultant and $\hat{i}$.

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20. Calculate the dot and cross product of $\overrightarrow{A} = 30$ units along east and $\overrightarrow{B} = 10$ units due north east.

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21. A unit vector is represented by $a\hat{i} + b\hat{j} + c\hat{k}$ If the values of 'a' and 'b' are 0.6 and 0.8 respectively, then find the value of 'c'.

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22. Write the values of the following.

$\hat{i} \cdot \left(\hat{i} \times \hat{j} \right)$

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23. Write the values of the following.

$$\hat{k}. \left(\hat{i} \times \hat{k} \right)$$

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24. Write the values of the following

$$\hat{k}. \hat{k}$$

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25. A swimmer can swim with a velocity of 10 kmph w.r.t the water flowing in a river with a velocity of 5 kmph.

In what direction should he swim to reach the point on the other bank just opposite to his starting point ?

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26. A swimmer can swim with a velocity of 10 kmph w.r.t the water flowing in a river with a

velocity of 5 kmph.

What will be the time taken to reach the opposite side, if its is 1 km away ?

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27. The angle between the vectors $\overline{A}$ and $\overline{B}$ is $60°$. What is the ratio of $\overline{A} \cdot \overline{B}$ and $\left| \overline{A} \times \overline{B} \right|$?

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28. Determine the unit vector which is perpendicular to both $\overline{A} = 2\hat{i} + \hat{j} + \hat{k}$ and $\overline{B} = \hat{i} - \hat{j} + \hat{k}$

29. Show that vectors $\left(i + 2j + 3\hat{k}\right)$ and $\left(2\hat{i} - \hat{j}\right)$ are perpendicular to each other.

30. The position of a particle is given by $\bar{r} = \left(3.0t\hat{i} - 2.0t^2\hat{j} + 4.0\hat{k} \right)$m where 't' is in seconds. (a) Find $\bar{v}$ and $\bar{a}$ of the particle (b) What is the magnitude and direction of velocity of the particle at t=0.0s ?

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31. Find the angular velocity of a particle moving around a circular path of radius 0.5 m with a linear speed of $10ms^{-1}$

32. Calculate the angular acceleration of a particle executing uniform circular motion of radius 0.60m and speed $5ms^{-1}$.

33. If the tangential acceleration of a particle around a circular path is $0.5ms^{-2}$ and radial acceleration is $0.65ms^{-2}$, then calculate the resultant acceleration of the particle.

34. Calculate the centripetal force on a particle

of mass 0.020 kg revolving around a circular

path of radius 0.75m and with a speed of

$40ms^{-1}$

35. An aircraft executes a horizontal loop of

radius 500m with a uniform speed of 5 machs.

Compare its centripetal acceleration with acceleration due to gravity.

36. A stone tied to one end of a string of radius 0.6m is whirled in a horizontal circle with an angular speed of 120rpm. Calculate the radial acceleration and force exerted by the stone of mass 0.010 kg on the agent.

37. A simple pendulum of length 1.5m is held horizontally and then released. If the mass of the system is 0.050 kg, then calculate the centripetal force at the bottom and maximum tension in the string (given g=$9.8ms^{-2}$)

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38. Calculate the minimum and maximum tensions in a string of length 1m, one end of which is tied to a stone of mass 0.010 kg and

whirled with a uniform speed of $10ms^{-1}\left(g = 9.8ms^{-2}\right).$

39. Given that the angle of banking is equal to $30°$ and radius of the circular path 50m , calculate the maximum velocity with which a vehicle has to negotiate the turn so that the inner wheels do not take off the road $\left(g = 9.8ms^{-2}\right)$

40. A ball is thrown vertically upwards with a velocity of $50ms^{-1}$ and the same later thrown at an angle for the maximum range. Compare the heights reached in the two cases $(g = 9.8ms^{-2})$

41. A projectile is launched into space at an angle of $60°$ with an initial speed of $200ms^{-1}$.

Calculate

maximum height

42. A projectile is launched into space at an angle of $60°$ with an initial speed of $200ms^{-1}$.

Calculate

time of flight.

43. A projectile is launched into space at an angle of $60°$ with an initial speed of $200ms^{-1}$. Calculate range of the projectile $(g = 9.8ms^{-2})$.

44. A particle is projected into space at an angle of $60°$ with an initial speed of $400ms^{-1}$ .Calculate the instantaneous velocity of the projectile along the horizontal, vertical and

the resultant velocity at t=15s. Calculate instantaneous position of the particle along the horizontal and vertical $\left(g = 9.8ms^{-2}\right)$

45. A projectile is projected at an angle of $60°$. If the projectile just clears a cliff $5\sqrt{3}$m high, at a distance of 10m from the point of projection, then calculate the range of the projectile. Also calculate the maximum height and time of flight.

46. A ball is thrown at an angle of $30°$ with respect to the horizontal from the top of a tower 100m high with a speed of $40ms^{-1}$. Calculate the time taken by the ball to reach the foot of the tower. With what velocity will the ball hit the ground ? $\left(g = 10ms^{-2}\right)$

47. An aeroplane flying at 540 kmph drops a missile towards the ground. If the height of the plane is 1000m then calculate (i) time taken by the missile to hit the ground & (ii) the horizontal distance covered by the missile form the initial point. $\left(g = 9.8ms^{-2}\right)$