CBSE

SYSTEM OF PARTICLES AND ROTATIONAL MOTION WS 4

Class 11 - Physics

Section A

1. If $\vec{\mathbf{a}} = \mathrm{a_x}\,\hat{\mathbf{i}} + \mathrm{a_y}\hat{\mathbf{j}} + \mathrm{a_z}\hat{\mathbf{k}}$ and $\vec{\mathbf{b}} = \mathrm{b_x}\,\hat{\mathbf{i}} + \mathrm{b_y}\hat{\mathbf{j}} + \mathrm{b_z}\hat{\mathbf{k}}$ then the cross product $\vec{\mathbf{a}} \times \vec{\mathbf{b}}$ is given by: **[1]**

   a) $\begin{vmatrix} \hat{\mathbf{i}} & \hat{\mathbf{j}} & \hat{\mathbf{k}} \\ \mathrm{a_x} & a_y & a_z \\ b_x & b_y & b_z \end{vmatrix}$

   b) $\begin{vmatrix} \hat{\mathbf{i}} & \hat{\mathbf{j}} & \hat{\mathbf{k}} \\ \mathrm{a_x} & a_y & a_z \\ b_x & b_y & b_x \end{vmatrix}$

   c) $\begin{vmatrix} \hat{\mathbf{i}} & \hat{\mathbf{j}} & \hat{\mathbf{k}} \\ \mathrm{a_x} & a_y & a_z \\ b_x & b_x & b_z \end{vmatrix}$

   d) $\begin{vmatrix} \hat{\mathbf{i}} & \hat{\mathbf{j}} & \hat{\mathbf{k}} \\ \mathrm{a_x} & a_x & a_z \\ b_x & b_x & b_z \end{vmatrix}$

2. If $\vec{F}$ is force and $\vec{r}$ is the radius vector, then torque is given by **[1]**

   a) $\vec{r} \times \vec{F}$

   b) $\vec{r} + \vec{F}$

   c) $\vec{r} \cdot \vec{F}$

   d) $|\vec{r}||\vec{F}|$

3. The vector product of two vectors a and b is a vector c such that c is perpendicular to the plane containing a and b and the direction is given by: **[1]**

   a) left hand rule

   b) left-handed screw rule

   c) index finger rule

   d) right-handed screw rule

4. The vector product of two vectors a and b is a vector c such that the magnitude of c is given by: **[1]**

   a) $|\mathbf{a}|\,|\mathbf{b}|\cos\theta$

   b) $|\mathbf{a}|\,|\mathbf{b}|\tan\theta$

   c) $|\mathbf{a}|\,|\mathbf{b}|\cot\theta$

   d) $|\mathbf{a}|\,|\mathbf{b}|\sin\theta$

5. **Assertion (A):** $\hat{i} \times \hat{k} = -\hat{j}$ but $\hat{k} \times \hat{i} = \hat{j}$ **[1]**

   Reason (R): If $\hat{i}, \hat{k}, \hat{j}$ occur in cyclic order then the vector product is negative. If $\hat{i}, \hat{k}, \hat{j}$ do not occur in cyclic order, the vector product is positive.

   a) Both A and R are true and R is the correct explanation of A.

   b) Both A and R are true but R is not the correct explanation of A.

   c) A is true but R is false.

   d) A is false but R is true.

6. What is the torque of the force $\overline{F} = 2\hat{i} - 5\hat{j} + 4\hat{k}$ acting at the point $\overline{r} = (3\hat{i} + 3\hat{j} + 3\hat{k})m$ about the origin? **[1]**

Section B

7. What is the value of linear velocity if $\overline{w} = 3\hat{i} - 4\hat{j} + \hat{x}$ and $\overline{r} = 5\hat{i} - 6\hat{j} + 6\hat{k}$? **[2]**

Section C

8. Show that the area of the triangle contained between the vectors **a** and **b** is one half of the magnitude of **a** $\times$ **b**. **[3]**

9. Show that **a.(b** $\times$ **c)** is equal in magnitude to the volume of the parallelepiped formed on the three vectors, **a, b** and **c**. **[3]**