Answer on Question 58095, Physics, Other

Question:

4. The dimension of power is

a) $ML^{-2}T^{2}$

b) $ML^{2}T^{-2}$

c) MLT^{-2}

d) $ML^{2}T^{-3}$

Solution:

By the definition of the power we have:

$$P = \frac{W}{t} = \frac{F \cdot s}{t} = m \cdot a \cdot \frac{s}{t} = M \cdot \frac{L}{T^2} \cdot \frac{L}{T} = ML^2T^{-3}.$$

Answer:

d) $ML^{2}T^{-3}$.

5. Which of the following physical quantities is an example of a cross product?

a) work

b) moment

c) power

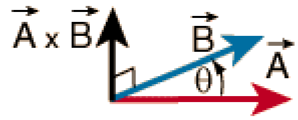
d) momentum

Answer:

By the definition, the magnitude of the vector product (or cross product) of two vectors can be constructed by taking the product of the magnitudes of the vector times the sine of the angle ($< 180^{\circ}$) between them. The magnitude of the vector product can be expressed in the form:

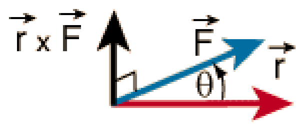
$$\vec{A} \times \vec{B} = AB \sin\theta.$$

$\vec{A} \times \vec{B}$ is perpendicular to both A and B and the direction is given by the right-hand rule:



Moment of force (or torque) is example of the cross product of the lever-arm distance vector and the force vector, which tends to produce rotation:

$$\tau = \vec{r} \times \vec{F} = rF \sin\theta$$



So, the correct answer is **b) moment**.

6. Given two vectors $\vec{a} = 4\hat{\imath} - 3\hat{\jmath} + 2\hat{k}$, $\vec{b} = \hat{\imath} + 2\hat{\jmath} - \hat{k}$. Calculate $\vec{a} \times \vec{b}$:

a) $2\hat{\imath} - 6\hat{\jmath} - 5\hat{k}$

b) $-\hat{\imath} + 6\hat{\jmath} + 5\hat{k}$

c) $-\hat{\imath} - 6\hat{\jmath} + 5\hat{k}$

d) $-2\hat{\imath} - 6\hat{\jmath} + 5\hat{k}$

Solution:

By the definition of the cross product we have:

$$\vec{a} \times \vec{b} = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ a_x & a_y & a_z \\ b_x & b_y & b_z \end{vmatrix} = \hat{\imath}\begin{vmatrix} a_y & a_z \\ b_y & b_z \end{vmatrix} - \hat{\jmath}\begin{vmatrix} a_x & a_z \\ b_x & b_z \end{vmatrix} + \hat{k}\begin{vmatrix} a_x & a_y \\ b_x & b_y \end{vmatrix} =$$
$$= \left(a_y b_z - a_z b_y\right)\hat{\imath} - (a_x b_z - a_z b_x)\hat{\jmath} + \left(a_x b_y - a_y b_x\right)\hat{k}$$
$$= \left((-3)\cdot(-1) - 2\cdot 2\right)\hat{\imath} - (4\cdot(-1) - 2\cdot 1)\hat{\jmath} + (4\cdot 2 - (-3)\cdot 1)\hat{k}$$
$$= -\hat{\imath} + 6\hat{\jmath} + 11\hat{k}.$$

Answer: None of these answers are correct. The correct answer is $-\hat{\imath} + 6\hat{\jmath} + 11\hat{k}$.