Mastering Physics Solutions Chapter 7 Work And Kinetic Energy

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Chapter 7 Work And Kinetic Energy Q.1P

The International Space Station orbits the Earth in an approximately circular orbit at a height of h = 375 km above the Earth's surface. In one complete orbit, is the work done by the Earth on the space station positive, negative, or zero? Explain.

Solution:

The work done by Earth on the space station is zero. This is because during the movement of the satellite, the force acting on it is always perpendicular to the direction of motion. If the force does not have non-zero components along the direction of motion, the work done is zero.

Chapter 7 Work And Kinetic Energy Q.2CQ

A friend makes the statement, "Only the total force acting on an object can do work." Is this statement true or false? If it is true, state why; if it is false, give a counterexample.

Solution:

If force $\vec{F}_1$ does a work W_1, force $\vec{F}_2$ does a work W_2, force $\vec{F}_3$ does a work W_3, and soon, the expression for the total work W_{total} is given as follows:

$$\begin{aligned} W_{total} &= W_1 + W_2 + W_3 + \ldots \\ &= \sum_i W_i \end{aligned}$$

The total work can be obtained by calculating vector sum of all the forces acting on the object.

$$\vec{F}_{total} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3 + \ldots$$

Here, $\vec{F}_{total}$ is the total force.

Then the expression for total work W_{total} is given as follows:

$$W_{total} = \vec{F}_{total} \cdot \vec{d}$$

Here, $\vec{d}$ is the displacement.

Use the above expression $W_{total} = \vec{F}_{total} \cdot \vec{d}$ the total force acting on an object can do work.

Thus, the given statement 'total force acting on an object can do work' is **true.**