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11

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Ask your question:

A body of mass 2 kg initially at rest moves under the action of an applied horizontal force of 7 N on a table with coefficient of kinetic friction = 0.1. Compute the work done by the applied force in 10 s.

Get Answer

Answer

To compute the work done by the applied force in 10 seconds, we first need to determine the acceleration of the body and then the distance it travels during that time.

1. **Calculate the frictional force (f_k)**: [f_k = \mu_k \cdot m \cdot g] where:

    - (\mu_k = 0.1) (coefficient of kinetic friction)
    - (m = 2 , \text{kg}) (mass of the body)
    - (g = 9.81 , \text{m/s}^2) (acceleration due to gravity)

    [f_k = 0.1 \cdot 2 \cdot 9.81 = 1.962 , \text{N}]

2. **Calculate the net force (F_net)**: [F_{\text{net}} = F_{\text{applied}} - f_k] where (F_{\text{applied}} = 7 , \text{N}).

    [F_{\text{net}} = 7 - 1.962 = 5.038 , \text{N}]

3. **Calculate the acceleration (a)**: [a = \frac{F_{\text{net}}}{m} = \frac{5.038}{2} = 2.519 , \text{m/s}^2]

4. **Calculate the distance (d) traveled in 10 seconds**: Since the body starts from rest, we can use the equation of motion: [d = \frac{1}{2} a t^2] where (t = 10 , \text{s}).

    [d = \frac{1}{2} \cdot 2.519 \cdot (10)^2 = \frac{1}{2} \cdot 2.519 \cdot 100 = 125.95 , \text{m}]

5. **Calculate the work done (W)**: [W = F_{\text{applied}} \cdot d] [W = 7 \cdot 125.95 = 881.65 , \text{J}]

Thus, the work done by the applied force in 10 seconds is approximately **881.65 J**.

Sources

- **File Name:** data/grade_11/physics/05_work_energy_power.pdf - **Page Number:** 17 - **Relevant Content:** PHYSICS88 EXERCISES 5.1 The sign of work done by a force on a body is important to understand. State carefully if the following quantities are positive or negative: (a) work done by a man in lifting a bucket out of a well by means of a rope tied to the bucket. (b) work done by gravitational force i

- **File Name:** data/grade_11/physics/04_laws_of_motion.pdf - **Page Number:** 11 - **Relevant Content:** horizontally to the body. W e know fr om experience that a small applied force may not be enough to move the body. But if the applied force F were the only external force on the body, it must move with acceleration F/m, however small. Clearly, the body remains at rest because some other force com

- **File Name:** data/grade_11/physics/05_work_energy_power.pdf - **Page Number:** 5 - **Relevant Content:** PHYSICS76 ▻ Fig. 5. 3 (a) The shaded rectangle represents the work done by the varying force F(x), over the small displacement Δ x, ΔW = F(x) Δx. (b) adding the areas of all the rectangles we find that for Δx → 0, the area under the curve is exactly equal to the work done by F(x). Example 5.5 A

- **File Name:** data/grade_11/physics/04_laws_of_motion.pdf - **Page Number:** 20 - **Relevant Content:** 4.14 Figure 4.16 shows the position-time graph of a particle of mass 4 kg. What is the (a) force on the particle for $t < 0$, $t > 4$ s, $0 < t < 4$ s? (b) impulse at $t = 0$ and $t = 4$ s ? (Consider one-dimensional motion only). Fig. 4.16 4.15 Two bodies of masses 10 kg and 20 kg respectively kept on a smo