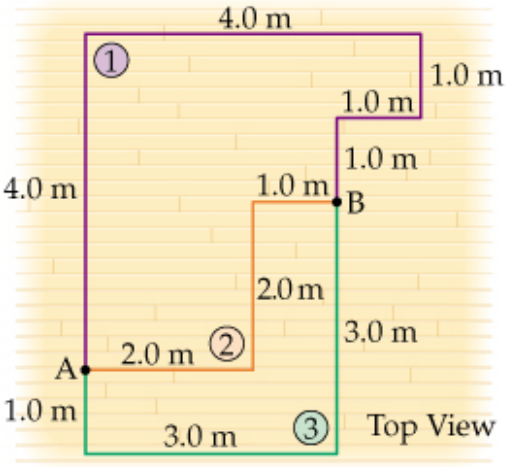
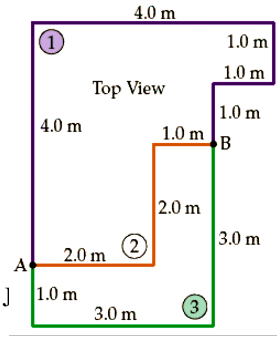
PHYSQ 124
Quiz 3, 6 octobre 2022 (solution)

La figure montre une vue du haut de trois trajets effectués par une boîte de 3.7 kg glissée le long d'un plancher. Calculez le travail effectué par le frottement lorsque cette boîte est glissée de point A au point B de la figure le long des chemins 1, 2 et 3. Supposez que le coefficient de frottement cinétique entre la boîte et le plancher soit de 0.26.



3. **Picture the Problem**: The three paths of the sliding box are depicted at right.



Strategy: The work done by friction is $W = -\mu_k m g d$, where d is the distance the box is pushed regardless of direction, because the friction force always acts in a direction opposite the motion. Sum the work done by friction for each segment of each path.

Solution: 1. Calculate the work for path 1:

$$W_1 = -\mu_k m g \left[d_1 + d_2 + d_3 + d_4 + d_5\right]$$
$$= -\mu_k m g \left[4.0 + 4.0 + 1.0 + 1.0 + 1.0 \text{ m}\right]$$
$$W_1 = -0.26(3.7 \text{ kg})(9.81 \text{ m/s}^2)[11.0 \text{ m}] = -104 \text{ J}$$
$$= \boxed{-0.10 \text{ kJ}}$$

2. Calculate W for path 2:

$$W_2 = -\mu_k m g \left[d_6 + d_7 + d_8\right]$$
$$= -0.26(3.7 \text{ kg})(9.81 \text{ m/s}^2)\left[(2.0 \text{ m}) + (2.0 \text{ m}) + (1.0 \text{ m})\right] = \boxed{-47 \text{ J}}$$

3. Calculate the work for path 3:

$$W_3 = -\mu_k m g \left[d_9 + d_{10} + d_{11}\right]$$
$$= -0.26(3.7 \text{ kg})(9.81 \text{ m/s}^2)\left[(1.0 \text{ m}) + (3.0 \text{ m}) + (3.0 \text{ m})\right] = \boxed{-66 \text{ J}}$$

Insight: The amount of work done depends upon the path because friction is a non-conservative force.