

①

Box

PROCESS

initial final

$W = F \cdot d \cdot \cos \theta$

$\theta = 0^\circ$
 $\cos(0^\circ) = 1$

d_B F_{HB}

Q1: What is the sign of the work done by the hand on the box?
(external force)

FBD (Box)

F_{HB}
 F_g

$a_y = 0$

Dec 18-10:31 AM

The box **gained** PE_g energy by being lifted straight up with constant velocity by the hand. The hand did **positive work** on the box = it transferred the energy to the box.

②

initial final

PROCESS

$W = F \cdot d \cdot \cos \theta$

$\theta = 180^\circ$

$\cos(180^\circ) = -1$

d_B

F_{HB}

Q1: What is the sign of the work done by the hand on the box? (external force)

$F_{B0}(\text{Box})$

$a_y = 0$

F_{HB}

F_g

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The box **lost** PE_g energy by being lowered straight down with constant velocity by the hand. The hand did **negative work** on the box = it transferred the energy out of the box.

③

initial final

F_{HB} $\theta = 90^\circ$
 $\cos(90^\circ) = \phi$

d_B

$W = F \cdot d \cdot \cos \theta$
NO!

Q1: Did the box gain/lose energy?
 Q2: How much work did my hand do on the box? ϕ

FBD (Box): $a_y = 0$

F_{HB}
 F_g

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The energy of the box **did not change** during the process of being moved horizontally with constant velocity by the hand. The hand did **zero work** on the box = it did not transfer any energy into or out of the box.

HW p. 206 #28, 29, 34.