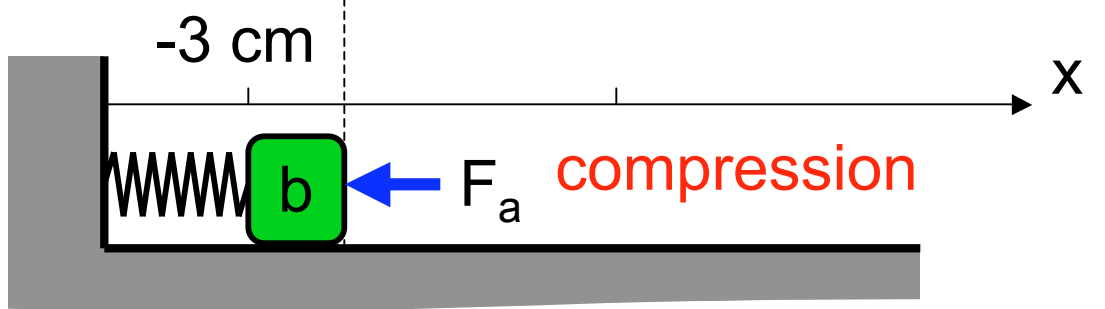
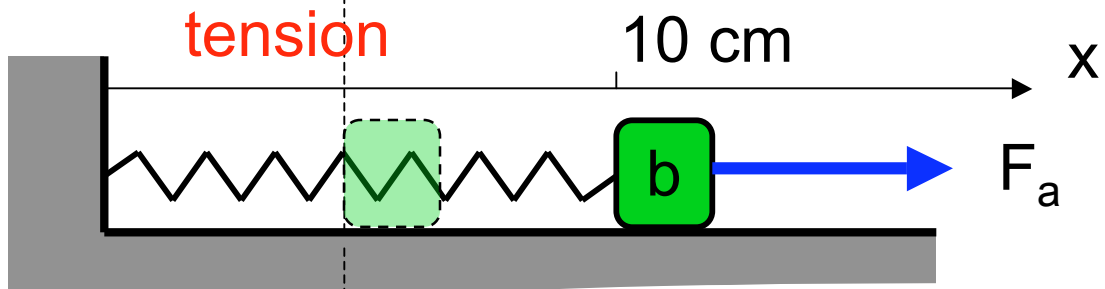
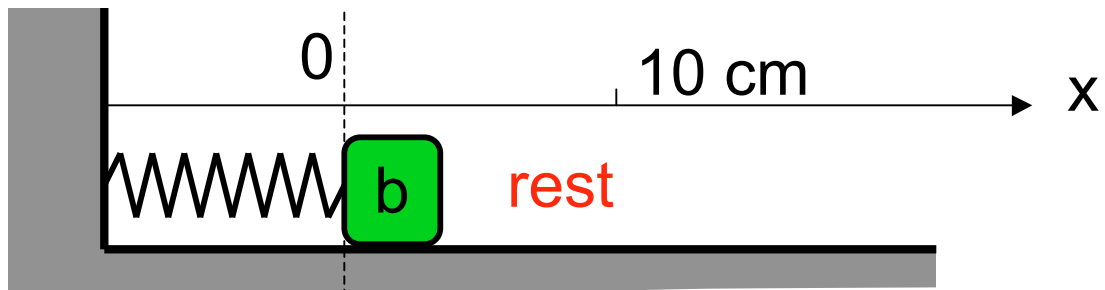
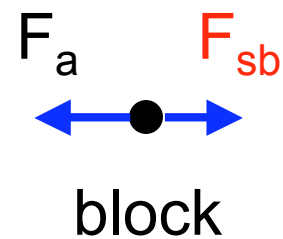
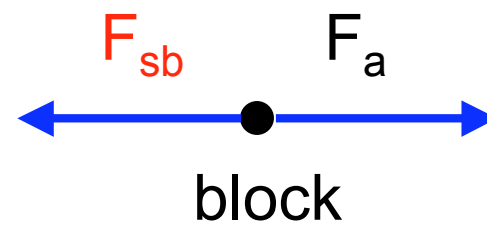


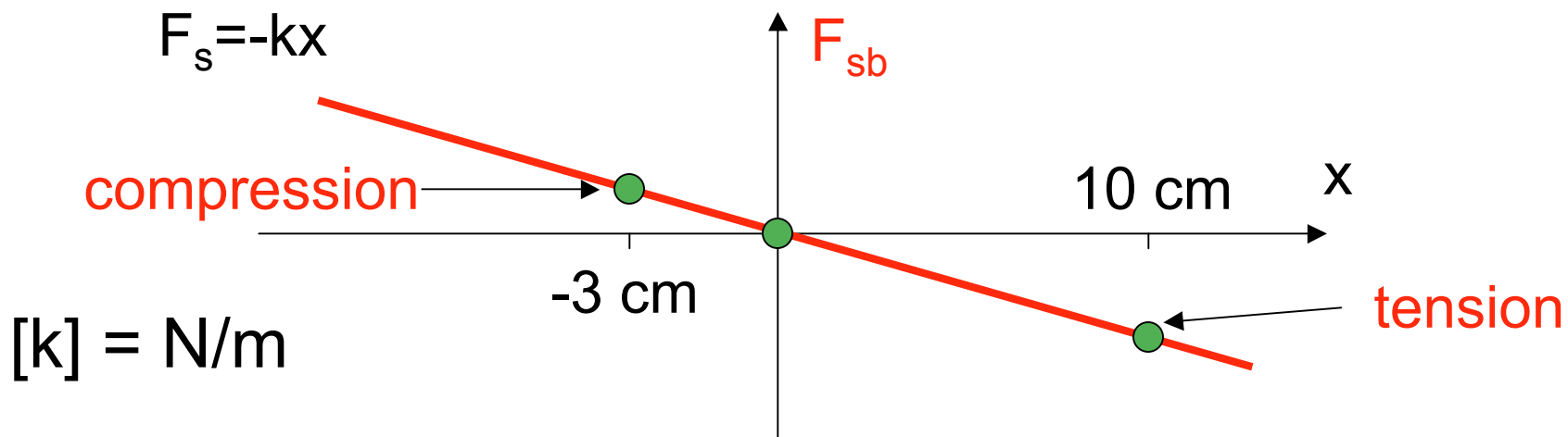
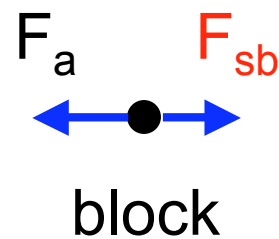
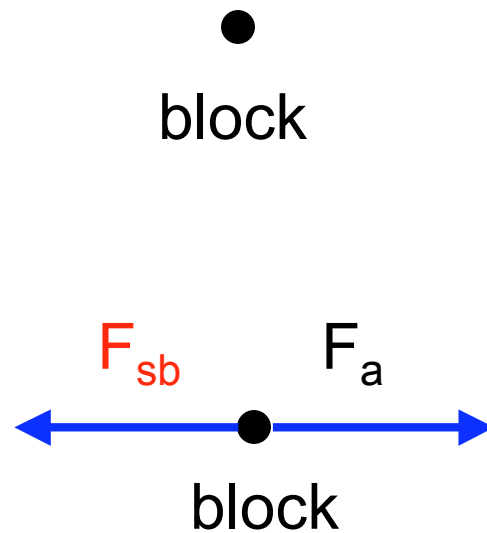
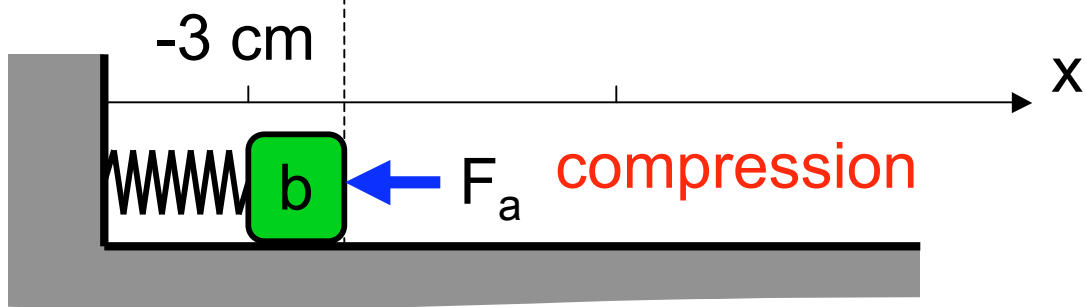
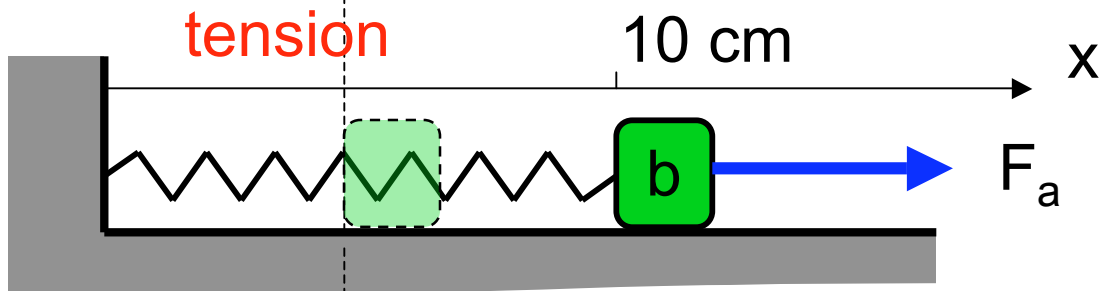
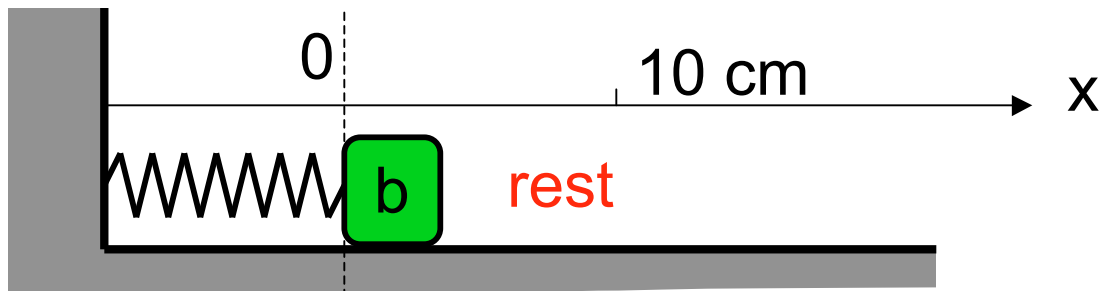
Springs



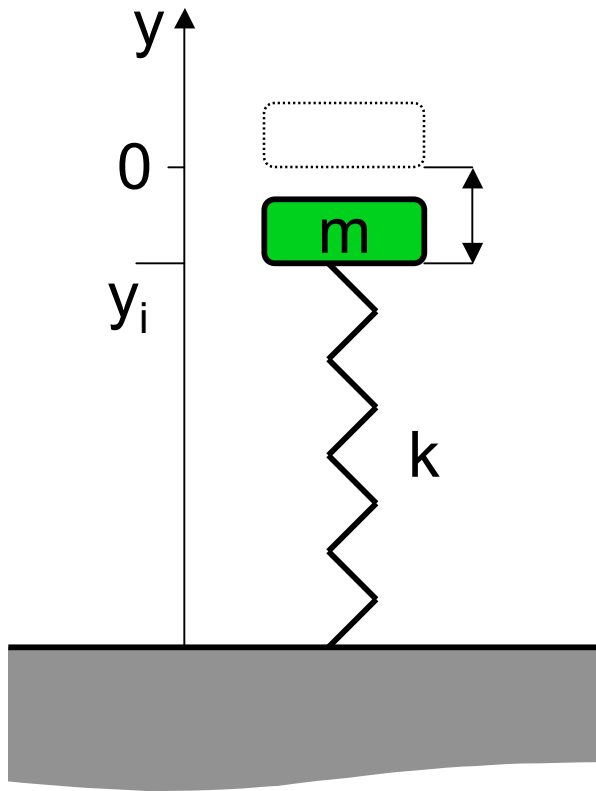


●
block

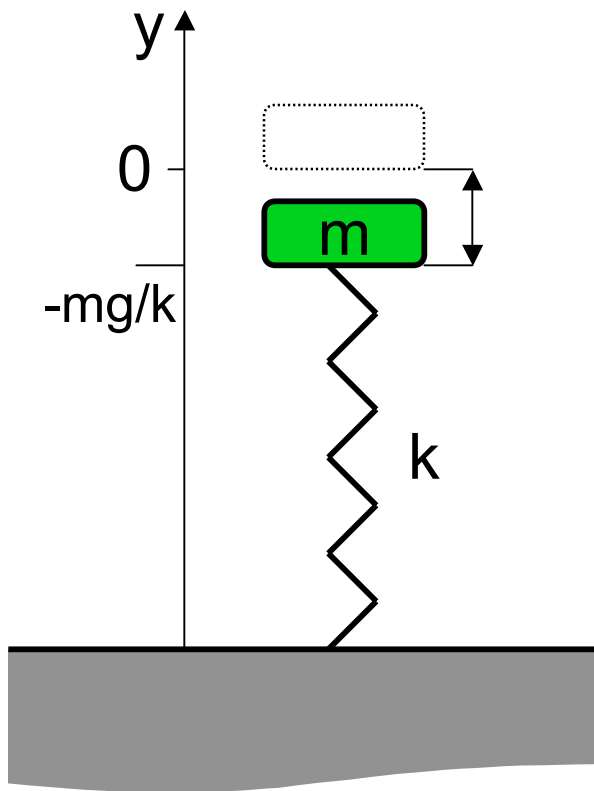




A mass is placed onto a very light spring. How far does it compress the spring?



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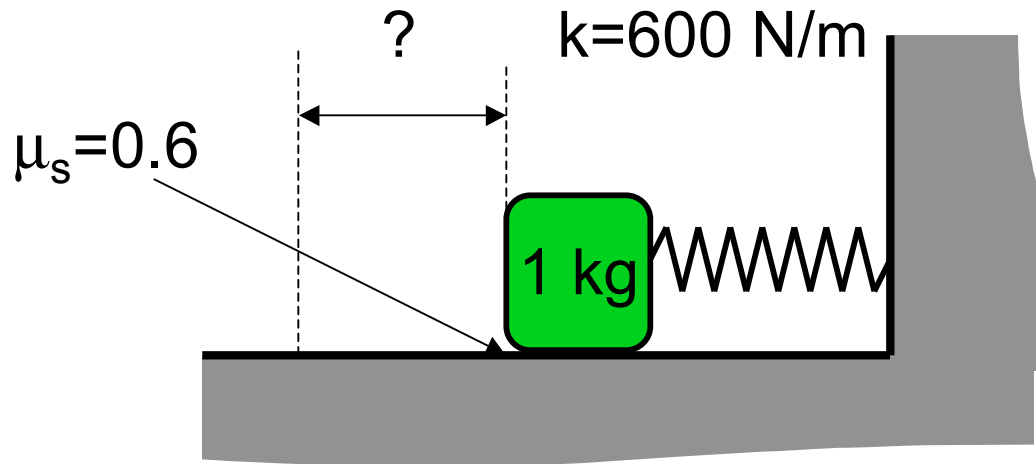


$$F_s = -ky$$

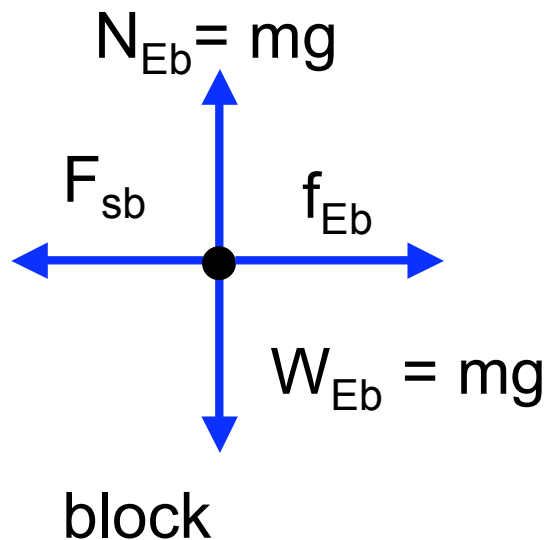
$$W_{Em} = -mg$$

$$-ky = +mg$$

$$y_i = -mg/k$$



A 1 kg block is attached to a spring with $k=600 \text{ N/m}$. It adheres to the table with $\mu_s=0.6$. Where can it be placed and not move.

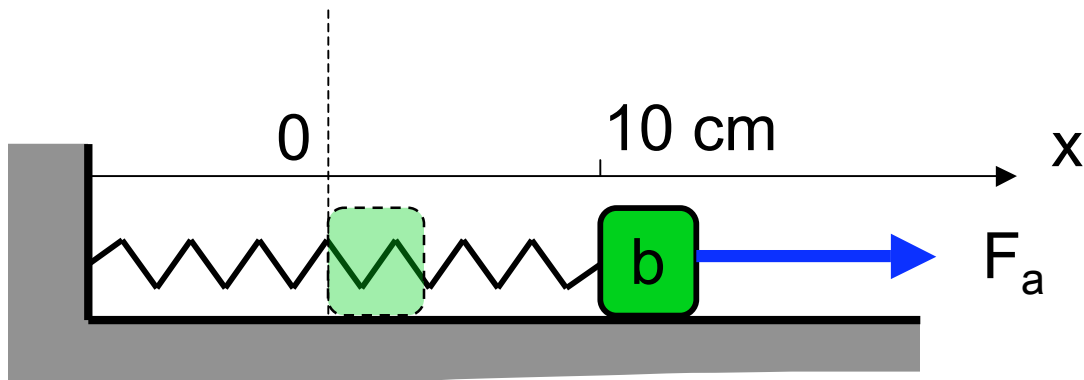


$$\text{maximum: } k|x| = \mu_s mg$$

$$|x| = \mu_s mg/k = 0.01 \text{ m}$$

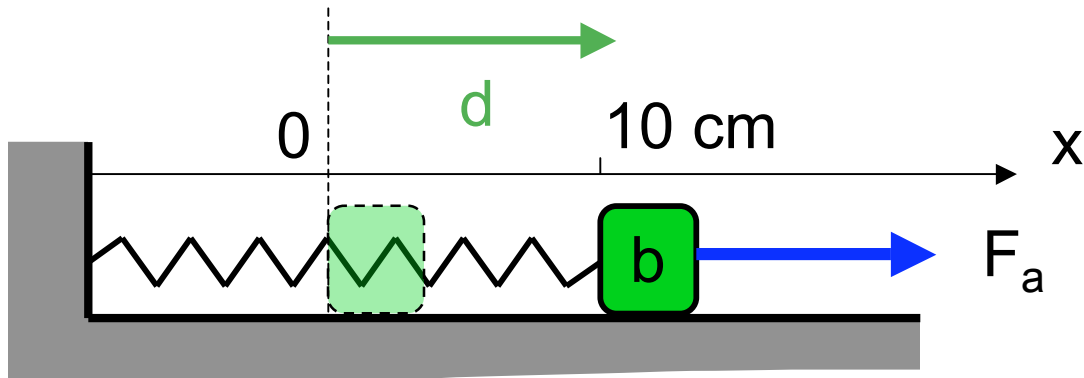
2 cm range centered on equilibrium

$$-1 \text{ cm} < x < 1 \text{ cm}$$



The block is moved 10 cm to the right. It begins at rest and ends at rest. The work done **by the spring** on the block is:

- A. positive
- B. zero
- C. negative

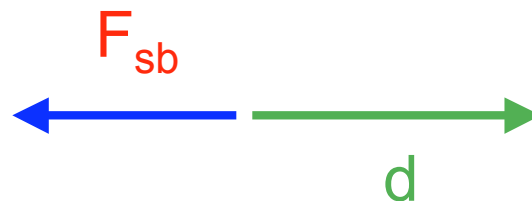
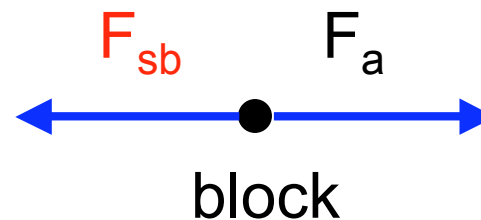


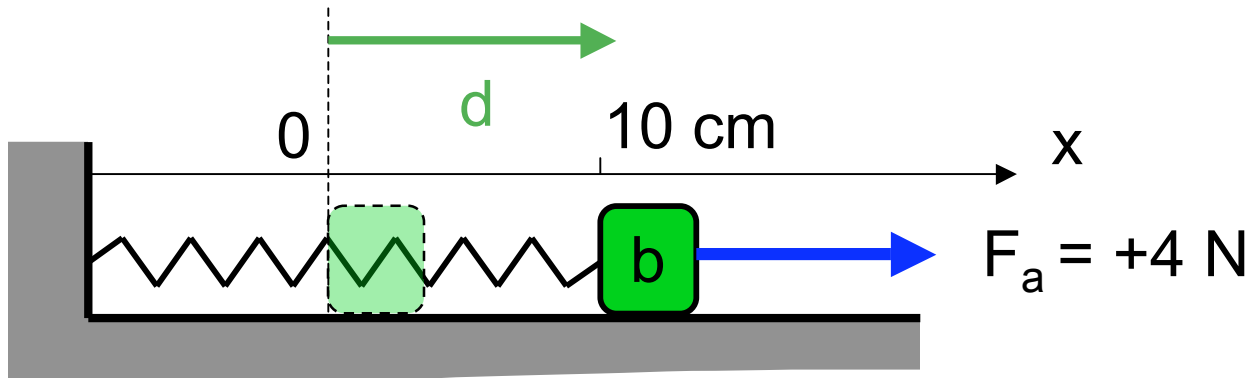
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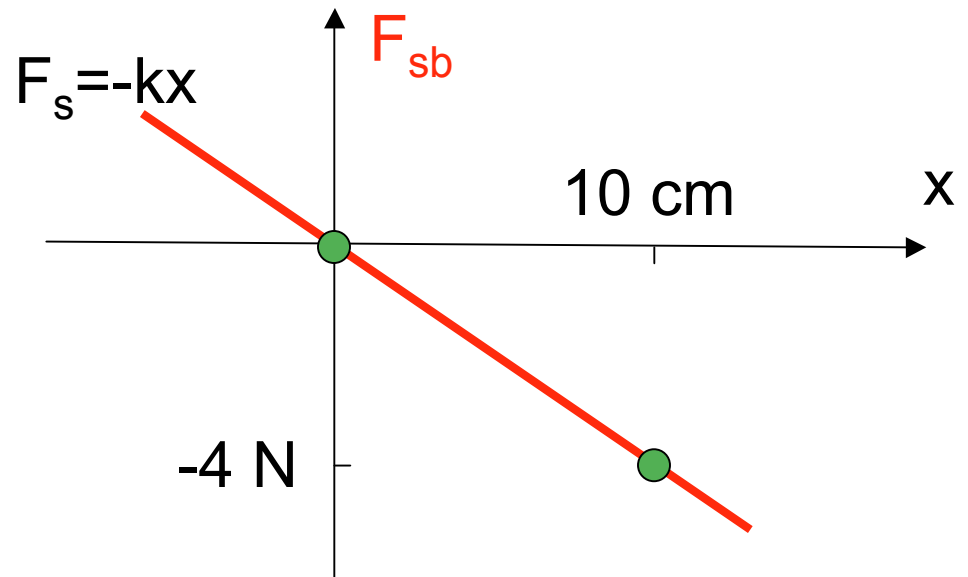
C. negative





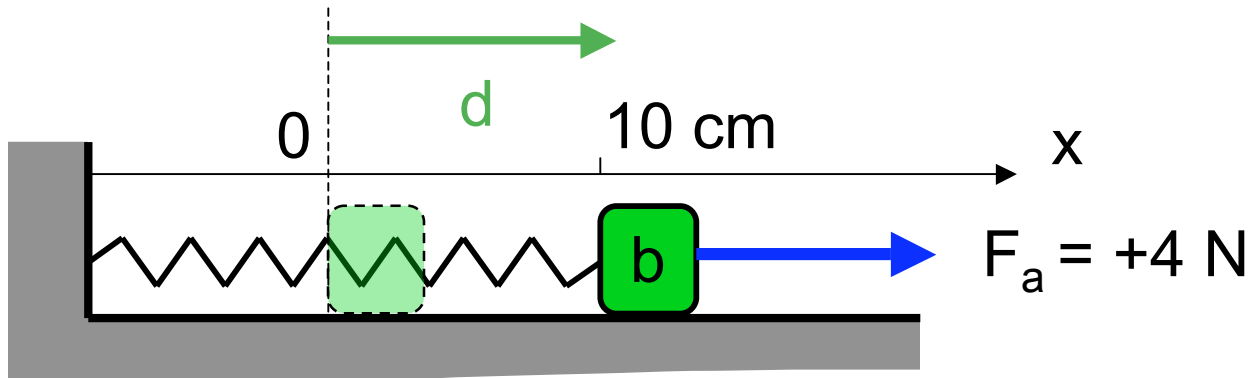
$$k=40 \text{ N/m}$$

The spring ($k=40 \text{ N/m}$) is stretched 10 cm from rest. At that point it exerts a force $F_{sb} = -4 \text{ N}$ on the block. The work done by the spring on the block is



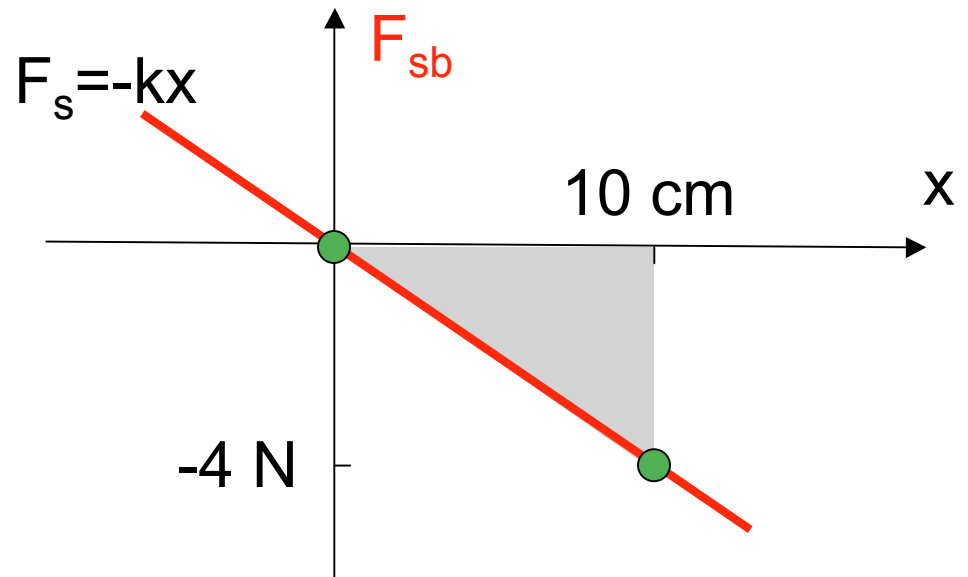
$$W = \vec{F} \cdot \vec{d} = F_x \Delta x = -0.4 \text{ J}$$

- A True
- B False



$$k=40 \text{ N/m}$$

The spring ($k=40 \text{ N/m}$) is stretched 10 cm from rest. At that point it exerts a force $F_{sb}=-4 \text{ N}$ on the block. The work done by the spring on the block is

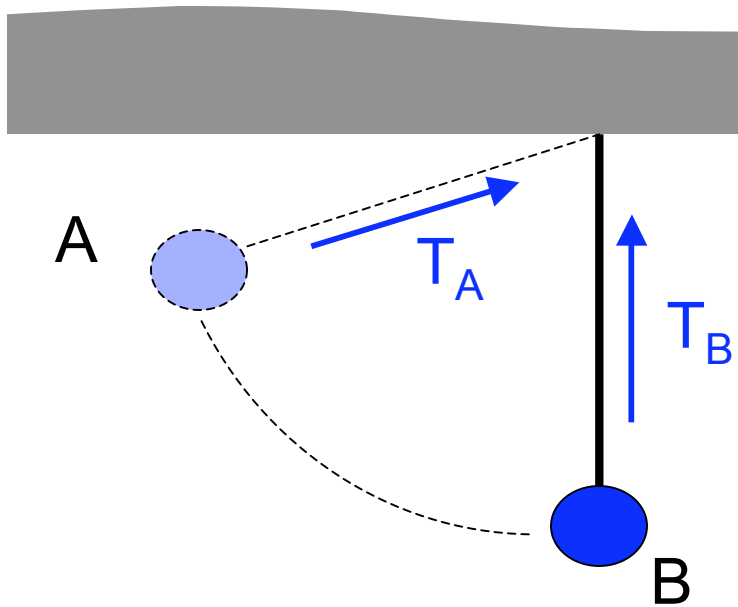


$$W = F_x \Delta x \quad \text{only when } F_x \text{ is constant}$$

$$W = \int F_x dx$$

- A** True
B False

$$W = \int F_x dx = \int_0^{0.1} (-kx) dx = -\frac{1}{2} kx^2 \Big|_0^{0.1}$$



Work by tension

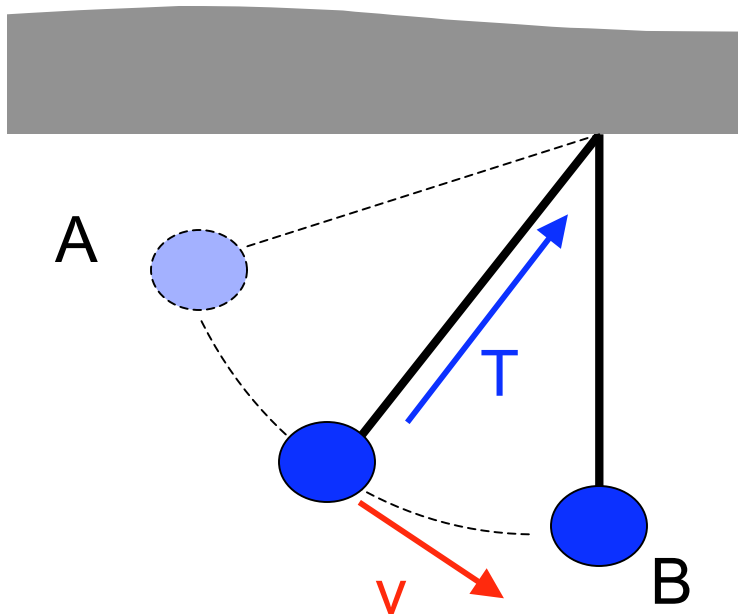
A bowling ball hangs from a wire hooked to the ceiling. The ball is allowed to swing from a resting position A. During its swing to B the tension from the wire is.

A constant

B not constant

C no way to know

Work by tension

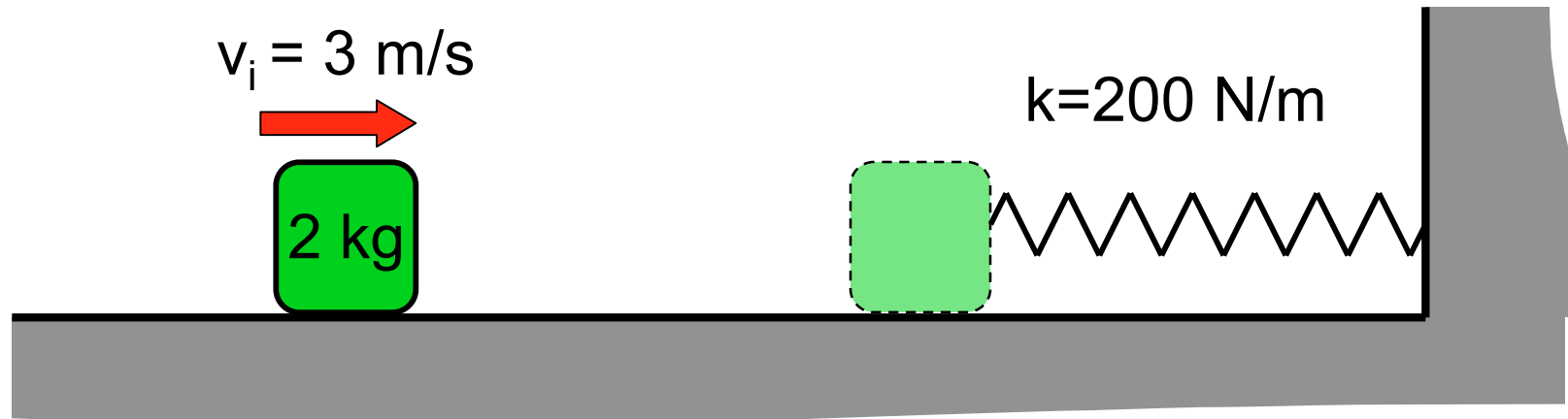


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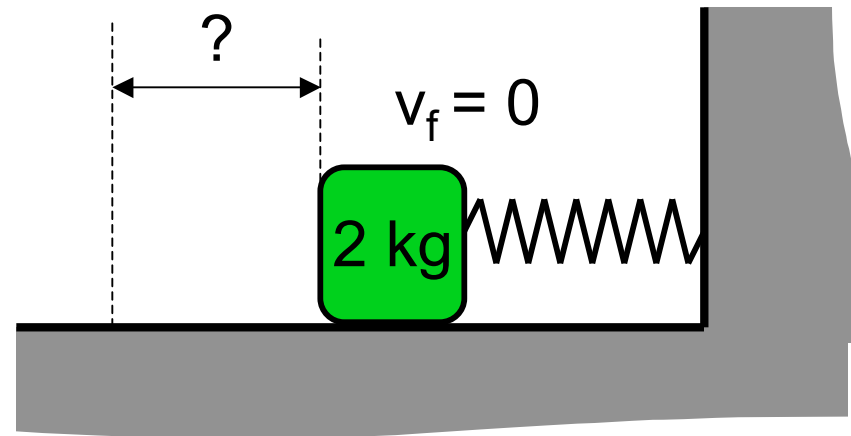
$$P = \vec{F} \cdot \vec{v} = 0$$

$$P = \frac{dW}{dt} = 0$$

- A positive work on the ball
- B zero work on the ball**
- C negative work on the ball
- D cannot determine work



A 2 kg block slides at 3 m/s across a frictionless table. It stops by hitting a spring with $k=200 \text{ N/m}$. How far does it compress the spring?

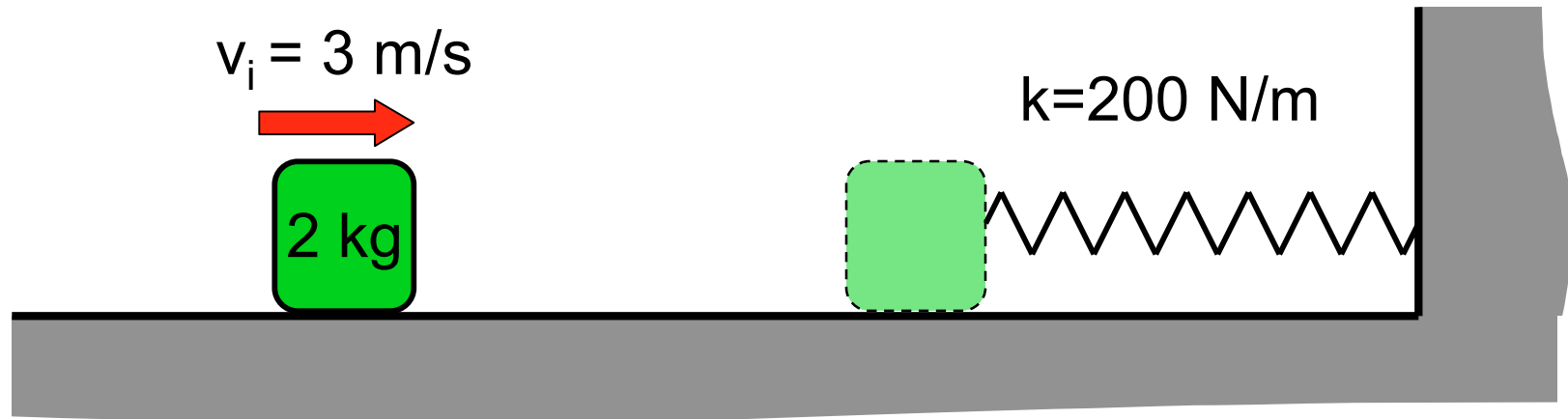


$$v_o = 3 \text{ m/s}$$

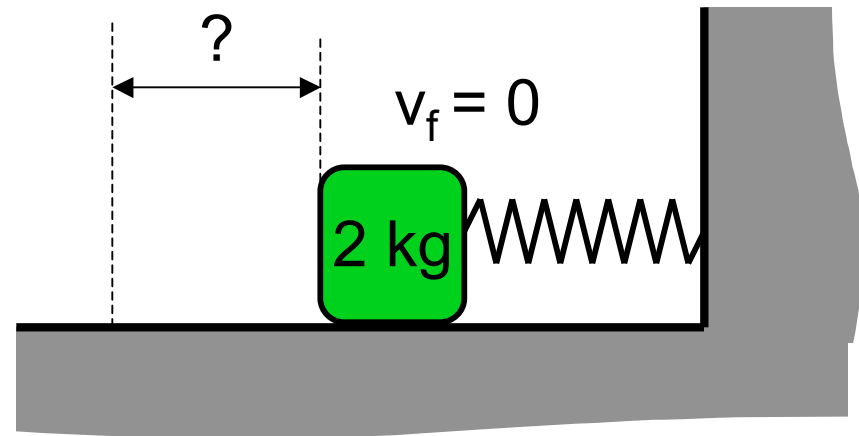
$$x_f = ?$$

$$a = F/m = -(k/m) x$$

- A $x - x_0 = v_0 t + \frac{1}{2} a t^2$
- B $v^2 = v_0^2 + 2a(x - x_0)$
- C $x - x_0 = \frac{1}{2}(v_0 + v)t$
- D $x - x_0 = vt - \frac{1}{2} a t^2$
- E none of these**



A 2 kg block slides at 3 m/s across a frictionless table. It stops by hitting a spring with $k = 200 \text{ N/m}$. How far does it compress the spring?

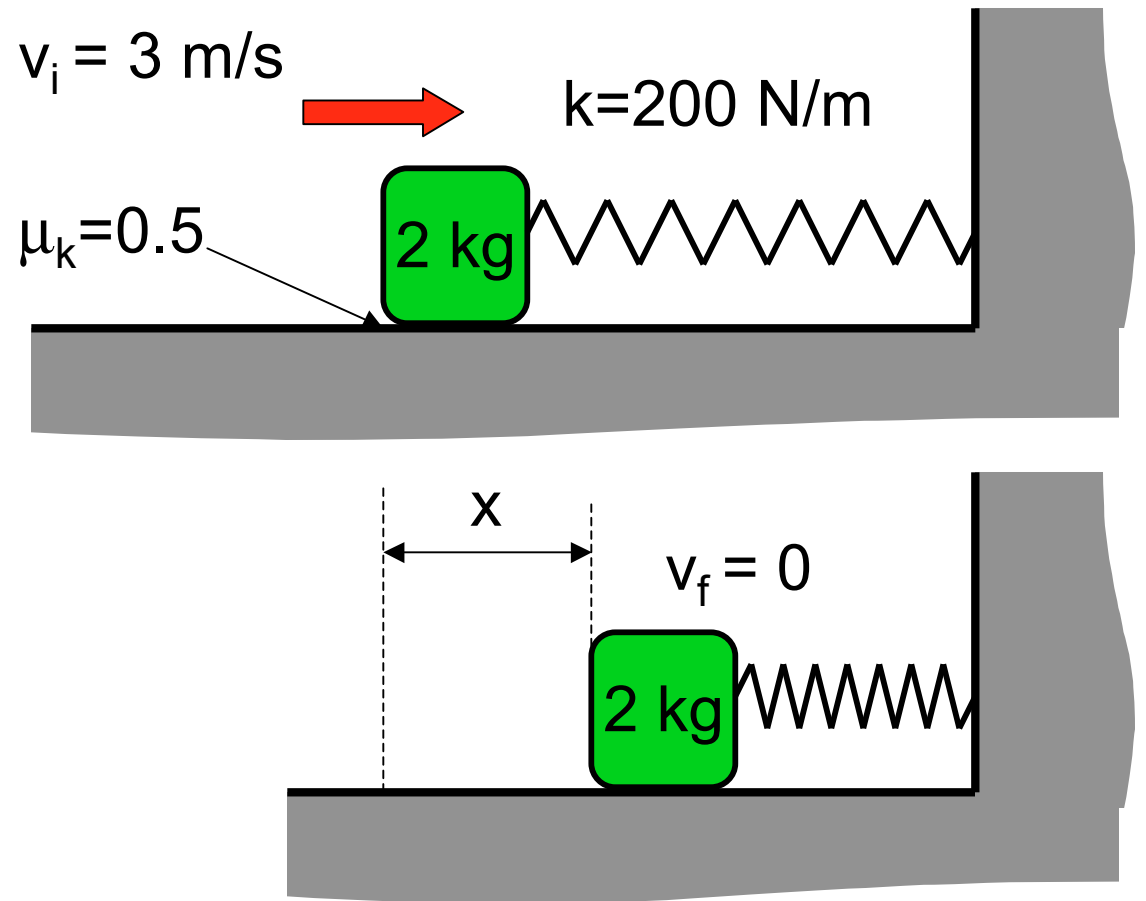


$$K_f - K_i = \Sigma W$$

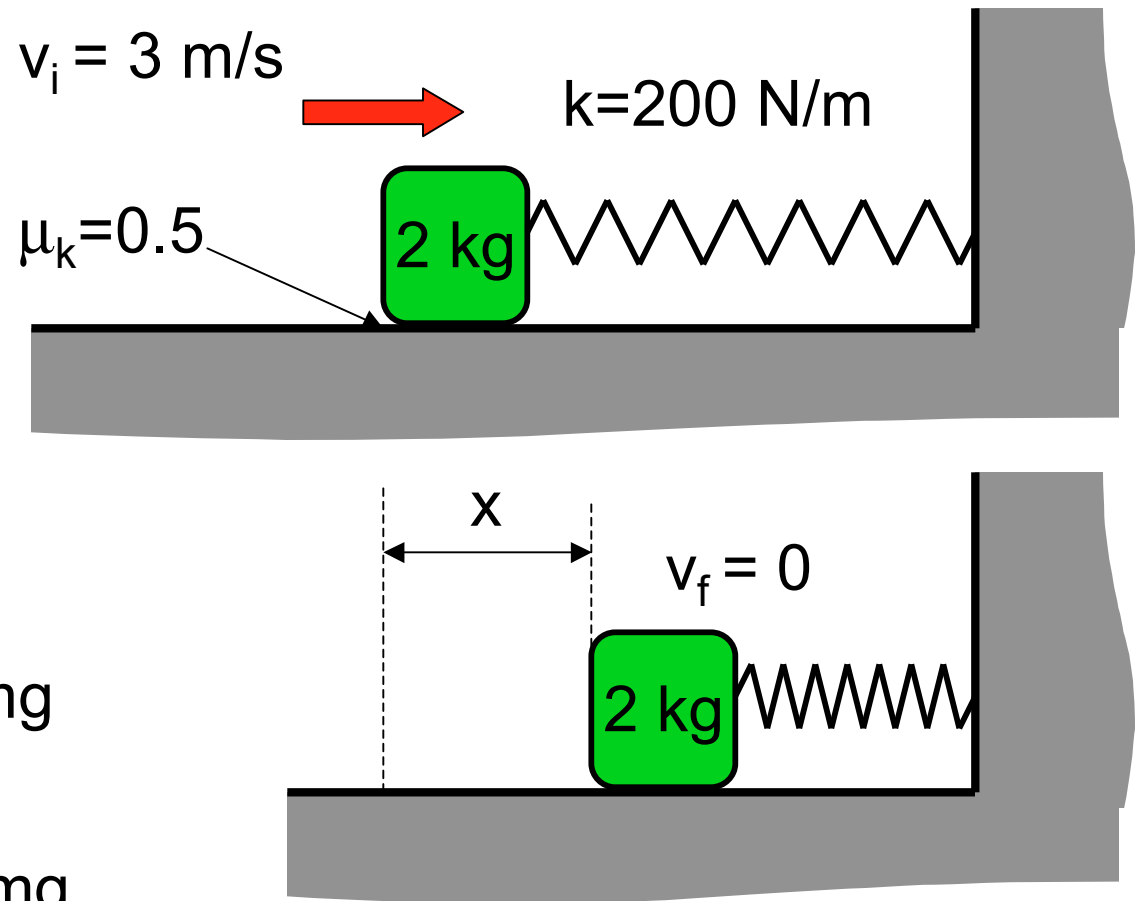
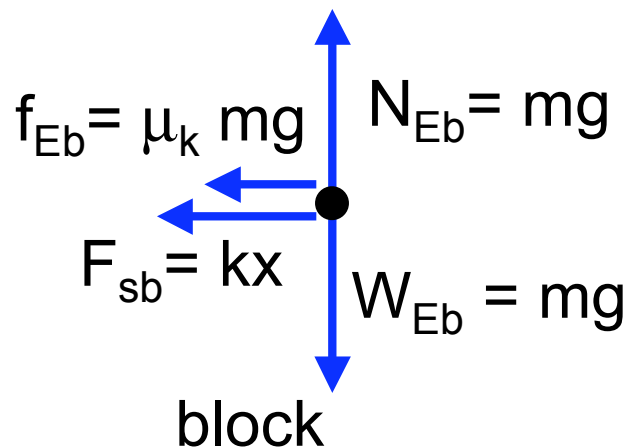
$$0 - 9 \text{ J} = - 100 x^2$$

$$x = 0.3 \text{ m}$$

A 2 kg block is sliding at 3 m/s at the instant it contacts a spring with $k=200$ N/m. It is sliding on a surface with $\mu_k=0.5$. How far does it travel before stopping?



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$$\sum W = K_f - K_i = -\mu_k mg - 0.5 k x^2$$

$$100 x^2 + 10 x - 9 = 0$$

$$x = \frac{-10 \pm \sqrt{100 + 4(9)(100)}}{2(100)} = -0.05 \pm 0.30$$