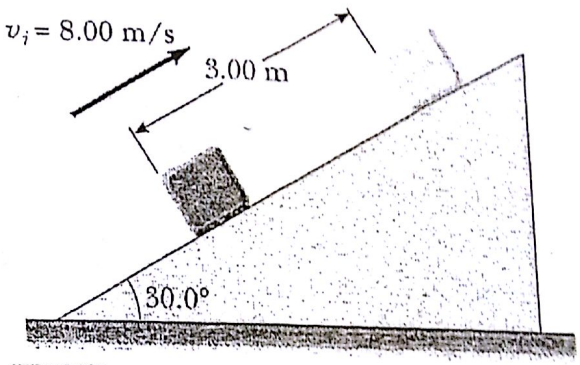
16) A 5 kg block is set into motion up an inclined plane with an initial speed of 8 m/s. The block comes to rest after traveling 3 m along the plane, which is inclined at an angle of 30° to the horizontal. For this motion determine

a) The change in the block's kinetic energy,
b) The change in the potential energy of the block-Earth system
c) The friction force exerted on the block
d) The coefficient of kinetic friction



16)

a) $\Delta K = \frac{1}{2} m \left(v_f^2 - v_i^2 \right) = -\frac{1}{2} m v_i^2 = \boxed{-160 \text{ J}}$

b) $\Delta u = mgh = mg(3)\sin 30 = 75 \text{J}$

c) $\Delta k + \Delta u = -fs \Rightarrow -160 + 75 = -85 \text{J}$

$$f = \frac{85}{3} = 28.3 \text{ N}$$

d) $f = \mu_k n = \mu_k mg \cos 30 = 28.3 \text{ N}$

$$\mu_k = \frac{28.3}{(5)(10)\cos 30} = 0.65$$

4- In a given displacement of a particle, its kinetic energy increases by 25 J while its potential energy decreases by 10 J. Determine the work of the nonconservative forces acting on the particle during this displacement.

a) + 15 J **b)** + 35 J **c)** - 15 J **d)** – 35 J **e)** + 55 J

5- A spring (k = 200 N/m) is suspended with its upper end supported from a ceiling. With the spring hanging in its equilibrium configuration, an object (mass = 2.0 kg) is attached to the lower end and released from rest. What is the speed of the object after it has fallen 4.0 cm?

a) 1.5 m/s **b)** 1.2 m/s **c)** 0.6 m/s **d)** 0.1 m/s **e)** 0.8 m/s

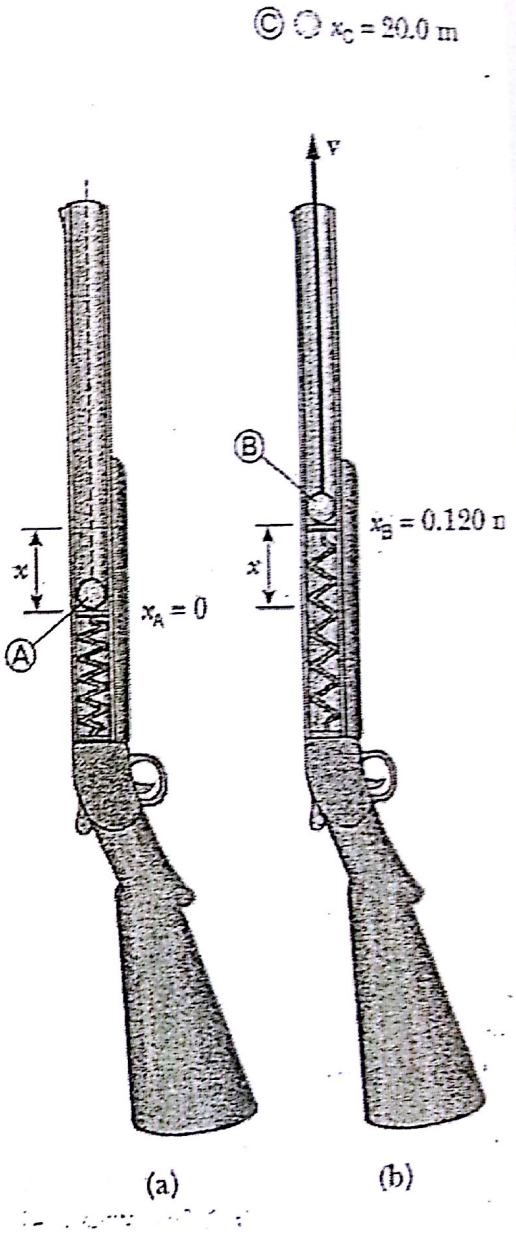
18) When a spring of a toy gun is compressed 0.12 m (as shown in figure) , the gun is able to launch vertically a 35 g projectile to a maximum height of 20 m above the position of the projectile before launching. Find the following:

8

a) The spring constant
b) The change in the potential energy of the system between points A& B
c) The speed of the projectile as it moves through the equilibrium position
d) The change in kinetic energy of the system between the points A & B

(Note that: A is initial position of the projectile, B is the equilibrium position of the spring, and C is the highest position of the projectile)

حل هذا السؤال في الورقة



18) a) $\Delta K + \Delta U = 0$

$K_C - K_A + U_{gC} - U_{gA} + U_{sC} - U_{sA} = 0$

$0 - 0 + mgh - 0 + 0 - \frac{1}{2}kx^2 = 0$

$k = \frac{2mgh}{x^2} = \frac{2(0.035)(10)(20)}{(0.12)^2} \simeq$ (972.2 N/m)

b) $U_{gB} - U_{gA} + U_{sB} - U_{sA} \Rightarrow \Delta U$

$mgx_B - 0 + 0 - \frac{1}{2}kx^2 \Rightarrow$

$=$ (−6.96 J)

c) $\Delta K + \Delta U = 0$

$\frac{1}{2}mv_B^2 - \frac{1}{2}mv_A^2 + mgh_B - mgh_A + \frac{1}{2}kx_B^2 - \frac{1}{2}kx_A^2$

$= \frac{1}{2}mv_B^2 + mgx_B - \frac{1}{2}kx_A^2 \Rightarrow$

$v_B = \sqrt{\frac{kx^2}{m} - 2gx_B}$

$= \sqrt{\frac{(972.2)(0.12)^2}{0.035} - 2(10)(0.12)}$

$\simeq$ (19.9 m/s)

d) $\Delta K_{AB} = K_B - K_A$

$= \frac{1}{2}mv_B^2 - \frac{1}{2}mv_A^2$

$= \frac{1}{2}(0.035)(19.9)^2 - 0$

$\simeq 6.9$ J