

(g) What is the total mechanical energy of the object?

Solution: The total mechanical energy of the object can be easily determined as the value of the maximum kinetic energy of the object.

$$E = E_{\text{kin}}^{\text{max}} = \frac{1}{2} m v_{\text{max}}^2 = (0.5) \cdot (0.25 \text{ kg}) \left(1.00 \frac{\text{m}}{\text{s}}\right)^2 = 0.125 \text{ J}.$$

(h) Determine the position, velocity and acceleration of the object at time $t=0$.

Solution:

We can use the general expressions given here for $x(t)$, $v_x(t)$ and $a_x(t)$. At $t=0$ we have:

$$x = 0.25 \text{ m} + (0.50 \text{ m}) \cos \frac{\pi}{6} = 0.25 \text{ m} + 0.5 \text{ m} \cdot 0.866 = 0.68 \text{ m}.$$

$$v_x = -1.00 \frac{\text{m}}{\text{s}} \sin \frac{\pi}{6} = -1.00 \frac{\text{m}}{\text{s}} \cdot 0.5 = -0.50 \frac{\text{m}}{\text{s}}.$$

$$a_x = -2.00 \frac{\text{m}}{\text{s}^2} \cos \frac{\pi}{6} = -2.00 \frac{\text{m}}{\text{s}^2} \cdot 0.866 = -1.73 \frac{\text{m}}{\text{s}^2}.$$