Homework of General Physics III

November 27, 2024

1. The displacement of a particle is given by $x(t) = 0.25\sin(5\pi t + \pi/4)\,\mathrm{m}$. Find: (a) the period; (b) the amplitude; (c) the initial phase angle; (d) the maximum speed; (e) the maximum acceleration.

2. A particle undergoes SHM. It is released from rest at $t = 0$ when its displacement from equilibrium is $0.34\,\mathrm{m}$. The initial acceleration is $-8.5\,\mathrm{m/s^2}$. (a) Write $x(t)$, the position as a function of time, (b) What is the maximum velocity? (c) At what time ($t > 0$) does the maximum (positive) velocity occur for the first time?

3. A $50\,\mathrm{g}$ block moving at $60\,\mathrm{cm/s}$ on a frictionless horizontal surface collides with a pan of negligible mass attached to a spring for which $k = 7.5\,\mathrm{N/m}$. (a) What is the maximum compression of the spring? (b) How long is the block in contact with the spring?

4. An unknown mass hangs at the end of a vertical spring. When a 50 g-block is added, the spring extends an additional $38\,\mathrm{cm}$. The period of oscillation without the 50 g-block was measured to be $0.8\,\mathrm{s}$. Find: (a) the spring constant; (b) the unknown mass.