Problems: you should show all your work.

A 4 kg particle attached to a spring moves according to a simple harmonic motion with a period of 4 s and a maximum energy of 16 J.

1) What is the elastic constant of the spring?

$$\omega = \sqrt{\frac{k}{m}} \longrightarrow k = m\omega^2 = (4\text{kg})\left(\frac{\pi}{2}\ \text{rad/s}\right)^2$$

$$\boxed{\omega = \frac{2\pi}{T} = \frac{\pi}{2}\ \text{rad/s}} \qquad = \pi^2\ \text{N/m}$$

2) What is the amplitude of this motion?

$$E_{TOTAL} = 16\ \text{J} = \frac{1}{2} k A^2$$

$$A^2 = \frac{32}{\pi^2} \longrightarrow A = \sqrt{\frac{32}{\pi^2}}\ \text{m}$$

$$= \frac{4}{\pi}\sqrt{2}\ \text{m}$$

3) What is the maximum acceleration of the 4 kg particle?

$$a_{MAX} = A\omega^2 = \left(\frac{4}{\pi}\sqrt{2}\right)\left(\frac{\pi^2}{4}\right)$$

$$= \pi\sqrt{2}\ \text{m/s}^2$$