

## State Examination Commission – Physics Higher Level, 2011

### Question 12a

State Hooke's law. (6)

A body of mass 250 g vibrates on a horizontal surface and its motion is described by the equation  $a = -16s$ , where  $s$  is the displacement of the body from its equilibrium position. The amplitude of each vibration is 5 cm.

Why does the body vibrate with simple harmonic motion? (6)

Calculate the frequency of vibration of the body? (9)

What is the magnitude of (i) the maximum force, (ii) the minimum force, which causes the body's motion? (7)

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State Hooke's law. (6)

standard definition

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Why does the body vibrate with simple harmonic motion? (6)

Because its acceleration is proportional to its displacement.

Calculate the frequency of vibration of the body? (9)

$$\omega^2 = 16 \Rightarrow \omega = 4.$$

Now,  $f = 1/T = 1/(2\pi/\omega) = \omega/2\pi = 4/2\pi = 0.64 \text{ Hz}$

What is the magnitude of (i) the maximum force, (ii) the minimum force, which causes the body's motion? (7)

Max force occurs at max displacement, 0.05 m

$$F_{max} = ma = m(-16s) = 0.25 \times -16 \times 0.05 = -0.2 \text{ N}$$

Min force occurs when  $s = 0$  m.

$$F_{min} = 0 \text{ N}$$