Earthquake!

crust $\rho = 3000\ kg/m^3$

wavelength $\lambda = 430\ m$

period $P = 0.8\ s$

amplitude $A = 2.1\ m$

a) Displacement is

$$y(x,t) = A\cos(kx - \omega t)$$

where

$$k = \frac{2\pi}{\lambda} = 0.0146\ \frac{rad}{m}$$

$$\omega = \frac{2\pi}{P} = 7.85\ \frac{rad}{s}$$

b) speed of the wave is

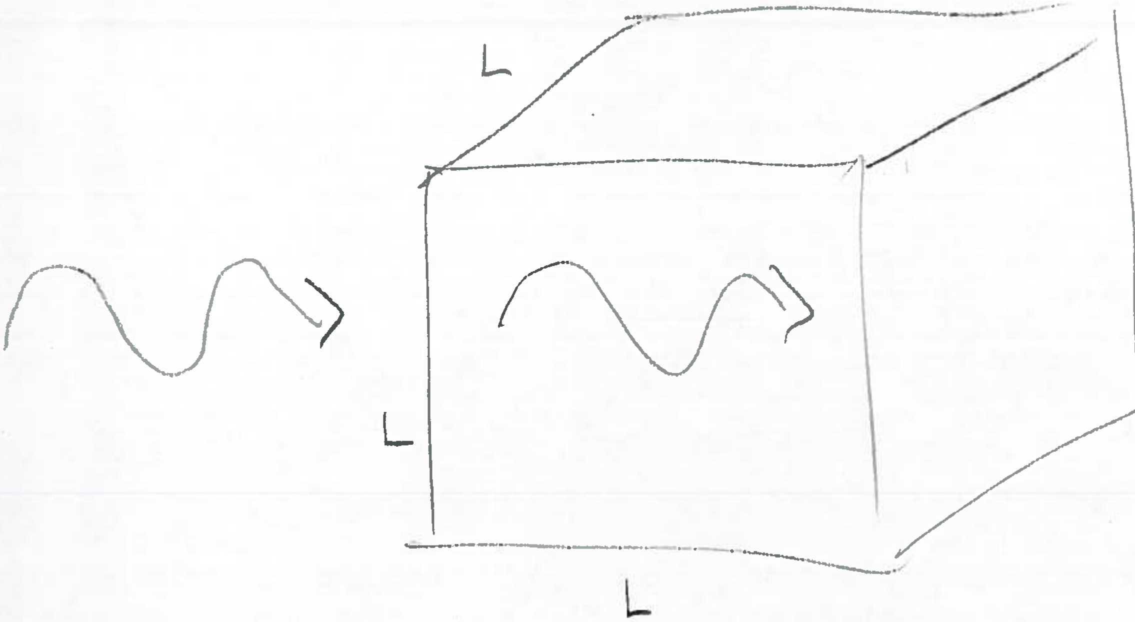
$$\text{wave speed} \quad v = \frac{\omega}{k} = 537\ \frac{m}{s}$$

c) max speed of little bits of crust as the move in response to the wave is

$$V_{max} = \left.\frac{dy}{dt}\right|_{max} = \omega A = 16.5\ \frac{m}{s}$$

d) intensity of wave is

$$I = \frac{1}{2}\rho v_{wave}(\omega A)^2 = 1.35 \times 10^{10}\ \frac{Watts}{m^2}$$



A region of rock in the form of a cube with sides of length $L = 100$ m is struck by the earthquake's wave. The wave passes through it for $t = 6$ seconds.

The energy deposited by the wave in this region is

$$E = (\text{Intensity})(\text{Area of cross-section})(\text{time})$$

$$= \left(1.35 \times 10^{10} \frac{W}{m^2}\right)(100\text{ m})^2(6\text{ s})$$

$$= 8.1 \times 10^{14}\text{ J}$$

This is somewhat larger than the energy released by the Hiroshima Bomb, which was $\approx 10^{14}$ J.