Answer **all** the questions in the spaces provided.

1 **(a)** The intensity of a progressive wave is defined as the average power transmitted through a surface per unit area.

Show that the SI base units of intensity are $kg\,s^{-3}$.

[2]

(b) **(i)** The intensity I of a sound wave is related to the amplitude x_0 of the wave by

$$I = K\rho c f^2 x_0^2$$

where ρ is the density of the medium through which the sound is passing,
c is the speed of the sound wave,
f is the frequency of the sound wave
and K is a constant.

Show that K has no units.

[2]

(ii) Calculate the intensity, in pW m^{-2}, of a sound wave where

$K = 20$,
$\rho = 1.2$ in SI base units,
$c = 330$ in SI base units,
$f = 260$ in SI base units
and $x_0 = 0.24\,\text{nm}$.

intensity = ...pW m^{-2} [3]