2 An open cube is placed in a liquid of density ρ, with a length l submerged as shown in Fig. 2.1. The cross-sectional area of the cube A is constant.

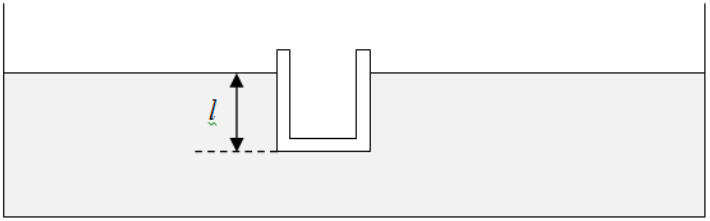

Fig. 2.1

When the cube is displaced downwards by a small distance from the equilibrium position and released, it resulted in simple harmonic motion of the cube. The frequency f of the cube is given by $f = \frac{1}{2\pi}\sqrt{\frac{g}{l}}$.

In an experiment, surface water waves of speed 0.90 m s^{-1} and wavelength 0.45 m are generated using a dipper shown in Fig. 2.2. The generated waves are incident on the cube, causing resonance in its up-and-down motion.

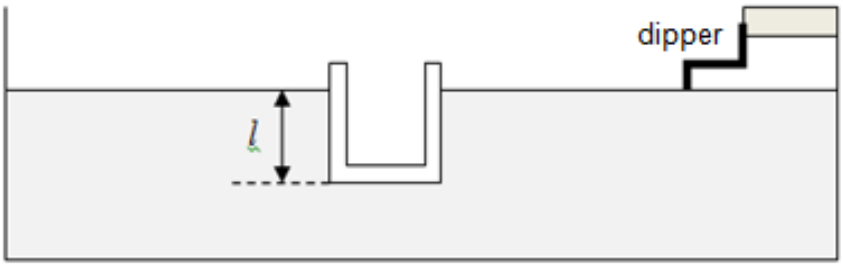

Fig. 2.2

(a) Explain why the cube undergoes *resonance.*

.....

.....

..... [2]

(b) Calculate the length l.

l = ... m [2]

(c) Describe and explain what happens to the amplitude of the vertical oscillations of the cube after the following changes are made independently:

(i) the distance between the wave crests increases,

.....

.....

..... [2]

(ii) some water is poured into the cube, without sinking it.

.....

.....

..... [2]

(d) Explain why the value of l that you found in **(b)** is larger than the actual measurement of l in the experiment

.....

.....

.....

.....

..... [2]

[Total: 10]