4 A beaker in air contains a liquid. The base of the beaker is in contact with the liquid and has area A, as shown in Fig. 4.1.

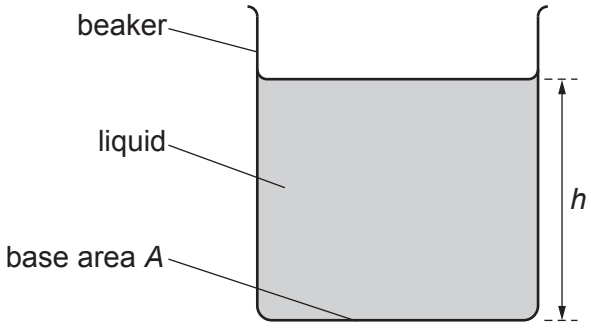

Fig. 4.1

The liquid has density ρ and fills the beaker to a depth h.

(a) By using the definitions of pressure and density, show that

$$p = \rho g h$$

where p is the pressure due to the liquid that is exerted on the base of the beaker and g is the acceleration of free fall.

[3]

(b) Suggest why the equation in **(a)** does not give the total pressure on the base of the beaker.

.....

..... [1]

(c) Fig. 4.2 shows the variation of the total pressure inside the liquid with depth x below the surface.

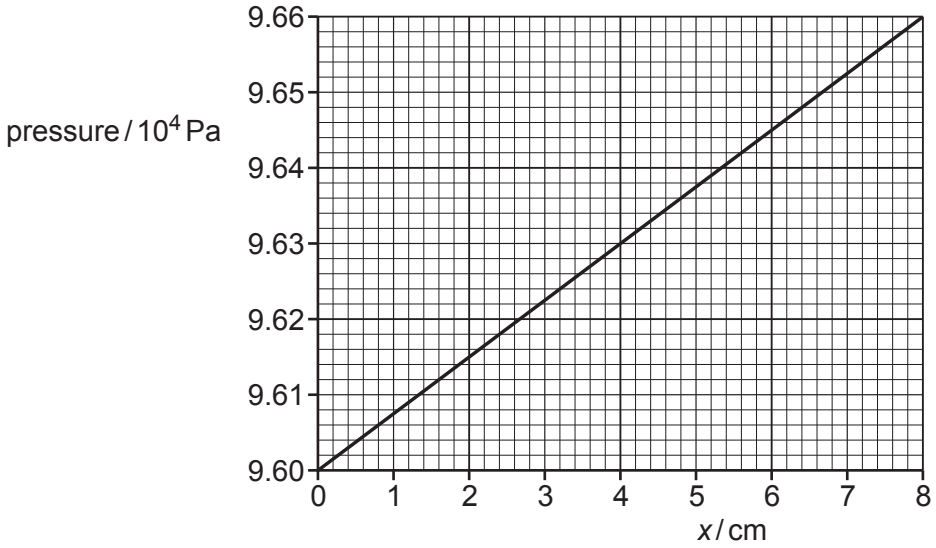

Fig. 4.2

Determine the density of the liquid.

density = ... kg m^{-3} [2]

(d) A solid cylinder is held stationary by a wire so that the base of the cylinder is level with the surface of the liquid, as shown in Fig. 4.3.

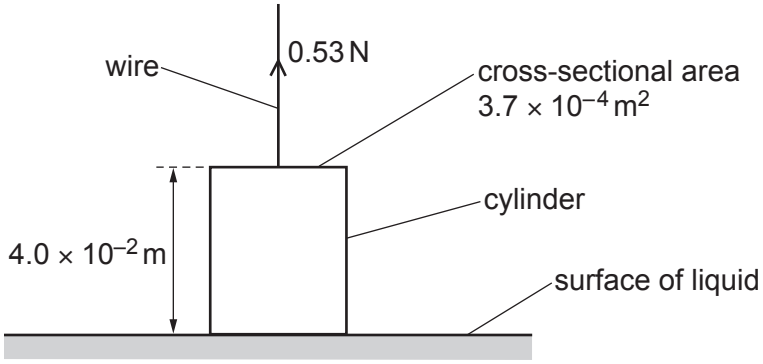

Fig. 4.3 (not to scale)

The cylinder has length 4.0×10^{-2} m and cross-sectional area 3.7×10^{-4} m^2. The tension in the wire is 0.53 N.

The cylinder is now lowered and then held stationary by the wire so that the top of the cylinder is level with the surface of the liquid.

Calculate the new tension in the wire.

tension = ... N [2]

[Total: 8]