3 **(a)** State the conditions for a body to be in equilibrium.

.....

.....

.....

..... [2]

(b) A uniform metre rule is pivoted at its centre as shown in Fig. 3.1.

The left end of the rule is suspended from a fixed point using a spring of force constant 21 N m^{-1}. A mass of 0.25 kg is hung from the same end of the rule using a string.

A block M is hung from the rule using a string at a distance of 30 cm from the pivot.

The rule is horizontal and the extension of the spring is 1.5 cm.

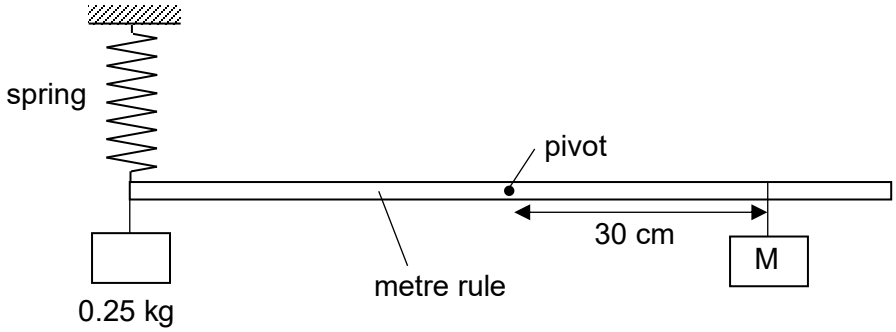

Fig. 3.1

(i) Show that the mass of block M is 0.36 kg.

[2]

(ii) Block M is now shifted to the end of the rule as shown in Fig. 3.2.

To keep the rule horizontal, half of block M is submerged in a liquid of unknown density.

The density of block M is 8.9×10^3 kg m^{-3}.

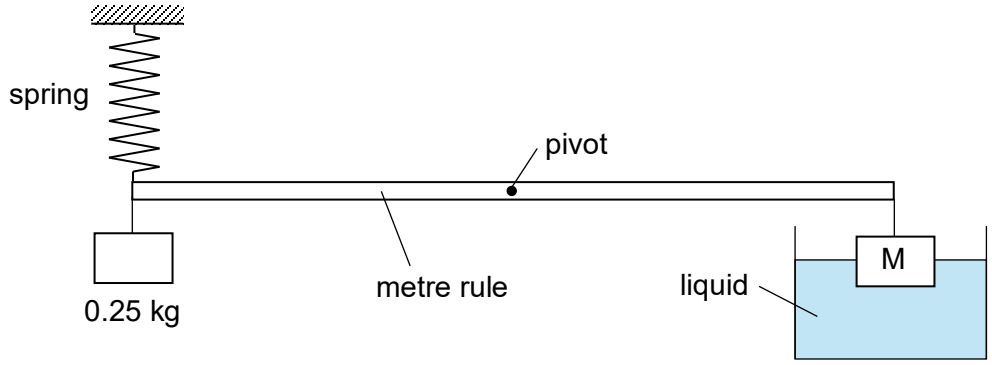

Fig. 3.2

Determine the density of the liquid.

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

(iii) Without further calculation, describe the equilibrium positions of the metre rule and block M when the spring in Fig. 3.2 is removed.

.....

..... [1]