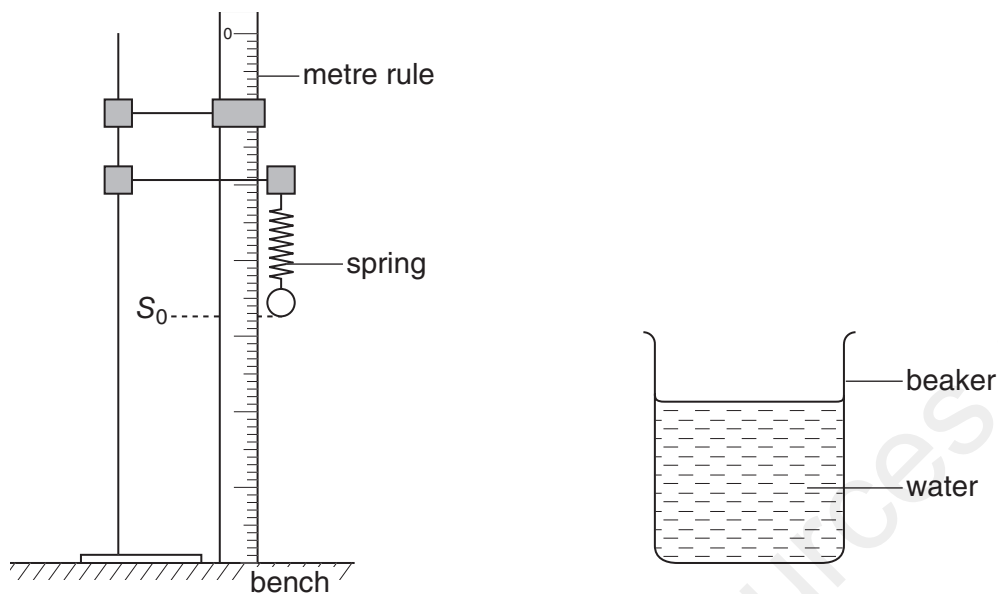# DENSITY OF A METAL

1 An IGCSE student is determining the density of the metal from which a load is made.
The apparatus is shown in Fig. 1.1.

Fig. 1.1

(a) The student records the scale reading S_0 on the metre rule at the bottom of the spring, as shown in Fig. 1.1.

$S_0 = 37.4\,cm$

Describe briefly how the student can avoid a parallax error when taking the scale reading.

....

....[1]

(b) He then hangs the load on the spring as shown in Fig. 1.2. He records the new scale reading S_1.

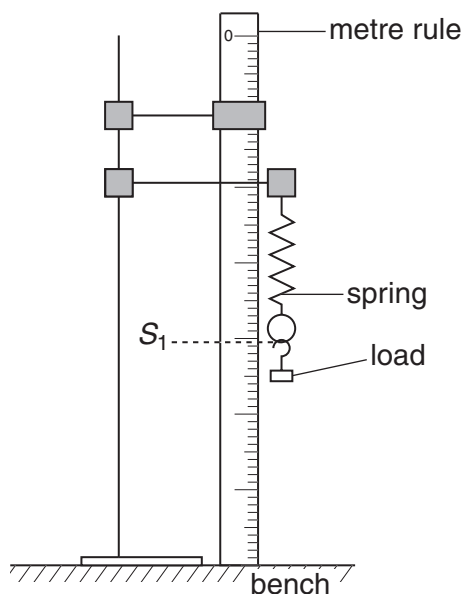**Fig. 1.2**

$S_1 = 40.5\,cm$

(i) Calculate the extension e_1 of the spring using the equation

$$e_1 = (S_1 - S_0).$$

$e_1 =$ ....

The student carefully raises the beaker under the load until it is completely under water. The load does not touch the sides or base of the beaker. He records the new scale reading S_2.

$S_2 = 39.8\,cm$

(ii) Calculate the extension e_2 of the spring using the equation $e_2 = (S_2 - S_0)$.

$e_2 =$ ....

[2]

(c) Calculate the density ρ of the material of the load using the equation

$$\rho = \frac{e_1}{(e_1 - e_2)} \times k$$

where $k = 1.00\,\text{g/cm}^3$.

ρ = ...[3]

(d) A second load, made from the same material and with the same mass, is too long to be completely submerged in the water.

Suggest whether

(i) the value obtained for e_2 would be greater, smaller or the same as that obtained in part **(b) (ii)**,

....

(ii) the value obtained for ρ would be greater, smaller or the same as that obtained in part **(c)**.

....

[2]

[Total: 8]

---------------------------------------MArking Scheme---

(a) view perpendicular to (or straight in front of rule)/use of set square [1]

(b) **(i)** correct e_1 value 3.1 and correct e_2 value 2.4 [1]
e in cm [1]

(c) density 4.43 (ecf) [1]
2/3 significant figures [1]
g/cm^3 [1]

(d) e_2 greater [1]
ρ greater (or identical to e_2 answer) (ecf) [1]

[Total: 8]