

- 1 A solid iron sphere of density 8000 kg m^{-3} and volume $4.50 \times 10^{-4} \text{ m}^3$ is completely submerged in a liquid of density 800 kg m^{-3} . The iron sphere is resting on a spring, as shown in Fig. 1.1. The spring is compressed by 10.2 cm.

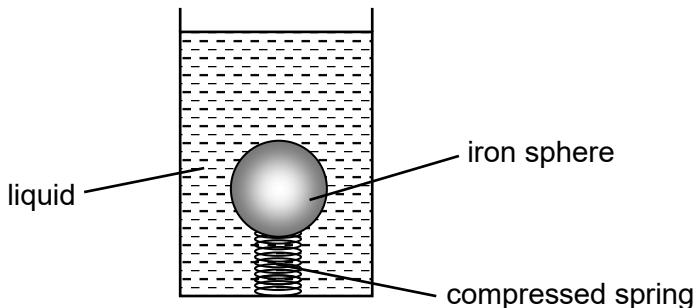


Fig. 1.1

- (a) Show that the upthrust on the iron sphere is 3.53 N.

[1]

- (b) Hence, calculate the force constant of the spring.

$$\text{force constant} = \dots \text{N m}^{-1} \quad [2]$$

- (c) A string of breaking strength 32.0 N is used to lift the iron sphere vertically upwards, as shown in Fig. 1.2. The iron sphere is then lifted partially out of the liquid as shown in Fig. 1.3.

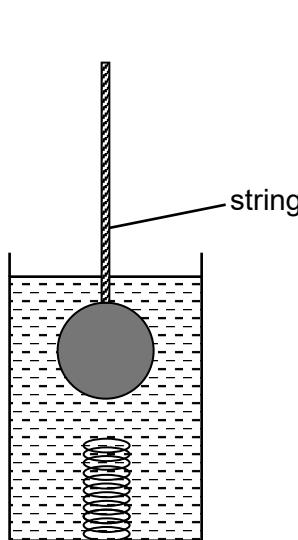


Fig. 1.2

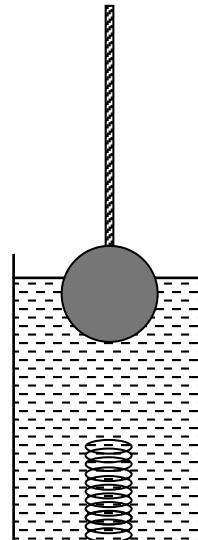


Fig. 1.3

- (i) Explain why the string breaks as the sphere emerges from the liquid.

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[2]

- (ii) Calculate the volume of the fluid displaced at the instant when the string breaks.

volume = m³ [3]