2 A mass is suspended from one end of a spring as shown in Fig. 2.1a. The mass is lowered into a beaker of water until it is fully submerged as shown in Fig. 2.1b. The extension of the spring reduces by 4.5 mm when the mass is fully submerged.

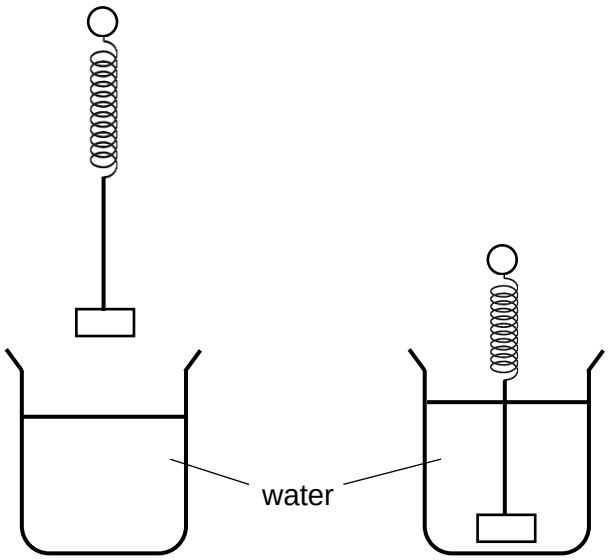

Fig. 2.1a **Fig. 2.1b**

The spring has a spring constant of 42 N m^{-1} and the density of water is 1000 kg m^{-3}.

(a) Show that the upthrust acting on the mass is 0.19 N.

[2]

(b) Determine the volume of the mass.

volume = …… m^3 [2]

(c) State the magnitude of force that the mass exerts on the water and explain your answer.

……..

……..

…….....[2]

(d) The mass is slowly raised vertically by lifting the upper end of the spring.

The vertical distance moved by the mass from its original position is s.

The mass reaches constant speed at $s = s_1$ as shown in Fig. 2.2a. It continues to move at a constant speed until it is fully out of the water for a short distance at $s = s_2$ as shown in Fig. 2.2b.

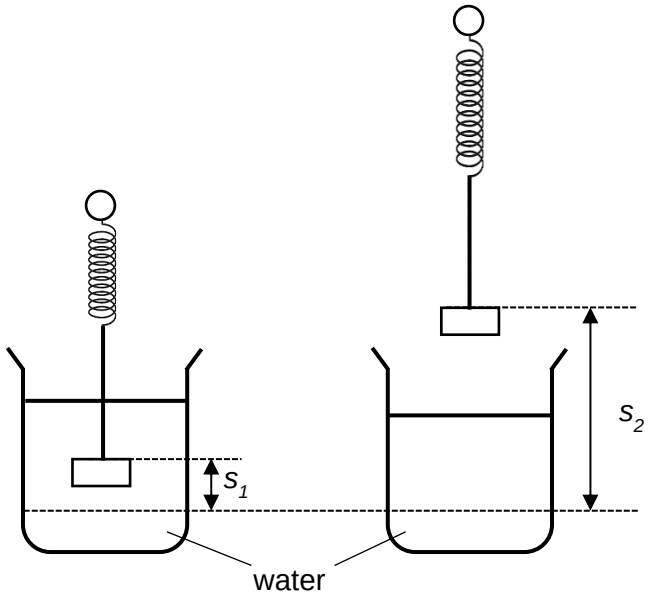

Fig. 2.2a **Fig. 2.2b**

On the axes of Fig. 2.3 below, sketch the variation with s of the extension e of the spring, from s_1 to s_2. Drag force is negligible.

Fig. 2.3

[3]

[Total: 9]