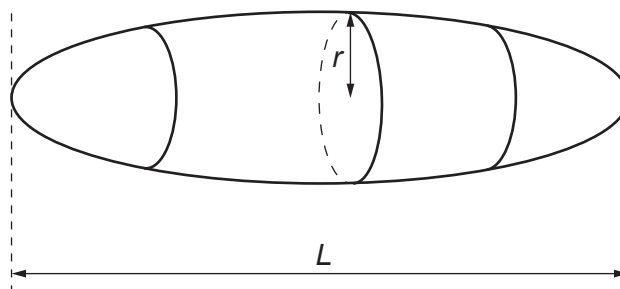


- 1 (a) Define *density*.

.....  
 ..... [1]

- (b) A smooth pebble, made from uniform rock, has the shape of an elongated sphere as shown in Fig. 1.1.



**Fig. 1.1**

The length of the pebble is  $L$ . The cross-section of the pebble, in the plane perpendicular to  $L$ , is circular with a maximum radius  $r$ .

A student investigating the density of the rock makes measurements to determine the values of  $L$ ,  $r$  and the mass  $M$  of the pebble as follows:

$$\begin{aligned} L &= (0.1242 \pm 0.0001) \text{ m} \\ r &= (0.0420 \pm 0.0004) \text{ m} \\ M &= (1.072 \pm 0.001) \text{ kg.} \end{aligned}$$

- (i) State the name of a measuring instrument suitable for making this measurement of  $L$ .

..... [1]

- (ii) Determine the percentage uncertainty in the measurement of  $r$ .

percentage uncertainty = ..... % [1]

- (c) The density  $\rho$  of the rock from which the pebble in (b) is composed is given by

$$\rho = \frac{Mr^n}{kL}$$

where  $n$  is an integer and  $k$  is a constant, with no units, that is equal to 2.094.

- (i) SI base units to show that  $n$  is equal to  $-2$ .

[2]

- (ii) Calculate the percentage uncertainty in  $\rho$ .

percentage uncertainty = ..... % [3]

- (iii) Determine  $\rho$  with its absolute uncertainty. Give your values to the appropriate number of significant figures.

$$\rho = (\text{.....} \pm \text{.....}) \text{ kg m}^{-3} \text{ [3]}$$

[Total: 11]