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.

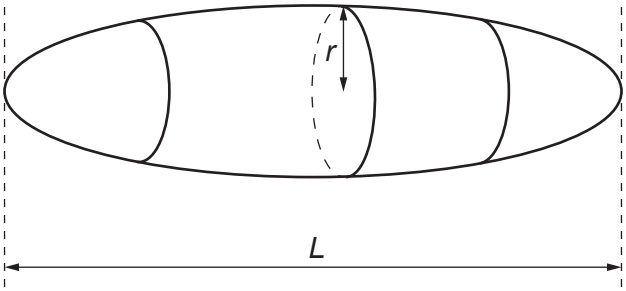

Fig. 1.1

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:

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

(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 ρ 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) Use SI base units to show that n is equal to –2.

[2]

(ii) Calculate the percentage uncertainty in ρ.

percentage uncertainty = ... % [3]

(iii) Determine ρ with its absolute uncertainty. Give your values to the appropriate number of significant figures.

ρ = (..... ± .....) kg m^{-3} [3]

[Total: 11]