

- 1 The rate of flow  $Q$  of a liquid along a narrow pipe of length  $L$  and radius  $r$  is given by

$$Q = \frac{\alpha r^4}{L}$$

where  $\alpha$  is a constant.

An experiment is carried out to determine the value of  $\alpha$ . The data from the experiment are shown in Table 1.1.

**Table 1.1**

quantity	value	percentage uncertainty
$Q$	$2.72 \times 10^{-8} \text{ m}^3 \text{s}^{-1}$	$\pm 3\%$
$r$	$7.1 \times 10^{-5} \text{ m}$	$\pm 2\%$
$L$	$2.5 \times 10^{-2} \text{ m}$	$\pm 4\%$

- (a) Use information in Table 1.1 to show that the SI base unit of  $\alpha$  is  $\text{s}^{-1}$ .

[1]

- (b) Show that the percentage uncertainty in  $\alpha$  is 15%.

[1]

- (c) Calculate  $\alpha$  with its absolute uncertainty. Give your answer to an appropriate number of significant figures.

$$\alpha = ( \dots \pm \dots ) \times 10^7 \text{ s}^{-1} \quad [3]$$

[Total: 5]