

1 Scientists are investigating the variation in air pressure at different locations on a mountain.

(a) The scientists take measurements of several physical quantities at each location.

Complete Table 1.1 by stating the SI base unit for each quantity and identifying with a tick (✓) whether each quantity is a scalar or a vector. Use the space for any working.

**Table 1.1**

quantity measured	SI base unit	scalar	vector
air temperature			
air pressure			

[2]

(b) (i) At one location, the density of the air is  $1.1 \text{ kg m}^{-3}$ . A spherical weather balloon is filled with a gas and released from rest. The balloon has radius 0.90 m.

Calculate the upthrust acting on the balloon when it is released.

upthrust = ..... N [2]

(ii) Explain why an upthrust acts on the balloon.

.....

.....

.....

..... [2]

- (iii) The balloon has weight 19 N.

Calculate the magnitude of the initial acceleration of the balloon.

acceleration = .....  $\text{ms}^{-2}$  [3]

- (c) A quantity  $c$  relating to the motion of the balloon is calculated from three measured quantities  $k$ ,  $F$  and  $v$  using the formula

$$c = \frac{2kF}{v^2}.$$

The percentage uncertainties in the measured quantities are given in Table 1.2.

**Table 1.2**

measured quantity	percentage uncertainty
$k$	5%
$F$	3%
$v$	4%

The calculated value of  $c$  is 1.8.

Determine the absolute uncertainty in  $c$ .

absolute uncertainty = ..... [2]

[Total: 11]