

3 What are the SI base units of the watt?

- A** Js^{-1} **B** $\text{kg m}^2 \text{s}^{-3}$ **C** $\text{kg m}^2 \text{s}^{-1}$ **D** Nm s^{-1}

22 What are the SI base units of stress?

- A** kg ms^{-2} **B** $\text{kg m}^{-1} \text{s}^{-2}$ **C** $\text{kg m}^{-2} \text{s}^{-2}$ **D** $\text{kg m}^{-3} \text{s}^{-2}$

3 Which physical quantity could have units of $\text{N s}^2 \text{m}^{-1}$?

- A** acceleration
B force
C mass
D momentum

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 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 = 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
<i>k</i>	5%
<i>F</i>	3%
<i>v</i>	4%

The calculated value of *c* is 1.8.

Determine the absolute uncertainty in *c*.

absolute uncertainty = [2]

[Total: 11]

2 What is 0.25 kN mm^{-2} expressed in N m^{-2} ?

- A** 0.00025 N m^{-2}
B 0.25 N m^{-2}
C $250\,000 \text{ N m}^{-2}$
D $250\,000\,000 \text{ N m}^{-2}$

4 The time period T of a pendulum is given by

$$T = 2\pi \left(\frac{L}{g} \right)^n$$

where L is the length of the pendulum and g is the acceleration of free fall.

The equation is homogeneous.

What is the value of n ?

- A** -2 **B** $-\frac{1}{2}$ **C** $\frac{1}{2}$ **D** 2