3 What are the SI base units of the watt?

A $J\,s^{-1}$ **B** $kg\,m^2\,s^{-3}$ **C** $kg\,m^2\,s^{-1}$ **D** $N\,m\,s^{-1}$

22 What are the SI base units of stress?

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

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

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 = ... $m\,s^{-2}$ [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]

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 $250\,000\,N\,m^{-2}$

D $250\,000\,000\,N\,m^{-2}$

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