For Examiner's Use

4 **(a)** **(i)** Define the terms

1. tensile stress,

.....

.....[1]

2. tensile strain,

.....

.....[1]

3. the Young modulus.

.....

.....[1]

(ii) Suggest why the Young modulus is not used to describe the deformation of a liquid or a gas.

.....

.....[1]

(b) The change ΔV in the volume V of some water when the pressure on the water increases by Δp is given by the expression

$$\Delta p = 2.2 \times 10^9 \frac{\Delta V}{V},$$

where Δp is measured in pascal.
In many applications, water is assumed to be incompressible.
By reference to the expression, justify this assumption.

.....

.....

.....[2]

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(c) Normal atmospheric pressure is 1.01×10^5 Pa.

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Divers in water of density $1.08 \times 10^3 \text{ kg m}^{-3}$ frequently use an approximation that every 10 m increase in depth of water is equivalent to one atmosphere increase in pressure. Determine the percentage error in this approximation.

error = ... % [3]

3 **(a)** Explain what is meant by the *internal energy* of a substance.

.....

.....

..... [2]

(b) State and explain, in molecular terms, whether the internal energy of the following increases, decreases or does not change.

(i) a lump of iron as it is cooled

.....

.....

.....

..... [3]

(ii) some water as it evaporates at constant temperature

.....

.....

.....

..... [3]

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Answer **all** the questions in the spaces provided.

For Examiner's Use

1 Make estimates of the following quantities.

(a) the speed of sound in air

speed = ... [1]

(b) the density of air at room temperature and pressure

density = ... [1]

(c) the mass of a protractor

mass = ... [1]

(d) the volume, in cm^3, of the head of an adult person

volume = ... cm^3 [1]

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8 A thermistor has resistance 3900 Ω at 0 °C and resistance 1250 Ω at 30 °C. The thermistor is connected into the circuit of Fig. 8.1 in order to monitor temperature changes.

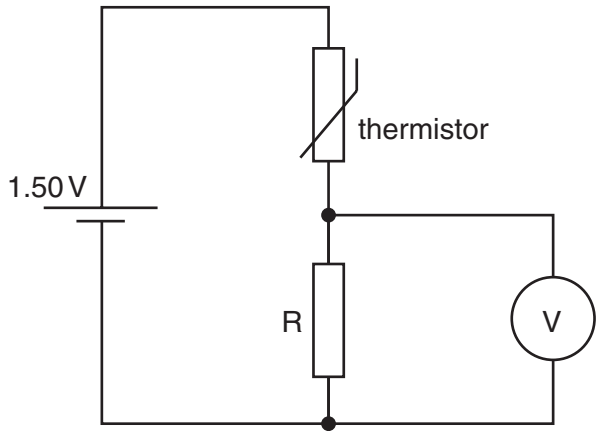

Fig. 8.1

The battery of e.m.f. 1.50 V has negligible internal resistance and the voltmeter has infinite resistance.

(a) The voltmeter is to read 1.00 V at 0 °C. Show that the resistance of resistor R is 7800 Ω.

[2]

(b) The temperature of the thermistor is increased to 30 °C. Determine the reading on the voltmeter.

reading = ... V [2]

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5 Some gas is contained in a cylinder by means of a moveable piston, as illustrated in Fig. 5.1.

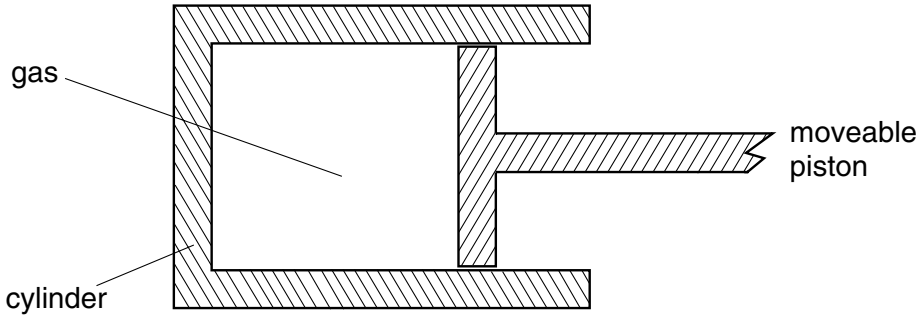

Fig. 5.1

State how, for this mass of gas, the following changes may be achieved.

(a) increase its gravitational potential energy

.....[1]

(b) decrease its internal energy

.....

.....[1]

(c) increase its elastic potential energy

.....

.....[1]