

## **A level Physics B**

**H557/01** Fundamentals of physics

### **Question Set 24**

1 (a)\*

Boyle's Law states that at constant temperature, pressure is proportional to  $\frac{1}{\text{volume}}$ .  
Explain how the random motion of particles gives rise to Boyle's law.

[6]

(b) (i)

Here are some data about trace gases in the atmosphere:

H<sub>2</sub> molar mass 2 grams

Xe molar mass 132 grams

Calculate the ratio:  $\frac{\text{speed of hydrogen molecule with average kinetic energy}}{\text{speed of xenon atom with average kinetic energy}}$ .

Make your reasoning clear.

ratio = ..... [3]

(b) (ii) The escape velocity for planet Earth is 11.2 kms<sup>-1</sup>.

Use the Boltzmann factor to estimate the number of H<sub>2</sub> molecules per mole with sufficient energy to escape the atmosphere and the Earth's gravitational field at a temperature of 288 K.

number = .....mole<sup>-1</sup> [4]

**Total Marks for Question Set: 13**

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