Answer on Question #75722, Chemistry / General Chemistry

Question:

The escape velocity required for gas molecules to overcome the Earth's gravity is 1.12 x 10^3 m/s at 15 degree Celsius. Would He escape the Earth? Would H_2 escape from Earth? Show.

Solution:

The average velocity of gas molecules:

$$v = \sqrt{\frac{3RT}{M}}$$

where:

R - universal gas constant ($8.31 \frac{J}{mol \cdot K} = 8.31 \cdot 10^3 \frac{m^2 \cdot g}{s^2 \cdot mol \cdot K}$)

T - temperature (15 °C = 288 K)

M - molar weight of the gas (4 g/mol for He; 2 g/mol for H_2)

For molecules of He: $v = \sqrt{\frac{3 \cdot (8.31 \cdot 10^3) \cdot 288}{4}} = 1340$ m/s

For molecules of H_2: $v = \sqrt{\frac{3 \cdot (8.31 \cdot 10^3) \cdot 288}{2}} = 1895$ m/s

Both velocities are larger than $1.12 \cdot 10^3$.

Answer:

Both gases would escape.