13) Escape speed from Earth $v_{esc} = 11.2\ km/s = 11.2 \times 10^3\ m/s$

At what temperature will 11.2% of O_2 molecules have speeds $> v_{esc}$?

From table

$$11.2\% \rightarrow 2\langle K \rangle = E_{escape}$$

$$\therefore \langle K \rangle = \tfrac{1}{2} E_{escape}$$

$$= \tfrac{1}{2}\left(\tfrac{1}{2} m v_{esc}^2\right)$$

For O_2 molecules,

$$m \simeq 32u \times 1.66 \times 10^{-27}\ kg/u = 53.12 \times 10^{-27}\ kg$$

$$\langle K \rangle = \tfrac{1}{4} \times 53.12 \times 10^{-27}\ kg \times (11.2 \times 10^3\ m/s)^2$$

$$= 1.67 \times 10^{-18}\ J$$

$$\tfrac{3}{2} kT = 1.67 \times 10^{-18}\ J$$

$$T = \frac{2 \times 1.67 \times 10^{-18}\ J}{3 \times 1.38 \times 10^{-23}\ J/K} = 0.8 \times 10^5\ K$$

(B)