2 **(a)** **(i)** The pressure p in an ideal gas is given by the expression

$$p = \frac{1}{3}\frac{Nm}{V}\langle c^2 \rangle$$

State the meaning of each of the symbols in the equation.

N : .....

m : .....

V : .....

$\langle c^2 \rangle$: .....

[2]

(ii) Using the equation in **(i)** and the equation of state of an ideal gas, $pV = NkT$, derive an expression for the relationship between the internal energy of the ideal gas and the thermodynamic temperature T.

[2]

(b) **(i)** The gravitational field is relatively weak on the surface of the Moon. The escape speed (i.e. the minimum speed which a body must have in order to escape to an infinite distance) from the Moon is 2.38 km s^{-1}.
Argon-40 may be assumed to be an ideal gas. Calculate the temperature of argon-40 gas at which the r.m.s speed of its atoms is equal to the escape speed from the Moon.

temperature = …….. K [2]

(ii) An appreciable amount radioactive potassium-40 is discovered below the lunar surface. It is known that potassium-40 decays to form argon-40 gas.

With reference to your answer in **(b)(i)**, discuss the likelihood of argon-40 being present in the Moon's atmosphere.

……...

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……...

…….. [2]

[Total: 8]