Change a few old habits

Change of a few old habits

Quantity	Earlier we used	Now we will use
Energy (Heat, work, stored energy)	Cal, J 1 cal = 4.186 J	kJ, kCal 1 kCal = 4.186 kCal
Sp Heat (mass basis)	Cal/g.°C J/g.°C	kCal/kg.K kJ/kg.K
Sp. Heat (mole basis)	Cal/gmol.°C J/g mol.°C	kJ/kmol.K kCal/kmol.K
Molecular wt. Molecular mass	g/mol	kg/kmol
R_u	8.315 J/gmole°C	8.315 kJ/kmol K
No of molecules	gram mole ($\equiv 6.023 \times 10^{23}$ molecules)	kilo mole or kmole (6.023×10^{26} molecules)

* Do not write °K. It's simply K for Kelvin

* 1 kmole of an ideal gas occupies 22.4 m^3 volume at STP (equivalent to 1 gm mol. of the ideal gas occupying 22.4 lit at STP)

We will also use a species specific gas constant.

$$R = \frac{R_u}{M_w} = \frac{8.315 \quad kJ/kmol\ K}{M_w \quad kg/kmol} = \left(\frac{8.315}{M_w}\right) \frac{kJ}{kg\ K}$$

molecular wt. (→ M_w)

Thus $R_{O_2} = \frac{8.315}{32} = 0.26 \frac{kJ}{kg\ K}$

$R_{H_2} = \frac{8.315}{2} = 4.1575\ kJ/kg\ K$

$R_{N_2} = \frac{8.315}{28} = 0.297\ kJ\ kg\ K$

(No need to remember these values

Q. What is the R_{Air}?

Air is not a molecule, but a mixture. Despite we assign a molecular wt. of air, and a molecular weight

A) Air composition : $1O_2 + 3.76N_2$ ← REMEMBER
(molar basis)

$$\therefore M_{Air} = \frac{1 \times 32 + 3.76 \times 28}{(\text{total no of k moles})} \frac{kg}{kmol}$$

$$= \frac{137.28}{4.76} = 28.84\ kg/kmol$$

No need to remember as long as you can do this algebra

$$\therefore R_{air} = \frac{R_u}{M_{air}} = \frac{8.315}{28.84} = 0.288 \quad (\text{approx})$$

↳ Remember, if you can, Not mandatory