(a) The reaction rate is reported in atm/h. Therefore, the units of rate constant in the given expression can be derived as follows:

(b) We are now asked to convert the rate law into concentration terms using SI units (mol, m3, s). So first, we need to convert the value of the pressure-based rate constant to SI units (atm🡪Pa, h🡪s)

which gives k = 1\*10-8 Pa-1s-1

Therefore the rate law is when is expressed in Pa/s

We are interested in converting the rate law from pressure terms to concentration terms. This can be done using the ideal gas law (PV=nRT) as follows:

Differentiating w.r.t time,

Substituting above,

Substituting and rearranging,

or,

Substituting R = 8.314 J/mol.K and T = 400 K,

Therefore, the concentration-based rate constant ‘k’ = 3.33 \* 10-5 m3/mol.s