d) When NO_2 absorbs UVA light in the atmosphere, at wavelengths shorter than 400 nm, it dissociates into NO + O: 2

$$NO_2 + h\nu \rightarrow NO + O$$

What is the bond dissociation energy (in kJ mol^{-1}) of the N–O bond in NO_2?

The energy per molecule required to break the bond is given by Planck's relationship:

$$\boldsymbol{E = hc / \lambda}$$
$$\mathbf{= (6.626 \times 10^{-34}\ J\ s) \times (2.998 \times 10^{8}\ m\ s^{-1}) / (400 \times 10^{-9}\ m) = 5.0 \times 10^{-19}\ J}$$

The energy required per mole is therefore:

$$\mathbf{\mathit{E} = 5.0 \times 10^{-19}\ J) \times (6.022 \times 10^{23}\ mol^{-1}) = 300\ kJ\ mol^{-1}}$$

Answer: **300 kJ mol^{-1}**