7.41)

(a), (b) $\frac{dN_1}{dt} = AN_2 + B'N_2 u(f) - BN_1 u(f) = 0.$

Divide through by N_1 and use $\frac{N_2}{N_1} = e^{-hf/kT}$ to get

$$A e^{-hf/kT} + B' u(f) e^{-hf/kT} - B u(f) = 0$$

Multiplying through by $e^{hf/kT}$ gives

$$A = u(f)\left(B e^{hf/kT} - B'\right) = \frac{\left(B e^{hf/kT} - B'\right)}{\left(e^{hf/kT} - 1\right)} \frac{8\pi h f^3}{c^3}$$

Since A, B, B' describe properties of the atom we should not expect dependence on temperature. This will happen if $B = B'$ in which case we get $A = B \cdot \frac{8\pi h f^3}{c^3}$, as needed.