An 12a) $I(\omega) = \frac{\hbar}{4\pi^2 c^2} \frac{\omega^3}{\left(e^{\hbar\omega/kT} - 1\right)}$

Now $W = \int_0^\infty I(\omega)\, d\omega$.

Change of variable. $\Rightarrow$ $\frac{\hbar\omega}{kT} = x$.

$\therefore \frac{\hbar\, d\omega}{kT} = dx$.

$d\omega = \left(\frac{kT}{\hbar} dx\right)$

$\omega^3 = \left(\frac{kT}{\hbar}\right)^3 x^3$.

Substituting we get

$$\int_0^\infty I(\omega)\, d\omega = \frac{\hbar (kT)^4}{4\pi^2 c^2 \hbar^3} \int_0^\infty \frac{x^3\, dx}{e^x - 1}$$

Proved.