$\boxed{13.1}$

$$\left.\begin{array}{l} T_2 = 502\,^\circ C \\ T_1 = 26\,^\circ C \end{array}\right\} \quad \Delta T = 476\,C^\circ$$

$L = 1.2\,m$

$r = 5.0 \times 10^{-3}\,m \longrightarrow A = \pi r^2 = \pi (5.0 \times 10^{-3}\,m)^2 = 7.854 \times 10^{-5}\,m^2$

$\Delta Q = ?$

$t = 5.0\,s$

$k_{iron} = 79\,\dfrac{J}{s\;\;m\,C^\circ}$

$$\therefore\ \Delta Q = \frac{k A \Delta T\, t}{L} = \frac{(79\,\frac{J}{s\;\;m\,C^\circ})(7.854 \times 10^{-5}\,m^2)(476\,C^\circ)(5.0\,s\;)}{1.2\,m} = \boxed{12\ J}$$

$\boxed{13.4}$

The heat ΔQ that is transfered by conduction is expressed by the equation

$$\Delta Q = \frac{k A \Delta T t}{L}$$

We can compare the heat lost through the wool jacket to that lost through the down in the form of the ratio

$$\frac{\Delta Q_w}{\Delta Q_d} = \frac{k_w A_w \Delta T_w t_w / L_w}{k_d A_d \Delta T_d t_d / L_d}$$

Because the areas, temperature differences and time intervals are the same (i.e. $A_w = A_d$, $\Delta T_w = \Delta T_d$ and $t_w = t_d$) this ratio reduces to

$$\frac{\Delta Q_w}{\Delta Q_d} = \frac{k_w / L_w}{k_d / L_d} = \left(\frac{k_w}{k_d}\right)\left(\frac{L_d}{L_w}\right) = \frac{(0.040 \text{ J/s m C°})}{(0.025 \text{ J/s m C°})} \frac{(15 \text{ mm})}{(5.0 \text{ mm})}$$

$$\frac{\Delta Q_w}{\Delta Q_d} = \boxed{4.8}$$

$\boxed{13.19}$

$T = 3000\,°C = 3273\,K$

$P = 60\,W$

$e = 0.36$

$A = ?$

Since $\Delta Q = e\sigma T^4 A t$ and power $P = \frac{\text{Energy}}{\text{time}}$

$$A = \frac{\Delta Q}{e\sigma T^4 t} = \frac{(\Delta Q/t)}{e\sigma T^4} = \frac{P}{e\sigma T^4}$$

$$\therefore A = \frac{60\,W}{(0.36)(5.67\times10^{-8}\,\frac{W}{m^2K^4})(3273\,K)^4} = \boxed{2.6\times10^{-5}\,m^2}$$

$\boxed{13.20}$

By definition, intensity equals power divided by area, or

$$I = \frac{P}{A}$$

So, $P = IA$ #1

Since the intensity of thermal radiation is

$I = e\sigma T^4$ #2,

eq 1 can be written as

$P = e\sigma T^4 A$ #3

We can use eq 3 to determine T:

$$T = \left[\frac{P}{e\sigma A}\right]^{1/4} \quad \#4$$

The area A is the area of the surface of the sun, a sphere of radius

$r = 6.96 \times 10^8 m.$

$A = 4\pi r^2 = 4\pi (6.96 \times 10^8 m)^2 = 6.087 \times 10^{18} m^2$

Since $P = 3.9 \times 10^{26} W$
and $e = 1$ (a black body)

eq 4 produces

$$T = \left[\frac{3.9 \times 10^{26} W}{(1)(5.67 \times 10^{-8} W/m^2 \cdot K^4)(6.087 \times 10^{18} m^2)}\right]^{1/4} = \boxed{5800 K}$$

$\boxed{13.27}$

$A = 1.6 m^2$
$L = 2.0 \times 10^{-3} m$
$T_1 = 11 °C$
$T_2 = 36 °C$
$t = 1.0 s.$
$k_{wool} = 0.040 \frac{J}{m C° s}$
$\Delta Q = ?$

$$\Delta Q = \frac{k A \Delta T t}{L} = \frac{(0.040 \frac{J}{m C° s})(1.6 m^2)(25 C°)(1.0 s)}{2.0 \times 10^{-3} m} = 800 J$$

Thus, the heat lost per second, $\frac{\Delta Q}{t} = \frac{800 J}{1.0 s.} = \boxed{800 \frac{J}{s}}$

$\boxed{13.31}$

$I = 560\ W/m^2$

Since $I = e\sigma T^4$

$T^4 = \dfrac{I}{e\sigma}$ or $T = \left(\dfrac{I}{e\sigma}\right)^{1/4}$

$$T = \left[\frac{560\ W/m^2}{(1)(5.67\times10^{-8}\ \frac{W}{m^2\,K^4})}\right]^{1/4} = (9.8765\times10^{9}\ K^4)^{1/4} = 3.1525\times10^{2}\ K$$

Rounded to two significant figures, $T = \boxed{320\ K}$