27.2 Using Wien's displacement law,

(a) $$\lambda_{max} = \frac{0.289\,8 \times 10^{-2}\ \text{m} \cdot \text{K}}{10^4\ \text{K}}$$

$$= 2.898 \times 10^{-7}\ \text{m}\ \boxed{\sim 100\ \text{nm}}\ \boxed{\text{Ultraviolet}}$$

(b) $$\lambda_{max} = \frac{0.289\,8 \times 10^{-2}\ \text{m} \cdot \text{K}}{10^7\ \text{K}} = 2.898 \times 10^{-10}\ \text{m}\ \boxed{\sim 10^{-1}\ \text{nm}}\ \boxed{\gamma\text{-rays}}$$

27.12 From Einstein's photoelectric effect equation,

$$e(\Delta V_s) = KE_{\max} = hf - \phi$$

Thus, $\phi = hf - e(\Delta V_s) = (6.63\times10^{-34}\ \text{J}\cdot\text{s})(3.0\times10^{15}\ \text{Hz})\left(\dfrac{1\ \text{eV}}{1.6\times10^{-19}\ \text{eV}}\right) - e(7.0\ \text{V})$

or $\phi = 12.4\ \text{eV} - 7.0\ \text{eV} = \boxed{5.4\ \text{eV}}$

27.13 From Einstein's photoelectric effect equation,

$$KE_{\max} = hf - \phi \qquad \text{or} \qquad KE_{\max} = \frac{hc}{\lambda} - \phi$$

Thus, $\lambda = \dfrac{hc}{KE_{\max} + \phi} = \dfrac{hc}{\frac{1}{2}m_e v_{\max}^2 + \phi}$

or $\lambda = \dfrac{(6.63\times10^{-34}\ \text{J}\cdot\text{s})(3.00\times10^{8}\ \text{m/s})}{\frac{1}{2}(9.11\times10^{-31}\ \text{kg})(1.00\times10^{6}\ \text{m/s})^2 + (2.46\ \text{eV})(1.60\times10^{-19}\ \text{J/eV})}$

$$\lambda = 2.34\times10^{-7}\ \text{m} = \boxed{234\ \text{nm}}$$

27.39 For relativistic particles, $p = \frac{\sqrt{E^2 - E_R^2}}{c}$ and $\lambda = \frac{h}{p} = \frac{hc}{\sqrt{E^2 - E_R^2}}$

For 3.00 MeV electrons, $E = KE + E_R = 3.00\text{ MeV} + 0.511\text{ MeV} = 3.51\text{ MeV}$

so $$\lambda = \frac{\left(6.63\times10^{-34}\text{ J}\cdot\text{s}\right)\left(3.00\times10^{8}\text{ m/s}\right)}{\sqrt{\left(3.51\text{ MeV}\right)^2 - \left(0.511\text{ MeV}\right)^2}}\left(\frac{1\text{ MeV}}{1.60\times10^{-13}\text{ J}}\right) = \boxed{3.58\times10^{-13}\text{ m}}$$