

Useful Constants and Conversions

$$1 \text{ atm} = 101.3 \text{ kPa and } 1 \text{ bar} = 10^5 \text{ Pa}$$

$$1 \text{ eV} = 1.602177 \times 10^{-19} \text{ J}$$

$$R = 8.31451 \text{ J/mol K} = 0.0820578 \text{ L atm/mol K} = 6.23640 \text{ L Torr/mol K}$$

$$k = 1.38066 \times 10^{-23} \text{ J/particle K}$$

$$h = 6.62608 \times 10^{-34} \text{ J s}$$

$$\hbar = h/2\pi = 1.05457 \times 10^{-34} \text{ J s}$$

$$N_o = 6.02214 \times 10^{23}/\text{mol}$$

$$u = 1.66054 \times 10^{-27} \text{ kg}$$

$$\sigma = 5.67051 \times 10^{-8} \text{ W/m}^2 \text{ K}^4$$

$$c = 2.99792458 \times 10^8 \text{ m/s}$$

$$m_e = 9.10939 \times 10^{-31} \text{ kg}$$

$$q = 1.602177 \times 10^{-19} \text{ C}$$

Useful Formula

$$v\lambda = c$$

$$\tilde{\nu} = 1/\lambda = v/c$$

$$E = hv = hc\tilde{\nu}$$

$$d\varepsilon = \rho d\lambda$$

$$\rho_{RJ} = \frac{8\pi kT}{\lambda^4}$$

$$\rho_{PD} = \frac{8\pi hc}{\lambda^5} (\exp(hc/\lambda kT) - 1)^{-1}$$

$$T\lambda_{max} = hc/5k$$

$$M = \sigma T^4$$

$$\bar{C}_v = 3RT$$

$$\bar{C}_v = 3Rf_E^2$$

$$\theta_E = hv/k$$

$$f_E = \frac{\theta_E}{T} \left(\frac{\exp(\theta_E/2T)}{\exp(\theta_E/T) - 1} \right)$$

$$T \gg \theta_E, f_E \approx 1$$

$$T \ll \theta_E, f \approx \theta_E \exp(-\theta_E/2T)/T$$

$$\bar{C}_v = 3Rf_D$$

$$\theta_D = hv_D/k$$

$$f_D = 3(T/\theta_D)^3 \int_0^{\theta_D/T} x^4 e^x / (e^x - 1)^2 dx$$

$$E_k = \frac{1}{2}mv^2$$

$$E_k = hv - \phi$$

$$\lambda = h/p$$

$$\lambda = h/\sqrt{2mE_k}$$

$$-\frac{\hbar^2}{2m} \nabla^2 \psi + V\psi = E\psi$$

$$H\psi = E\psi$$

$$1 = \int_{-\infty}^{\infty} \psi^2 dV$$

You may tear off and keep this page of the exam.