

$$1. a = \frac{GM}{R^2} = \frac{6.7 \times 10^{-11} \times 2 \times 10^{30}}{(7 \times 10^8)^2} = 273 \text{ m/s}^2$$

1040 ps # 2
answers
W. Cash 9/29/17

$$g = \frac{273}{9.8} = 28 \text{ gees}$$

$$g \propto \frac{1}{R^2} \rightarrow g_{\text{us}} = \left(\frac{10^4}{7 \times 10^9} \right)^2 \text{ gees} = 1.4 \times 10^{11} \text{ gees}$$

$$2. P_{\oplus} = 10^5 \text{ N/m}^2 = 10^5 \text{ J/m}^3 = 10^5 \times \frac{10^7 \text{ erg/J}}{10^6 \text{ cm}^3/\text{m}^3} = 10^6 \text{ erg/cm}^3$$

$$\frac{B^2}{8\pi} = 10^6 \Rightarrow B = 5000 \text{ Gauss}$$

$$3. D_{\odot} = 1.5 \times 10^{11} \text{ m} \quad 1 \text{ radian} = 206,265''$$

$$1 \text{ pc} = 1.5 \times 10^{11} \times 2 \times 10^5 = 3 \times 10^{16} \text{ m}$$

$$4. 10 \text{ pc} = 2 \times 10^6 \text{ AU} \quad L \propto \frac{1}{R^2}$$

$$\left(2 \times 10^6 \right)^2 \text{ fainter} = 4 \times 10^{12} = 4 \text{ trillion}$$

$$5. 0.1 \text{ \AA} \quad \lambda \nu = c \quad \nu = \frac{3 \times 10^8 \text{ m/s}}{10^{-11} \text{ m}} = 3 \times 10^{19} \text{ Hz}$$

$$E = h\nu = 6.6 \times 10^{-34} \times 3 \times 10^{19} = 2 \times 10^{-14} \text{ J}$$

$$6. \lambda = \frac{.0029 \text{ m}}{1} = \frac{3 \times 10^{-3}}{3 \times 10^4} = 10^{-7} \text{ m} = 100 \text{ nm}$$

$$7. L = \sigma AT^4 = 5.7 \times 10^{-8} \times 4\pi \times (7 \times 10^6)^2 \times 10^{16} \\ = 3.5 \times 10^{23} \text{ W} \quad L_{\text{WD}}/L_{\odot} = \frac{3.5 \times 10^{23}}{3.8 \times 10^{26}} \approx 10^{-3}$$

8. $\Delta \nu = 30,000 \text{ Hz}$

$$V = c \cdot \frac{\Delta \nu}{\nu} = 3 \times 10^8 \text{ m/s} \cdot \frac{30,000}{10^8} = 90,000 \text{ m/s}$$

90 km/s receding (lower frequency)

9. $D = \frac{1}{0.14} \text{ pc} = 7.1 \text{ pc} = 2.1 \times 10^{17} \text{ m} \rightarrow 4.2 \times 10^{17} \text{ m}$ round trip

$$T = 1.4 \times 10^9 \text{ s} = \frac{1.4 \times 10^9 \text{ s}}{3.15 \text{ s/yr}} = 45 \text{ years}$$