Gravitational Field Strength

① Since $g = \frac{GM}{r^2}$, g would **increase** as r decreases.

② Since $g = \frac{GM}{r^2}$, g would **increase** as M increased. (At twice the mass, g would double).

③ $g_e = \frac{GM_e}{r_e^2}$ $\qquad g_j = \frac{GM_j}{r_j^2}$

$$= \frac{G(300 M_e)}{(10 r_e)^2}$$

$$= \frac{300}{100} \frac{GM_e}{r_e^2}$$

$$g_j = 3 g_e$$

$$g_j = 3(9.8) = \boxed{29.4 \text{ N/Kg}}$$

④ $g = \frac{GM}{r^2} = \frac{(6.67\times10^{-11})(1.9\times10^{27})}{(7.2\times10^{7})^2}$

$$g = \boxed{24.4 \text{ N/Kg}}$$

(5) $M_m = \frac{M_e}{8}$ $\qquad r_m = \frac{r_e}{2}$

$$g_m = \frac{GM_m}{r_m^2} = \frac{G\left(\frac{M_e}{8}\right)}{\left(\frac{r_e}{2}\right)^2} = \frac{\frac{1}{8}}{\left(\frac{1}{2}\right)^2} \frac{GM_e}{r_e^2}$$

$$= 0.5 \; g_e$$

$$= 0.5\,(9.8)$$

$$g_m = \boxed{4.9 \text{ m/s}^2}$$

(6) $$g = \frac{GM}{r^2} = \frac{(6.67\times10^{-11})(5.67\times10^{26})}{(6.3\times10^{7})^2}$$

$$g = \boxed{9.5 \text{ m/s}^2}$$

$$F_g = mg = (60)(9.5) = \boxed{572 \text{ N}}$$

(7) a) $$g = \frac{GM}{r^2} = \frac{(6.67\times10^{-11})(4.83\times10^{24})}{(6.31\times10^{6})^2}$$

$$g = \boxed{8.09 \text{ m/s}^2}$$

b) $$g = \frac{GM}{r^2} = \frac{(6.67\times10^{-11})(6\times10^{23})}{(3\times10^{6})^2}$$

$$g = \boxed{4.45 \text{ m/s}^2}$$

⑦ c) $g = \frac{GM}{r^2} = \frac{(6.67\times10^{-11})(7.34\times10^{22})}{(1.74\times10^{6})^2}$

$$g = \boxed{1.62\ m/s^2}$$

⑧ a) $g = \frac{GM}{r^2} = \frac{(6.67\times10^{-11})(7\times10^{20})}{(500\ 000)^2}$

$$g = \boxed{0.19\ m/s^2}$$

b) $F_g = mg = (85)(0.19) = \boxed{15.9\ N}$