① $R = 6370\ km + 300\ km = 6670\ km = 6.67 \times 10^6\ m$

$$F = \frac{GmM}{R^2} = \frac{mv^2}{R}$$

$$v = \sqrt{\frac{GM}{R}} = 7727\ m/s$$

$$v = \frac{2\pi R}{T} \Rightarrow T = \frac{2\pi R}{v} = 5421\ s = 90.3\ min$$

②

$$F = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{R^2} = \frac{mv^2}{R} \qquad q_1 = q_2 = e$$

$$v = \sqrt{\frac{1}{4\pi\varepsilon_0}\frac{e^2}{mR}} = 2.19 \times 10^6\ m/s$$

$$T = \frac{2\pi R}{v} = 1.5 \times 10^{-16}\ s$$

③ (a) $F = \frac{GmM}{R^2} = \frac{(6.67\times10^{-11}\ N\cdot m^2/kg^2)(5.97\times10^{24}\ kg)(60\ kg)}{(6.37\times10^6\ m)^2} = 588.8\ N$

(b)

(c) $v = \frac{2\pi R}{T} = 463\ m/s \qquad \frac{v^2}{R} = 0.0334\ m/s^2$

(d) $mg - N = \frac{mv^2}{R} \Rightarrow N = mg - \frac{mv^2}{R}$

$= 588.8\ N - (60\ kg)(0.0334\ \frac{m}{s^2})$

$= 586.8\ N$