An astronomical object has its mass 4 times the mass of earth and radius half of the radius of earth. If acceleration due to gravity at earth is ***g***, find its value at the surface of the astronomical object.

Answer on Question#37374 – Physics - Astronomy

We have according to the Newton's law of gravity that the

$$g_{planet} = \frac{GM}{R^2}$$

$$M = 4M_e$$

$$R = \frac{1}{2}R_e$$

$$g = \frac{GM_e}{R_e^{\ 2}} = 9.8\frac{m}{s^2}$$

$$G = 6.67 \cdot 10^{-11}\frac{m^3}{kg \cdot s^2}$$

M_e is mass of the Earth, R_e is radius of Earth.

From hence, gravitational acceleration at surface of planet is

$$g_{planet} = \frac{4GM_e}{R_e^{\ 2}/4} = 16g = 156.8\frac{m}{s^2}$$

Answer:

$$g_{planet} = 16g = 156.8\frac{m}{s^2}$$