Worksheet 5.2 - Gravitational Field Strength

1) What is the weight of a 25.0 kg object near the surface of the earth?

\[ F_g = mg = (25.0 \text{ kg})(9.80 \text{ m/s}^2) = 245 \text{ N} \]

5) What is the mass of an object if it has a weight of 127 N near the earth’s surface?

\[ m = \frac{F_g}{g} = \frac{127 \text{ N}}{9.80 \text{ m/s}^2} = 13.0 \text{ kg} \]

2) What is the mass of an object if it has a weight of 80.0 N near the earth’s surface?

\[ m = \frac{F_g}{g} = \frac{80.0 \text{ N}}{9.80 \text{ m/s}^2} = 8.16 \text{ kg} \]

6) What is the gravitational field strength at a point 6.38 x 10^6 m above earth’s surface?

\[ q = \frac{GM}{r^2} = \frac{(6.67 \times 10^{-11})(5.98 \times 10^{24})}{(1.276 \times 10^7)^2} = 2.45 \text{ m/s}^2 \]

3) What is the acceleration due to gravity near the surface of the moon if an object that has a mass of 22.0 kg has a weight of 36.0 N near the moon’s surface?

\[ g = \frac{F_g}{m} = \frac{36.0 \text{ N}}{22.0 \text{ kg}} = 1.64 \text{ m/s}^2 \]

7) What is the acceleration due to gravity on the surface of the sun?

\[ r_{\text{sun}} = 6.96 \times 10^8 \text{ m} \]
\[ m_{\text{sun}} = 1.99 \times 10^{30} \text{ kg} \]

\[ q = \frac{GM}{r^2} = \frac{(6.67 \times 10^{-11})(1.99 \times 10^{30})}{(6.96 \times 10^8)^2} = 274 \text{ m/s}^2 \]

4) What is the weight of a 72.0 kg object near the surface of the Moon?

\[ F_g = mg = (72.0 \text{ kg})(1.64 \text{ m/s}^2) = 118 \text{ N} \]

8) The Earth orbits the Sun at a distance of 1.46 x 10^{11} m from center to center. What is the strength of the Sun’s gravitational field at this distance?

\[ q = \frac{GM}{r^2} = \frac{(6.67 \times 10^{-11})(1.99 \times 10^{30})}{(1.46 \times 10^{11})^2} = 0.622 \text{ m/s}^2 \]

1) 245 N 2) 8.16 kg 3) 1.64 m/s^2 4) 118 N 5) 13.0 kg 6) 2.45 m/s^2 7) 274 m/s^2 8) 0.622 m/s^2