

$$F_g = mg \quad F_g = \frac{Gm_1m_2}{r^2} \quad g = 9.80 \text{ m/s}^2 \text{ near the Earth.}$$

1. Geosynchronous satellites orbit the Earth once every 24 hours so that they remain fixed above one spot on the surface. These satellites are 42,000 km from the centre of the Earth. One of these satellites has a mass of 10,000 kg.

a) What does one of these satellites weigh on Earth?

b) What is the force of gravity on the satellite when it is orbiting the Earth?

c) What is the acceleration due to gravity 42,000 km from the centre of the Earth?

2. An 80 kg astronaut is in the Space Shuttle above the Earth. If the astronaut would weigh 720 N at this altitude, then find the altitude of the Shuttle. (**altitude** means the height above the surface, but the law of universal gravitation measures distance from the centre of the Earth. The radius of the Earth is  $6.38 \times 10^6$  m.)

3. A giant space slug weighs 420 N when it is far from the Earth. What is its weight when it is 50 times closer to the Earth?
4. The giant space slug in the question above has a weight of 5.4 N when it is 15,000,000,000 km from the centre of the Earth. What is its mass?
5. A 1972 Pontiac Satellite is launched into outer space. It has a weight of 12,000 N on Earth.
- a) What is the weight of the Satellite when it is 4 Earth radii from the centre of the Earth?
- b) What is the weight when the Satellite is 9 Earth radii above the surface of the Earth?
- c) What is the mass of the Satellite when it is 9 Earth radii above the surface of the Earth?