7.1 Newton’s law of gravitation

Objects with mass are attracted to each other. This is the force due to gravity.

(1) What two factors affect the size of this force?

Open the following simulation: https://tinyurl.com/ma8rw9x

Try changing the size of the two forces and their separation.

(2) How does the force on the two masses compare?

(3) Circle the correct statement:

The force of attraction between two objects is proportional/inversely proportional to the product of the masses and proportional/inversely proportional to the distance between the masses (squared).

(4) Now write a mathematical expression for the force of attraction between two masses.
Newton’s Law of Gravitation states that the force of attraction between two bodies with mass \( m_1 \) and \( m_2 \) is given by:

\[
F = G \frac{m_1 m_2}{r^2}
\]

where \( G \) = gravitational constant = \( 6.67 \times 10^{-11} \text{ m}^3 \text{kg}^{-1} \text{s}^{-2} \), and \( r \) = the distance between the centre of mass of the two masses.

(5) The mass of the Earth is \( 6 \times 10^{24} \text{ kg} \) and has a mean radius of 6400km. What is the force of gravitational attraction between you and the Earth, on the Earth’s surface? (Note: if you don’t know you mass, take it to be 70kg)

(6) What is the force of gravitational attraction between you and someone of the same mass standing 1m away from you?

(7) From the previous answer, what can you conclude about the magnitude of gravitational attraction?