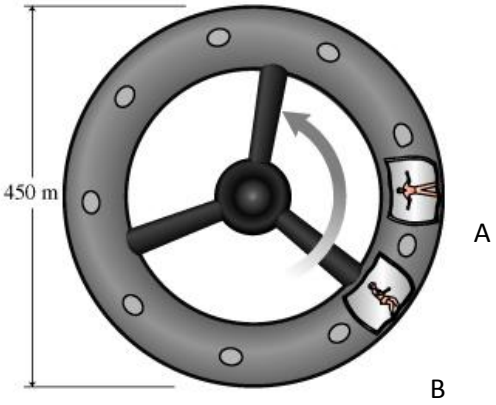
06 Circular motion and gravitation review questions

Part A Uniform Circular Motion.

1. A circular shaped space station has a 450m diameter and rotates to create an acceleration that results in a gravity like effect at its perimeter for the occupants.



   a. Add an arrow to show the direction of the force on person A.
   b. State the magnitude and direction of the acceleration at the perimeter in order to produce a gravitational effect equivalent to 0.5g.
   c. Calculate, for achieving this effect the….
      (i) Velocity at the edge
      (ii) the angular velocity
      (iii) the time taken to create angular displacement of π radians

Part B: Newton's Law of Gravitation

1. The gravitational field strength at the Earth's surface is g. g = 9.81 N/kg.
   a. How much does a 62.3kg person weigh on Earth?
   b. The radius of the Earth is 6,378,000 meters. What is Earth's mass?
2. At increased height above sea level reduces there is less gravitational field strength. At the top of Mount Everest the gravitational field strength is 9.76 N/kg.
   a. Estimate the height of Mount Everest.
   b. Explain how the rotation of the Earth affects measurements of g.
3.
   a. Calculate the average force of attraction between the Earth and the moon. [M_e = 6.0×10^{24} kg, M_m = 7.3×10^{22}kg, Average distance from the Earth to the Moon is 3.8×10^{8}m].
   b. Calculate the gravitational field strength at the surface of the moon (diameter 3500km).
   c. Calculate the gravitational field strength due to the moon and the Earth combined at a point Y. 3.8×10^{7}m from the moon in a direction directly towards the Earth.