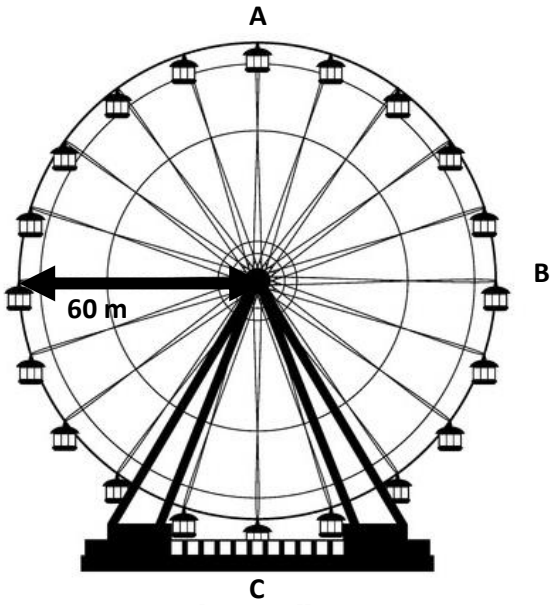
Year 13 Physics 2021

Worksheet 1- Mechanics

1. A schematic representation of a Ferris wheel is shown below. The wheel has a radius of 60 m and makes one rotation every 30 minutes.



(Source: https://dlpng.com/)

   a. Identify at which position A, B or C, the net force acting on the passenger sitting inside a capsule the greatest. Give a reason for your answer.
   b. Calculate the normal force acting on a 50 kg passenger sitting inside a capsule at position C.

2. A car travelling along a road approaches a bend. The bend is horizontally flat, with a circular arc and has a radius of 20 m. The car and the passengers have a combined mass of 700 kg. The force of kinetic friction between the tyres and the road is 9000 N.
   a. Determine the maximum speed at which the car can travel around the bend.
   b. Explain with some calculations why motorists are advised to travel at slower speeds in wet weather.
   c. For safety reasons bends in roads are banked towards the inside of the turn, such that the flat road surface forms an angle to the horizontal. If the road bend in part (a) was banked at 5°, describe with calculations how this increases the maximum speed at the turn so that it can be successfully travelled.

3. Use the law of conservation of energy to show that the escape velocity of an object is independent of its mass.

4. An experiment was performed with a pendulum 40 cm long, which had a period of 1.2 s.
   a. Calculate the value for gravitational acceleration, g at this location.
   b. Calculate the radius of the earth at this location.