Circular Motion Design Problem

**Warm Up Question:**

Use the roller coaster diagrams below to indicate which features correspond with the following scenarios (circle all correct answers)

Can result in riders feeling lighter than usual (Low Normal Reaction Force) A B C

Can result in riders feeling heavier than usual (High Normal Reaction Force) A B C

A picture containing text, athletic game, sport

Description automatically generated

**Design problem:**

You are hired by an amusement park to create a roller coaster inspired by a non-Earth planet in the solar system. As part of the ride, you decide to design a feature (like those in the previous problem) allowing riders to experience an apparent weight matching their weight on this planet.

Planet (circle one)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Mercury** | **Venus** | **Mars** | **Jupiter** | **Saturn** | **Uranus** | **Neptune** |
| **Mercury | The Solar System Wiki | Fandom** | **Venus | The Solar System Wiki | Fandom** | **Mars | The Solar System Wiki | Fandom** | **Jupiter | The Solar System Wiki | Fandom** | **Saturn | The Solar System Wiki | Fandom** | **Uranus Facts | Rotation, Rings, Atmosphere, Size, History & Definition** | **Neptune Facts | Temperature, Surface, Information, History & Definition** |
| g = 3.59 m/s2 | g = 8.87 m/s2 | g = 3.77 m/s2 | g = 25.95 m/s2 | g = 11.08 m/s2 | g = 10.67 m/s2 | g = 14.07 m/s2 |

Rider Statistics:

|  |  |
| --- | --- |
| Mass | 75 kg |
| Weight on Earth |  |
| Weight on Planet |  |

A picture containing text, athletic game, sport

Description automatically generatedRide Design:

Design a roller coaster feature that (when built on earth) results in an apparent weight (normal reaction force) that matches the weight of the rider on the theme planet.

Circle the feature that you plan on designing →

|  |  |  |
| --- | --- | --- |
| **Property** | **Range to Choose From** | **Selected/Calculated Values** |
| Linear Velocity | 1 m/s - 30 m/s |  |
| Radius of Feature | 1 m - 20 m |  |

Draw a free body diagram and show all work below. Write final design values that result in the desired outcome in the table above