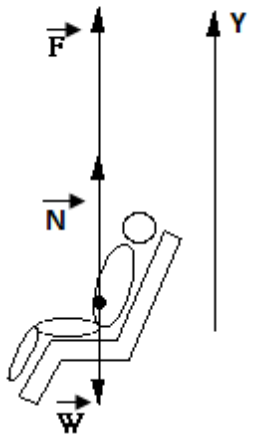
Answer on Question #61702-Physics-Mechanics

What is the effective weight of a person of mass 60 kg carried vertically up in a rocket with an acceleration of 2g? Draw a properly labeled free-body diagram.

Solution



Write Newton's second law in the vector form

$$\vec{F} = \vec{N} + \vec{W}$$

The equation will look like in the projection on the axis of +Y

$$ma = N - mg$$

$$N = ma + mg$$

Where, a= 2g

$$N = 2mg + mg$$

Finally,

$$N = 3mg = 3 \cdot 60\ kg \cdot 9.8 \frac{m}{s^2} = 1764\ N$$

Answer: 1764 N.

b) An aeroplane flies due east along the equator with a speed of 300 ms−1. Determine the magnitude and direction of the Coriolis acceleration.

Solution

The Coriolis acceleration is

$$\boldsymbol{a_C} = 2\,\boldsymbol{\Omega} \times \boldsymbol{v}$$

Where

$$\Omega = \frac{2\pi}{24 \cdot 60 \cdot 60}.$$

The magnitude is

$$a_C = 2\frac{2\pi}{24 \cdot 60 \cdot 60} 300 \sin 90 = 0.044 \frac{m}{s^2}.$$

The direction is towards the center of Earth.