Q1- An airplane has a mass of 3.1 x 10^4 kg and takes off under the influence of a constant net force of 3.7x10^4 N. What is the net force that acts on the plane's 78kg pilot?

Answer:

The acceleration of the airplane is given by using Newton's second law of motion. The force acting is F = 3.7*10^4 N, mass of the plane M = 3.1*10^4 kg and hence its acceleration is given by

$$a = F/M = (3.7*10^4)/(3.1*10^4) = 1.194 \text{ m/s}^2.$$

Now as the pilot is in the plane and will have same acceleration, the resultant (net) force on the pilot is given by the same equation as

$$F_p = m*a$$

Here m is the mass of the pilot.

Gives $F_p = 78*1.194 = 93.1$ N.

Q2- In the amusement park ride known as Magic, powerful magnets accelerate a car and it's riders from rest to 45 m/s in 7 seconds. The mass of the car and riders is 5.5x10^3 kg. Find the average net force exerted on the car and riders by the magnets?

Answer:

The acceleration of the car can be calculated using first equation of motion

$$v = u + a*t$$

Initial velocity of the car u = 0
Final velocity of the car v = 45 m/s
Time interval t = 7 s.

Substituting in equation of motion we have

$$45 = 0 + a*7$$

or $a = 45/7 = 6.428 \text{ m/s}^2$

Now according Newton's law of motion

$$F = m*a = 5.5*10^3*6.428 = 35354.0 \text{ N}$$

Hence the average force on the car and the riders is 35354 N.
