Question # 79719

A man of mass 80 kg is travelling in a lift which is moving upwards. If the lift comes to rest from a velocity of 2 m/s in a 2 seconds, find the force exerted by the man on the lift floor if the deceleration is constant. What would be the reaction if the lift were travelling downwards?

Answer:

According to Newton's Second Law the force *F* exerted by the man on the lift floor is given by

$$F = m(g - a), \tag{1}$$

where m = 80 kg – the mass of the man,

g = 9.81 m/s^2 – the acceleration due to gravity,

a – the constant upward deceleration of the man, which is given by

$$a = \frac{\Delta u}{t}, \tag{2}$$

where Δu = 2 m/s – the change in the velocity of the man,

t = 2 s – the time of change of the velocity.

Substitute into (2) and (1):

$$a = \frac{2}{2} = 1 \text{ m/s}^2,$$

$$F = 80 \cdot (9.81 - 1) = 704.8 \text{ N}.$$

In case of lift travelling downward, the direction of the deceleration changes resulting in transformation of (1) to form

$$F = m(g + a), \tag{3}$$

Substitute into (3) to obtain the force exerted by the man on the lift floor when lift moves downward

$$F = 80 \cdot (9.81 + 1) = 864.8 \text{ N}.$$