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Lifts

(Haf 2006)

1. A lift, starting from rest, descends with a uniform acceleration of 3 ms^{-2} until it reaches a speed of 9 ms^{-1}. It then travels at a constant speed of 9 ms^{-1} for a short time and finally, it is brought to rest with a uniform retardation of 2 ms^{-2}. An object, of mass 6 kg, is on the floor of the lift. Calculate the magnitude of the reaction of the floor on the object during each of the three stages of the motion. [5]

(Gaeaf 2007)

3. The mass of a lift is 5600 kg. The lift starts from rest and descends with uniform acceleration for 8 s until it reaches a speed of V ms^{-1}. The tension in the lift cable is 50 400 N.

(a) Show that the magnitude of the acceleration of the lift is 0·8 ms^{-2}. [2]

(b) Find the value of V. [2]

The lift maintains this constant speed of V ms^{-1} for 25 s before decelerating uniformly to rest. The **total** time for descent is 40 s.

(c) Draw a sketch of the velocity-time graph of the motion. [3]

(d) Calculate the total distance that the lift descends. [3]

(e) Find the maximum tension in the lift cable during the motion. [3]

(Gaeaf 2008)

4. A parcel is on the floor of a lift which is ascending with acceleration 0·8 ms^{-2}. The mass of the parcel is 20 kg and the mass of the lift is 700 kg.

(a) Calculate the tension in the lift cable. [3]

(b) Find the reaction of the floor of the lift on the parcel. [3]

(Haf 2008)

3. The mass of a lift is 430 kg. When a man, of mass 70 kg, is standing in the lift and the tension in the cable is 4800 N, the lift is descending with acceleration a ms^{-2}.

(a) Find the value of a. [3]

(b) Determine the reaction of the floor of the lift on the man. [3]

(Gaeaf 2009)

3. A crate, of mass 15 kg, is placed on the floor of a lift. Calculate, in newtons, the magnitude of the reaction of the floor on the crate,

(a) when the lift is descending with a retardation of $2\,\text{ms}^{-2}$, [3]

(b) when the lift is ascending at a constant speed of $3\,\text{ms}^{-1}$, [1]

(Haf 2009)

3. A person of mass 65 kg is standing on the floor of a lift of mass 835 kg. The lift is descending with acceleration $a\ \text{ms}^{-2}$. The tension in the lift cable is 8550 N.

(a) Calculate the value of a. [3]

(b) Find the reaction of the floor on the person. [3]

(Gaeaf 2010)

2. A lift is pulled upwards by means of a vertical cable. Initially, the lift is at rest. It then accelerates until it reaches a maximum speed. The lift moves at this maximum speed before decelerating uniformly at $3\,\text{ms}^{-2}$ to rest. The total mass of the lift and its contents is 360 kg.

(a) Calculate the tension in the lift cable

(i) when the lift is decelerating,
(ii) when the lift is moving at its maximum speed. [4]

A crate on the floor of the lift has a mass of 25 kg. When the lift is accelerating the reaction between the crate and the floor of the lift is 280 N.

(b) Find the magnitude of the acceleration of the lift. [3]

(Haf 2010)

2. An express lift in a skyscraper travels non-stop from the ground floor to the top floor. For the first 15 s of its journey, the lift accelerates uniformly from rest. It then travels at a constant speed of $2{\cdot}7\ \text{ms}^{-1}$ for 90 s before finally decelerating uniformly to rest. The total time for the journey is 2 minutes.

(a) Sketch a velocity-time graph for the motion of the lift. [3]

(b) Calculate the distance travelled by the lift. [3]

A woman, of mass 75 kg, is standing on the floor of the lift during its journey.

(c) Calculate the reaction exerted by the floor of the lift on the woman when the lift is accelerating. [4]

(Gaeaf 2011)

2. A crate, of mass 80 kg, lies on the floor of a lift. Find the reaction of the floor of the lift on the crate when

(a) the lift is moving down with acceleration $0{\cdot}3\,\text{ms}^{-2}$, [3]

(b) the lift is moving up with acceleration $0{\cdot}2\,\text{ms}^{-2}$, [3]

(c) the lift is moving up with constant speed. [1]

(Haf 2011)

2. A person, of mass 60 kg, is standing in a lift, which is of mass 540 kg. When the lift is accelerating upwards at a constant rate of $a\,\text{ms}^{-2}$, the tension in the lift cable is 6600 N.

(a) Calculate the value of a. [3]

(b) Find the reaction between the person and the floor of the lift. [3]

(Gaeaf 2012)

1. A lift is moving upwards. It accelerates from rest with uniform acceleration $0{\cdot}4\,\text{ms}^{-2}$ until it reaches a speed of $2\,\text{ms}^{-1}$. It then travels at this constant speed of $2\,\text{ms}^{-1}$ for 17 s before decelerating uniformly to rest in 8 s.

(a) Calculate the time taken for the lift to reach the speed of $2\,\text{ms}^{-1}$. [3]

(b) Sketch a velocity-time graph for the lift's journey. [3]

(c) Find the distance travelled by the lift during the journey. [3]

(d) A man, of mass 70 kg, is standing in the lift during its journey.
Calculate the greatest value of the reaction exerted by the floor of the lift on the man during the journey. [4]

(Haf 2012)

1. A lift of mass 2500 kg is ascending with an acceleration of $1{\cdot}8\,\text{ms}^{-2}$.

(a) Calculate the tension in the lift cable. [3]

(b) A person of mass M kg stands on the floor of the lift. Given that the magnitude of the reaction of the floor of the lift on the person is 696 N, find the value of M. [3]

(Gaeaf 2013)

6. A parcel of mass 25 kg is on the floor of a lift, which is descending with an acceleration of $a\,\text{ms}^{-2}$. The mass of the lift is 775 kg.

(a) Given that the tension in the lift cable is 6500 N, calculate the value of a. [3]

(b) Find the magnitude of the reaction of the floor of the lift on the parcel. [3]

(Haf 2013)

2. A person of mass 64 kg is standing in a lift which is of mass M kg. When the lift is accelerating downwards at a constant rate of $0{\cdot}425\,\text{ms}^{-2}$, the tension in the lift cable is 7500 N.

(a) Calculate the value of M. [3]

(b) Find the reaction between the person and the floor of the lift. [3]

(Gaeaf 2014)

3. A man of mass 65 kg stands in a lift which is ascending with acceleration $1{\cdot}2\,\text{ms}^{-2}$. Find the magnitude of the reaction of the floor of the lift on the man. [3]

(Haf 2014)

1. A crate of mass 25 kg rests on the floor of a lift, which is descending. Find the reaction of the floor of the lift on the crate when

(a) the acceleration of the lift is $1{\cdot}2\,\text{ms}^{-2}$, [3]

(b) the velocity of the lift is constant. [1]

(Haf 2015)

1. A man of mass M kg stands on the floor of a lift which is ascending with constant acceleration of $0{\cdot}2\,\text{ms}^{-2}$. The reaction of the floor of the lift on the man is 680 N. The mass of the lift is 1800 kg. Determine the value of M and the tension in the lift cable. [6]

(Haf 2016)

1. A lift, starting from rest, descends with a uniform acceleration of $3{\cdot}2\,\text{ms}^{-2}$ until it reaches a speed of $12\,\text{ms}^{-1}$. It then travels at a constant speed of $12\,\text{ms}^{-1}$ for a short time and finally, it is brought to rest with a uniform deceleration of $2{\cdot}4\,\text{ms}^{-2}$. A person of mass 65 kg is standing in the lift. Calculate the magnitude of the reaction of the floor of the lift on the person during each of the three stages of the motion. [5]

(Haf 2017)

1. *(a)* When a lift is ascending with an acceleration of $a\,\text{ms}^{-2}$, the tension in the lift cable is 15000 N. The total mass of the lift and its contents is 1200 kg. Determine the value of a. [3]

(b) A crate on the floor of another lift has mass 50 kg. The lift is descending with an acceleration of $0{\cdot}2\,\text{ms}^{-2}$. Find the magnitude of the reaction of the floor on the crate. [3]

(Haf 2018)

1. *(a)* A lift, of mass 1200 kg, is moving upwards. Find the tension in the lift cable when the lift is moving with

(i) an acceleration of $2\,\text{ms}^{-2}$,

(ii) constant speed. [4]

(b) A person of mass M kg stands in a lift which is moving downwards with an acceleration of $3\,\text{ms}^{-2}$. The reaction of the floor of the lift on the person is 442 N. Determine the value of M. [3]