

LIFTS

AS Unit 2: Applied Mathematics A

Section B: Mechanics

WJEC past paper questions

Total marks available 85 (approximately 1 hour 45 minutes)

1. 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 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)

(January 10)

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 2.7 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)

(Summer 10)

3. A crate, of mass 80kg, 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 0.3 ms^{-2} , (3)
 - b) the lift is moving up with acceleration 0.2 ms^{-2} , (3)
 - c) the lift is moving up with constant speed. (1)

(January 11)

4. 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)

(Summer 11)

5. A lift is moving upwards. It accelerates from rest with uniform acceleration 0.4 ms^{-2} until it reaches a speed of 2 ms^{-1} . It then travels at this constant speed of 2 ms^{-1} for 17 s before decelerating uniformly to rest in 8 s.
- Calculate the time taken for the lift to reach the speed of 2 ms^{-1} . (3)
 - Sketch a velocity-time graph for the lift's journey. (3)
 - Find the distance travelled by the lift during the journey. (3)
 - 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)
- (January 12)
6. A lift of mass 2500 kg is ascending with an acceleration of 1.8 ms^{-2} .
- Calculate the tension in the lift cable. (3)
 - 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)
- (Summer 12)
7. 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.
- Given that the tension in the lift cable is 6500 N, calculate the value of a . (3)
 - Find the magnitude of the reaction of the floor of the lift on the parcel. (3)
- (January 13)
8. 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 0.425 ms^{-2} , the tension in the lift cable is 7500 N.
- Calculate the value of M . (3)
 - Find the reaction between the person and the floor of the lift. (3)
- (Summer 13)
9. A man of mass 65 kg stands in a lift which is ascending with acceleration 1.2 ms^{-2} . Find the magnitude of the reaction of the floor of the lift on the man. (3)
- (January 14)
10. A crate of mass 25kg rests on the floor of a lift, which is descending. Find the reaction of the floor of the lift on the crate when
- the acceleration of the lift is 1.2 ms^{-2} , (3)
 - the velocity of the lift is constant. (1)
- (Summer 14)
11. A man of mass M kg stands on the floor of a lift which is ascending with constant acceleration 0.2 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)
- (Summer 15)

12. A lift starting from rest, descends with a uniform acceleration of 3.2 ms^{-2} until it reaches a speed of 12 ms^{-1} . It then travels at a constant speed of 12 ms^{-1} for a short time and finally, it is brought to rest with a uniform deceleration of 2.4 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 motion. (5)
(Summer 16)
13. a) When a lift is ascending with an acceleration of $a \text{ ms}^{-2}$, the tension in the lift cable is $15\,000 \text{ N}$. 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 0.2 ms^{-2} . Find the magnitude of the reaction of the floor on the crate. (3)
(Summer 17)