physics UK
Smarter practice. Stronger understanding
WORKSHEETS
ATTEMPT CHECK CORRECT IMPROVE

Dynamics and the loaded lift worksheet

AQA AS 7407 and first-year A Level 7408 | OCR A AS H156 and A Level H556

35–40 minutes independent practice + 15–20 minutes review | 30 marks

Specification points covered

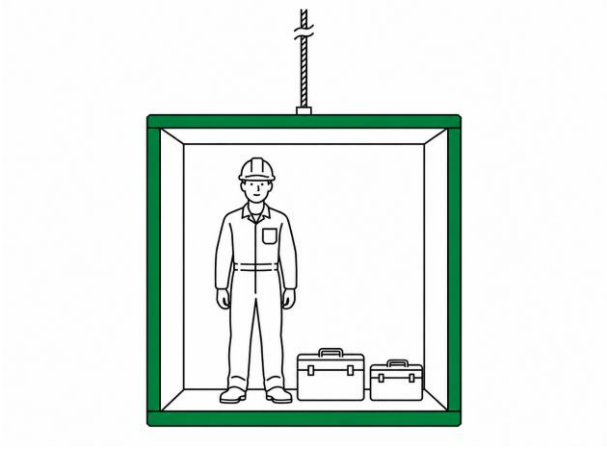
AQA 7407 / 7408: 3.4.1.1 selected force balance and equilibrium; 3.4.1.5 selected Newton's second law and constant-mass resultant-force calculations.
OCR A H156 / H556: 3.2.1(a), (b), (c), (d) tension only, (e), (f) one-dimensional constant-force motion only. Upthrust, friction and two-dimensional motion are not assessed here.

Main scenario

At a coastal monitoring centre, a 680 kg lift car carries a 75.0 kg technician and 45.0 kg of instrument cases to a rooftop laboratory. One vertical cable supports the car and its contents.

Model the car and contents as one system. Upwards is positive; g = 9.81 m s^{-2}. Neglect air resistance, guide friction and cable mass. Each given tension is constant during its stated interval.

1. Initial journey: lift car and cable



1. Define one newton. [1 mark]

2. Calculate the total mass of the lift car, technician and instrument cases. [1 mark]

Continue your physics journey
Videos, practice and support for your next step
www.physicsuk.co.uk

1. Initial journey: lift car and cable continued

3. In the blank space below, draw a free-body diagram for the combined system of the lift car and all its contents. Ignore air resistance and guide friction. Label all external forces on this system. [2 marks]

4. Calculate the weight of the loaded lift car. [1 mark]

5. The cable tension is 8400 N. Calculate the resultant force on the lift car. State its direction. [1 mark]

6. Use your answer to question 5 to calculate the acceleration of the lift car. [1 mark]

7. The cable tension is adjusted so that it equals the weight of the lift car. The lift is moving upwards. Describe its subsequent motion and explain your answer. [2 marks]

8. The cable tension is reduced to 7000 N. Calculate the acceleration of the lift car. State its direction. [2 marks]

9. The lift is still moving upwards when the cable tension is 7000 N. State how its speed changes. Use precise scientific language. [1 mark]

Continue your physics journey
Videos, practice and support for your next step
www.physicsuk.co.uk

2. Heavier lift load

New condition

Two further instrument cases, with a combined mass of 90.0 kg, are loaded into the lift. For questions 10-17, use the new total mass.

10. Two further instrument cases, with a combined mass of 90.0 kg, are added. Calculate (i) the new total mass and (ii) the new weight of the lift car and its load. [2 marks]

11. Calculate the cable tension required to accelerate the loaded lift car upwards at 0.850 m s^{-2}. [2 marks]

12. The cable has a safe maximum tension of 1.02×10^4 N. Determine whether it can accelerate the loaded lift car upwards at 1.80 m s^{-2}. Show your reasoning. [3 marks]

13. A pupil writes, 'The cable tension is 9.49×10^3 N, so this is the resultant force.' Explain why this is not correct. [2 marks]

Continue your physics journey

Videos, practice and support for your next step

www.physicsuk.co.uk

3. Return journey

New condition

The loaded lift car now travels downwards from the rooftop laboratory. Continue to identify the direction of the resultant force before applying F = ma.

14. The loaded lift car descends at constant velocity. Calculate the cable tension. [1 mark]

15. While the loaded lift car is descending, the cable tension is 9.20×10^3 N. Calculate its acceleration. State how its speed changes. [3 marks]

16. While the loaded lift car is descending, the cable tension is 7.60×10^3 N. Calculate its acceleration. State how its speed changes. [3 marks]

17. A pupil writes, “The velocity is accelerating upwards” for the situation in question 15. Rewrite the statement correctly, describing acceleration and the change in signed velocity or speed. [2 marks]

Review and improve

□ I can identify a resultant force before using F = ma.
□ I can distinguish weight, tension and resultant force.
□ I can describe velocity and acceleration using precise scientific language.

Continue your physics journey

Videos, practice and support for your next step

www.physicsuk.co.uk