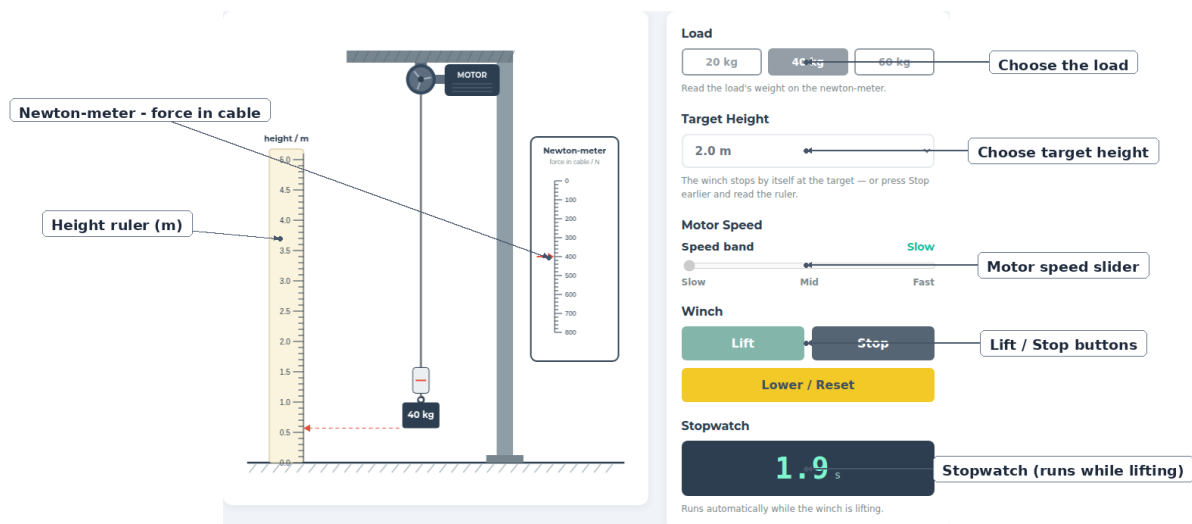


Power

Work Done and Power of an Electric Winch

Aim:

You are investigating whether lifting faster changes the work done, the power, or both.



Prediction:

Lifting the same load to the same height on Fast instead of Slow. Do you predict the work done will change? Do you predict the power will change?

Work done: Power:

Test it in the simulation.

Method:

1. Choose the 60 kg load, a target height of 3.0 m and the Mid speed band. Press Lift, and when the winch stops record the weight F , the height d and the time t in your table.
2. Press Lower / Reset. Keep the same load and target height, but set the speed to Slow. Lift again and record a second row.
3. Press Lower / Reset. Keep the same load and target height, but set the speed to Fast. Lift again and record a third row.
4. Keep the speed on Mid. Choose a different load, lift it to the same target height, and record a row.
5. Keep the load and speed on Mid. Choose a different target height, lift, and record a row.
6. Search for a pair of lifts with the same power but different work done — try different combinations of load, height and speed. Record both rows once you find a pair.
7. Away from the screen, calculate the work done $W = F \times d$ and the power $P = W \div t$ for every row and fill in the last two columns.

Results:

Weight, F (N)	Height, d (m)	Time, t (s)	Work done, W (J)	Power, P (W)

Analysis:

Compare your first three rows (same load and height, different speeds). Which readings changed, and which stayed exactly the same?

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Did lifting more slowly change the work done? Using your rows with different loads and heights, which two quantities does the work done depend on, and which quantity does it ignore completely?

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Compare the three times and the three powers from your Slow/Mid/Fast rows. What pattern links time and power?

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Look at the pair of rows you found with the same power but different work done. How are their times related to their work done values?

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Explaining why:

Work done, W (J) = force, F (N) $\times$ distance moved, d (m)

Power, P (W) = work done, W (J) $\div$ time taken, t (s)

Two winches do the same job — same load, same height — but one takes twice as long. Use your table to decide which is more powerful, and say what "more powerful" means here.

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In one sentence, using your own results, what does power tell you that work done alone cannot?

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