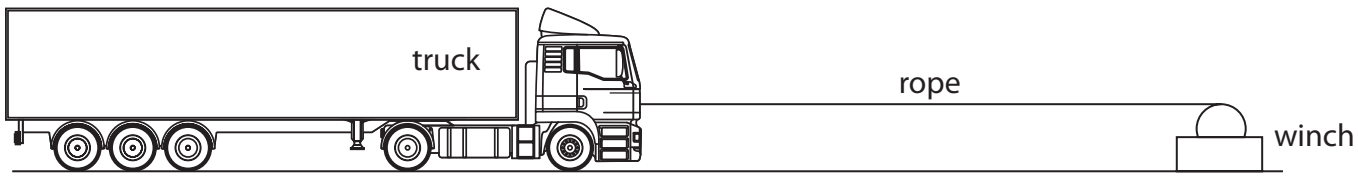
3 A winch is used to pull a truck along a horizontal road.

The winch is connected to the truck by a thick rope.



(Source: © A. Bizgaimer/Shutterstock)

(a) The winch does 41 kJ of useful work on the truck when the truck is pulled a horizontal distance of 15 m.

(i) State the formula linking work done, force and distance moved in the direction of the force.

(1)

(ii) Calculate the force that the rope exerts on the truck.

(3)

force = ... N

(b) The winch includes a small engine. The engine burns petrol to power the motor in the winch.

The winch transfers energy mechanically to the truck.

(i) The winch has an efficiency of 25% when pulling the truck.

Draw a Sankey diagram for this energy transfer.

(3)

(ii) The winch can also be used to pull the truck uphill at a constant speed.

The table gives some energy stores.

Add one tick (✓) to each row to show what happens to the energy in each store as the truck is pulled uphill.

(4)

Energy store	Decreases	Increases	Stays the same
chemical store of petrol in winch			
gravitational store of truck			
kinetic store of truck			
thermal store of surroundings			

(Total for Question 3 = 11 marks)

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