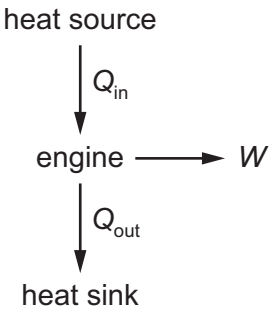
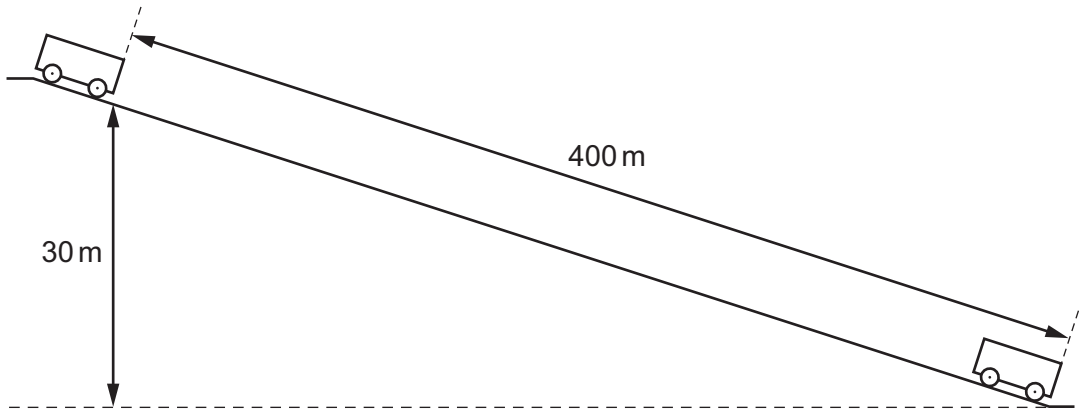
18 An engine transforms thermal energy into mechanical work. The engine takes in thermal energy Q_{in} from a heat source and gives out thermal energy Q_{out} to a heat sink, producing useful work W.



What is the efficiency of this engine?

A $\frac{W}{Q_{in} + Q_{out}}$ **B** $\frac{W}{Q_{in} - Q_{out}}$ **C** $\frac{W}{Q_{in}}$ **D** $\frac{W}{Q_{out}}$

19 A truck of mass 500 kg moves from rest at the top of a section of track 400 m long and 30 m high, as shown. The frictional force acting on the truck is 250 N throughout its journey.



What is the final speed of the truck?

A $14\,m\,s^{-1}$ **B** $24\,m\,s^{-1}$ **C** $31\,m\,s^{-1}$ **D** $190\,m\,s^{-1}$

20 Which condition must apply for the work done by an expanding gas to be $p\Delta V$, where p is the pressure of the gas and ΔV is its change in volume?

A No thermal energy must be supplied to the gas.

B The expansion must be at a constant rate.

C The pressure must be constant.

D The temperature of the gas must be constant.