

Teacher notes

Topic A

A question inspired by the M2026 exam

A car has kinetic energy K at the bottom of a hill. The car drives up the hill and when it gets to the top its gravitational potential energy has increased by an amount U .

- (a) The total work done on the car by all the forces on the car is W .
- (b) The work done by the engine force pushing the car is W .

What is the kinetic energy of the car at the top of the hill in each case?

- A** K
- B** $K - U$
- C** $K + W$
- D** $K + W - U$

(a) Here we use $W_{\text{net}} = \Delta E_K$. We have been told that $W = W_{\text{net}}$ and so right away $W = K_{\text{top}} - K$ and so $K_{\text{top}} = K + W$, answer C.

(b) Here we use $W_{\text{ext}} = \Delta E_{\text{total}}$. The only external (strictly non-conservative) force is the engine force and so $W = W_{\text{ext}}$. Hence $W = K_{\text{top}} + U - K$ and so $K_{\text{top}} = K + W - U$, answer D.

The point is that one must always be careful with what work we are talking about.