

Lesson 3a - Work Done

Physics - KS3

Forces in Action

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Work Done

Work done is the amount of energy transferred when a force causes an object to move.

See video for diagram

Work done and energy transferred are both measured in Joules (J)



Work Done

See video for diagram

Exerts a force

Energy is transferred

Work is done



Pause the video to complete your task

Fill in the gaps

Work done is the amount of _____ transferred when a _____ causes an object to move.

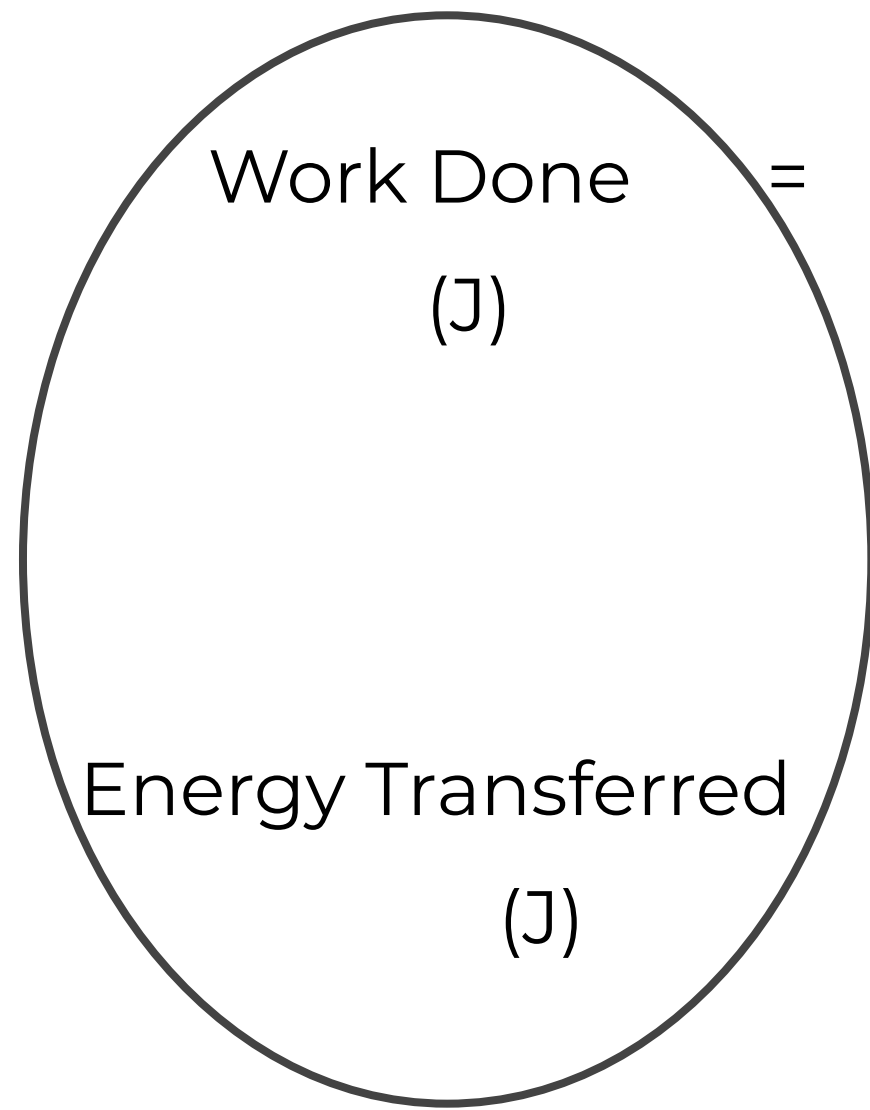
Work done and energy transferred are both measured in _____



$$\begin{array}{ccccccc} \text{Work Done} & = & \text{Force} & \times & \text{distance} \\ (\text{J}) & & (\text{N}) & & (\text{m}) \end{array}$$

$$\begin{array}{ccccccc} \text{Energy Transferred} & = & \text{Force} & \times & \text{distance} \\ (\text{J}) & & (\text{N}) & & (\text{m}) \end{array}$$





Work Done (J) = Force (N) x distance (m)

Energy Transferred (J) = Force (N) x distance (m)



$$\begin{array}{ccccc} \text{Work Done or} & = & \text{Force} & \times & \text{distance} \\ \text{Energy Transferred} & & & & \\ (\text{J}) & & (\text{N}) & & (\text{m}) \end{array}$$

What is the work done when the box is pushed 5 m by a force of 60 N?

See video for diagram

$$\text{Work Done} = \text{Force} \times \text{Distance}$$

$$\text{Work Done} = 60 \times 5$$

$$\text{Work Done} = 300 \text{ J}$$

What would the energy transferred be? 300J



$$\begin{array}{ccccc} \text{Work Done or} & = & \text{Force} & \times & \text{distance} \\ \text{Energy Transferred} & & & & \\ \text{(J)} & & \text{(N)} & & \text{(m)} \end{array}$$

See video for diagram

The climber climbs to the top of the cliff. She weighs 660N. Calculate the work done against gravity to climb to the top.



What is the unit of Work done?

Option 1

Metre (m)

Option 2

Joules (J)

Option 3

Newton (N)

Option 4

Centimetre (cm)



What is the unit of Energy transferred?

Option 1

Metre (m)

Option 2

Joules (J)

Option 3

Newton (N)

Option 4

Centimetre (cm)



What is the unit of distance we use in this equation?

Option 1

Metre (m)

Option 2

Joules (J)

Option 3

Newton (N)

Option 4

Centimetre (cm)



What is the unit of Force?

Option 1

Metre (m)

Option 3

Newton (N)

Option 2

Joules (J)

Option 4

Centimetre (cm)



$$\begin{array}{ccccc} \text{Work Done or} & = & \text{Force} & \times & \text{distance} \\ \text{Energy Transferred} & & & & \\ (\text{J}) & & (\text{N}) & & (\text{m}) \end{array}$$

Your Turn:

A car is dragged 5.7 m over flat ground. It is pulled by a force of 360 N.

- a) What is the work done?
- b) What is the energy transferred?



$$\begin{array}{ccccc} \text{Work Done or} & = & \text{Force} & \times & \text{distance} \\ \text{Energy Transferred} & & & & \\ (\text{J}) & & (\text{N}) & & (\text{m}) \end{array}$$

500 J is transferred to the box when it is pushed 25m.
What is the force on the box while it is pushed?

See video for diagram

Energy transferred = Force x distance

$$500 \div 25 = \text{Force} \times 25 \div 25$$

$$20 = \text{Force}$$

$$\text{Force} = 20 \text{ N}$$



$$\begin{array}{ccccc} \text{Work Done or} & = & \text{Force} & \times & \text{distance} \\ \text{Energy Transferred} & & & & \\ (\text{J}) & & (\text{N}) & & (\text{m}) \end{array}$$

Your Turn:

A toy car is dragged for 10 m. The work done is 450 J. What is the force on the car?

Work Done = Force x distance



$$\begin{array}{ccccc} \text{Work Done or} & = & \text{Force} & \times & \text{distance} \\ \text{Energy Transferred} & & & & \\ (\text{J}) & & (\text{N}) & & (\text{m}) \end{array}$$

See video for diagram

The climber has a weight of 650 N. The work done in climbing up the cliff is 1300 J.
How far up the cliff has she climbed?



$$\begin{array}{ccccc} \text{Work Done or} & = & \text{Force} & \times & \text{distance} \\ \text{Energy Transferred} & & & & \\ (\text{J}) & & (\text{N}) & & (\text{m}) \end{array}$$

Your turn: A man transfer 350 J of energy to the box. He exerts a force of 70 N on the box. How far has he pushed the box?

See video for diagram



$$\begin{array}{ccccc} \text{Work Done or} & = & \text{Force} & \times & \text{distance} \\ \text{Energy Transferred} & & & & \\ \text{(J)} & & \text{(N)} & & \text{(m)} \end{array}$$

cm $\xrightarrow{\div 100}$ m

km $\xrightarrow{\times 1000}$ m



Work Done or Energy Transferred = Force x distance
(J) (N) (m)

cm $\xrightarrow{\div 100}$ m

km $\xrightarrow{\times 1000}$ m

$$30 \text{ cm} \div 100 = 0.3 \text{ m}$$

$$100 \text{ km} \times 1000 = 100\,000 \text{ m}$$

$$5 \text{ km} \times 1000 = 5\,000 \text{ m}$$

$$23 \text{ cm} \div 100 = 0.23 \text{ m}$$



Work Done or Energy Transferred = Force x distance
(J) (N) (m)

cm $\xrightarrow{\div 100}$ m

km $\xrightarrow{\times 1000}$ m

Your turn:

50 cm

23 km

0.4 km

600 cm



$$\begin{array}{ccccc} \text{Work Done or} & & = & \text{Force} & \times & \text{distance} \\ \text{Energy Transferred} & & & & & \\ \text{(J)} & & & \text{(N)} & & \text{(m)} \end{array}$$

A car is dragged over 470 cm on flat ground. It is pulled by a force of 250 N. What is the work done?

$$\text{Distance} = 470 \text{ cm} \div 100 = 4.7 \text{ m}$$

$$\text{Work Done} = \text{Force} \times \text{distance}$$

$$\text{Work Done} = 250 \times 4.7$$

$$\text{Work Done} = 11750 \text{ J}$$



$$\begin{array}{ccccc} \text{Work Done or} & & = & \text{Force} & \times & \text{distance} \\ \text{Energy Transferred} & & & & & \\ & \div 100 & & (\text{N}) & & (\text{m}) \end{array}$$

cm  m

Your turn:

A trolley is pushed 230cm with a resultant force of 50 N.
Calculate the work done by the force.

See video for diagram



$$\begin{array}{ccccc}
 \text{Work Done or} & & & & \\
 \text{Energy Transferred} & = & \text{Force} & \times & \text{distance} \\
 (\text{J}) & & (\text{N}) & & (\text{m})
 \end{array}$$

A car is travels 5 km on flat ground. The force from the engine is 240N. What is the work done?

$$\text{km} \xrightarrow{\times 1000} \text{m}$$



Work Done or
Energy Transferred
(J)

= Force x distance
(N) (m)

See video for diagram

km $\xrightarrow{\times 1000}$ m

Your turn:

A climber climbs 0.15 km. The force exerted is 240 N.
Calculate the work done.



On the next page there is a table.

Use the equation:

Work = Force x Distance to fill it in.

A few have been completed for you.

Remember to check your units!



		Force				
		12 N	Work = force x distance 3.85 = Force x 0.35 Force = 11N	120,000 N	Force = ?	8 N
Distance	35cm	4.2 J	3.85 J	Work =?	Work =?	
	100m	Work done = force x distance = 12 x 100 = 1200J	Work =?	Work =?	37200 J	
	3.62cm	Work =?	Work =?	Work = force x distance = 0.0362 x 120000 = 4344J		
	1.87m	Work =?	Work =?			
	Distance =?	1.2 J	1.1 J			



Answers		Force				
		12 N	Work = force x distance 3.85 = Force x 0.35 Force = 11N	120,000 N	372 N	8 N
Distance	35cm	4.2 J	3.85 J	42000J	130.2 J	2.8 J
	100m	Work done = force x distance = 12 x 100 = 1200J	1100 J	12 000 000 J	37200 J	800 J
	3.62cm	0.4344 J	0.3982	Work = force x distance = 0.0362 x 120000 = 4344J	13.5 J	0.2896 J
	1.87m	22.44 J	20.57 J	224400 J	695.64 J	14.96 J
	0.1 m	1.2 J	1.1 J	12 000 J	37.2 J	0.8 J

