

Work, Energy and Power Equations Worksheet

Level: GCSE / A-Level / AP Physics 1 | Difficulty: Intermediate | Topic: Mechanics

Practice the core energy equations with 10 problems covering kinetic energy, gravitational potential energy, work done, and power. Full solutions included.

Equations you will need

$W = Fs \cos \theta$	Work done = force x distance x cos(angle)
$KE = \frac{1}{2}mv^2$	Kinetic energy
$PE = mgh$	Gravitational potential energy
$P = W/t$	Power = work done / time
$P = Fv$	Power = force x velocity
$\text{Efficiency} = (\text{useful output} / \text{total input}) \times 100\%$	Efficiency

Symbol key

Symbol	Quantity	Unit
W	work / energy	J (joules)
F	force	N
s	distance	m
m	mass	kg
v	velocity	m/s
h	height	m
P	power	W (watts)
t	time	s

Practice problems

1. A 50 N force pushes a box 8 m horizontally. Find the work done.
2. Find the kinetic energy of a 2 kg ball moving at 10 m/s.
3. A 5 kg book is lifted 1.5 m. Find the gain in PE. ($g = 9.8 \text{ m/s}^2$)
4. A motor does 6000 J of work in 30 s. Find the power.
5. A 1500 kg car accelerates from rest to 20 m/s. Find the work done by the engine.

6. A pump lifts 50 kg of water 10 m in 20 s. Find the power. ($g = 9.8 \text{ m/s}^2$)
7. A force of 100 N pulls a sled 20 m at 30deg to the horizontal. Find the work done.
8. A 0.5 kg ball is dropped from 20 m. Find its speed just before hitting the ground (no air resistance).
9. An engine outputs 800 W useful power but consumes 1000 W. Find its efficiency.
10. A 70 kg runner climbs stairs of total height 5 m in 4 s. Find the power developed. ($g = 9.8 \text{ m/s}^2$)

Answer key

Full worked solutions for each problem.

1. $W = Fs = 50 \times 8 = 400 \text{ J}$
2. $KE = \frac{1}{2}mv^2 = \frac{1}{2}(2)(100) = 100 \text{ J}$
3. $PE = mgh = 5(9.8)(1.5) = 73.5 \text{ J}$
4. $P = W/t = 6000/30 = 200 \text{ W}$
5. $W = DKE = \frac{1}{2}(1500)(400) = 300,000 \text{ J}$
6. $W = mgh = 4900 \text{ J}; P = 4900/20 = 245 \text{ W}$
7. $W = Fs \cos \theta = 100(20)(\cos 30^\circ) = 1732 \text{ J}$
8. $PE \rightarrow KE: mgh = \frac{1}{2}mv^2 \rightarrow v = \sqrt{2gh} = \sqrt{392} = 19.8 \text{ m/s}$
9. $\text{Efficiency} = 800/1000 \times 100\% = 80\%$
10. $W = mgh = 70(9.8)(5) = 3430 \text{ J}; P = 3430/4 = 857.5 \text{ W}$