

Worksheet: Work & Power Problems Answer Key

I. Work

A. Sample Problems:

- F = 200 Newtons
d = 50 meters
W = ?

Formula: $W = Fd$
Substitution: $W = (200\text{ N})(50\text{ m})$
Answer with unit of measure: $W = 10,000\text{ J}$
- F = 5 Newtons
W = 75 Joules
d = ?

Formula: $d = W/F$
Substitution: $d = 75\text{ J}/5\text{ N}$
Answer with unit of measure: $d = 15\text{ m}$
- W = 125 Joules
d = 10 meters
F = ?

Formula: $F = W/d$
Substitution: $F = 125\text{ J}/10\text{ m}$
Answer with unit of measure: $F = 12.5\text{ N}$
- If 150 Joules of work is needed to move a box 10 meters, what force was used?

$W = 150\text{ J}$ $F = W/d$ $F = 15\text{ N}$
 $d = 10\text{ m}$ $F = 150\text{ J}/10\text{ m}$

B. Fill-in-the-blank:

- Work** is done when an object moves through a distance because of a **force** acting upon the object.
- When calculating work, you should use the formula: work = force X **distance**.
- The SI unit for work is the **Joule**. It is represented by the letter **J**.

C. Work Problems:

- F = 90 N $W = Fd$ 5. F = 6 N $d = W/F$ 6. W = 120 J $F = W/d$
d = 5 m $90(5)$ W = 72 J $72/6$ d = 24 m $120/24$
W = ? 450 J d = ? 12 m F = ? 5 N
- W = ? $W = Fd$ 8. W = 13.2 J $d = W/F$ 9. W = 136 J $F = W/d$
F = 62.6 N $62.6(13)$ F = 2 N $13.2/2$ d = 27.2 m $136/27.2$
d = 13 m 813.8 J d = ? 6.6 m F = ? 5 N
- If 360 Joules of work are needed to move a crate a distance of 4 meters, what is the weight of the crate?

$W = 360\text{ J}$ $F = W/d$ $F = 90\text{ N}$
 $d = 4\text{ m}$ $F = 360\text{ J}/4\text{ m}$
- If a group of workers can apply a force of 1000 Newtons to move a crate 20 meters, what amount of work will they have accomplished?

$F = 1000\text{ N}$ $W = Fd$ $W = 20,000\text{ J}$
 $d = 20\text{ m}$ $W = 1000(20)$
- If 68 Joules of work were necessary to move a 4 Newton crate, how far was the crate moved?

$W = 68\text{ J}$ $d = W/F$ $d = 17\text{ m}$
 $F = 4\text{ N}$ $d = 68\text{ J}/4\text{ N}$
- How much work is done in holding a 15 N sack of potatoes while waiting in line at the grocery store for 3 minutes. **Not moving** $F = 15\text{ N}$ $W = Fd$ $W = 0\text{ J}$
 $d = 0\text{ m}$ $W = 15(0)$

II. Power

A. Samples

- W = 500 Joules
t = 25 seconds
P = ?

Formula: $P = W/t$
Substitution: $P = 500\text{ J}/25\text{ sec}$
Answer with unit of measure: 20 W
- P = 25 watts
W = 5000 Joules
t = ?

Formula: $t = W/P$
Substitution: $t = 5000\text{ J}/25\text{ W}$
Answer with unit of measure: $t = 200\text{ sec}$
- P = 170 watts
t = 20 seconds
W = ?

Formula: $W = Pt$
Substitution: $W = 170\text{ W}(20\text{ sec})$
Answer with unit of measure: $W = 3,400\text{ J}$
- If a man moves a large box that weighs 10 Newtons 20 meters in 30 seconds, how much power was used?

$F = 10\text{ N}$ $P = W/t$ and $W = Fd$, so $P = Fd/t$
 $d = 20\text{ m}$ $P = (10\text{ N} \times 20\text{ m})/30\text{ sec}$
 $t = 30\text{ sec}$ $P = 6.67\text{ W}$

B. Fill-in-the-blank:

- Power** is the rate at which work is done.
- When calculating power, you should use the formula $P = \text{work}$ divided by **time**. In this formula, "P" stands for power, **W** stands for work, and **t** for time.
- The SI unit for Power is the **Watt**.

C. Power Problems

- W = 100 J $P = W/t$ 5. W = 225 J $t = W/P$ 6. P = 20 W $W = Pt$
t = 10 s $P = 100/10$ P = 25 W $t = 225/25$ t = 15 s $W = 20 \times 15$
P = ? $P = 10\text{ W}$ t = ? $t = 9\text{ sec}$ W = ? $W = 300\text{ J}$
- W = 500 J $P = W/t$ 8. W = 336 J $t = W/P$ 9. W = ? $W = Pt$
t = 25 s $P = 500/25$ t = ? $t = 336/14$ t = 16.6 s $W = 64(16.6)$
P = ? $P = 20\text{ W}$ P = 14 W $t = 24\text{ sec}$ P = 64 W $W = 1,062.4\text{ J}$
- A person weighing 600 N gets on an elevator. The elevator lifts the person 6 m in 10 seconds. How much power was used?

$F = 600\text{ N}$ $P = Fd/t$
 $d = 6\text{ m}$ $P = (600 \times 6)/10$
 $t = 10\text{ sec}$ $P = 360\text{ W}$
- How much time is needed to produce 720 Joules of work if 90 watts of power is used?

$W = 720\text{ J}$ $t = W/P$ $t = 8\text{ sec}$
 $P = 90\text{ W}$ $t = 720\text{ J}/90\text{ W}$
- If 68 W of power is produced in 18 seconds, how much work is done?

$P = 68\text{ W}$ $W = Pt$ $W = 1,224\text{ J}$
 $t = 18\text{ sec}$ $W = 68(18)$
- A set of pulleys lifts an 800 N 4 meters in 7 seconds. What power was used?

$F = 800\text{ N}$ $P = Fd/t$ $P = 457.1\text{ W}$
 $d = 4\text{ m}$ $P = 800(4)/7$
 $t = 7\text{ sec}$