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Work and Power Worksheet

Answer each question by calculating for the missing variable. Be sure to show all calculation work in the space provided. Please circle your final answer and be sure it has the proper label.

1. You must exert a force of 4.5 N on a book to slide it across a table. If you do 2.7 J of work in the process, how far have you moved the book?

$W = FD$ $D = W/F$

$F = 4.5\,N$

$W = 2.7\,J$ $= \frac{2.7\,J}{4.5\,N} = 0.6\,m$

2. A child pulls a sled up a snow-covered hill. The child does 405 J of work on the sled. If the child walks 15 m up the hill, how large of a force must the child exert?

$W = 405\,J$ $W = FD$

$D = 15\,m$ $F = W/D = \frac{405\,J}{15\,m} = 27\,N$

$F = ?$

3. How much work is done on a small car if a 3150 N force is exerted to move it 75.5 m to the side of the road?

$F = 3150\,N$ $W = FD$

$D = 75.5\,m$ $= 3150\,N \cdot 75.5\,m$

$W = ?$ $= 237825\,J$

4. A crate is being lifted into a truck. If it is moved with a 2470 N force and 3650 J of work is done, then how far is the crate being lifted?

$F = 2470\,N$ $W = F \cdot D$

$W = 3650\,J$ $D = W/F = \frac{3650\,J}{2470\,N} = 1.48\,m$

$D = ?$

5. If 16,700 J of work is done to shoot the human cannonball down a 3.05 m barrel, then how much force is applied to the person to fire them out the cannon?

$W = 16{,}700\,J$ $W = F \cdot D$ $\frac{16700\,J}{3.05} = 5475\,N$

$D = 3.05\,m$ $F = W/D$

6. An elephant pushes with 2000 N on a load of trees. It then pushes these trees for 150 m. How much work did the elephant do?

$W = F \cdot D$ $W = 2000\,N \cdot 150\,m$

$F = 2000\,N$ $= 300{,}000\,J$

$D = 150\,m$

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7. An 190,000 W engine can accelerate from rest to a top speed in 9 s. How much work did the engine do?

Remember W = watts (not work)

$Power = \frac{W}{t}$

$190{,}000\ W = \frac{W}{9s} = 190{,}000 \times 9\ sec = 1{,}710{,}000\ J$

8. Another engine reaches its top speed from rest in 7.5 s. It is able to perform 250,000 J of wok in that time. How much power does this engine have in that time?

$P = W/t$

$T = 7.5\ s$

$W = 250{,}000\ J$

$= \frac{250{,}000}{7.5} = 33{,}333\ watts$

9. If a runner exerts 350 J of work to make 125 W of power, then how long did it take the runner to do the work?

$work = 350\ J$

$power = 125\ W$

$t = ?$

$P = \frac{W}{t}$

$125\ W = \frac{350\ J}{t}$

$125\ W(t) = 350\ J$

$t = \frac{350\ J}{125\ W} = 2.8\ sec$

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Worksheet - Work & Power Problems

I. Work

A. Sample Problems:

1. F = 200 Newtons
   d = 50 meters
   W = ?
   Formula: W = Fd
   Substitution: W = 200 N (50 m)
   Answer with unit of measure: 10,000 J

2. F = 5 Newtons
   W = 75 Joules
   D = ?
   Formula: W = Fd or d = W/F
   Substitution: 75 J = 5 N · d
   Answer with unit of measure: 15 m

3. W = 125 Joules
   d = 10 meters
   F = ?
   Formula: F = W/d
   Substitution: F = 125 ÷ 10
   Answer with unit of measure: 12.5 N

4. If 150 Joules of work is needed to move a box 10 meters, what force was used?

$$\frac{150\ J}{10\ m} = 15\ N$$

B. Fill-in-the-blank:

1. Work is done when an object moves through a distance because of a Force acting upon the object. (or displacement)
2. When calculating work, you should use the formula: work = force X distance.
3. The SI unit for work is the Joule. It is represented by the letter J.

C. Work Problems:

4. F = 90 N
   d = 5 m
   W = ?
   W = F·d
   450 J

5. F = 6 N
   W = 72 J
   d = ?
   d = W/F
   12 m

6. W = 120 J
   d = 24 m
   F = ?
   F = W/d
   5 N

7. W = ?
   F = 62.6 N
   d = 13 m
   W = F·d
   813.8 J

8. W = 13.2 J
   F = 2 N
   d = ?
   d = W/F
   6.6 m

9. W = 136 J
   d = 27.2 m
   F = ?
   F = W/D
   5 N

10. 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 J
    D = 4 m
    W = F·D
    $\frac{360}{4} = 90\ N$

11. 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 N
    D = 20 m
    W = F·d = 1000 N · 20 m = 20,000 J

12. If 68 Joules of work were necessary to move a 4 Newton crate, how far was the crate moved?
    W = 68 J
    F = 4 N
    D = ?
    W = Fd
    D = W/F = 68/4 = 17 m

13. How much work is done in holding a 15 N sack of potatoes while waiting in line at the grocery store for 3 minutes.

0 Joules

II. Power

A. Sample Problems:

1. W = 500 Joules
   t = 25 seconds
   P = ?
   Formula: P = W / t
   Substitution: P = 500 ÷ 25
   Answer with unit of measure: 20 Watts

2. P = 25 watts
   W = 5000 Joules
   t = ?
   Formula: t = Work/P
   Substitution: t = 1000 ÷ 25
   Answer with unit of measure: = 200 sec

3. P = 170 watts
   t = 20 seconds
   W = ?
   Formula: W = P · t
   Substitution: W = 170 · 20
   Answer with unit of measure: 3400 J

4. If a man moves a large box that weighs 10 Newtons 20 meters in 30 seconds, how much power was used?

$P = \frac{W}{T} = \frac{200\ J}{30s} =$ 6.7 watts

B. Fill-in-the-blank:

1. Power is the rate at which work is done.
2. When calculating power, you should use the formula P = work divided by time. In this formula, "P" stands for power, W stands for work, and t for time.
3. The SI unit for Power is the Watt.

C. Power Problems

4. W = 100 J
   t = 10 s
   P = ?
   100 ÷ 10
   10 W

5. W = 225 J
   P = 25 W
   t = ?
   225 J ÷ 25 W
   9 s

6. P = 20 W
   t = 15 s
   W = ?
   W = 20 · 15
   300 J

7. W = 500 J
   t = 25 s
   P = ?
   500 ÷ 25
   20 W

8. W = 336 J
   t = ?
   P = 14 W
   T = W/P
   24 sec

9. W = ?
   t = 16.6 s
   P = 64 W
   1062.4 J
   W = 64 · 16.6
   W = P · t

10. 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 = 600N t = 10 sec
D = 6m

W = F · d = 600N · 6m = 3600 J

P = W/t = 3600 J / 10 sec = 360 W

11. How much time is needed to produce 720 Joules of work if 90 watts of power is used?

t = W/P 720 J / 90 W = 8 sec

12. If 68 W of power is produced in 18 seconds, how much work is done?

P = 68 W P = W/t
T = 18 s W = P · t
= 68 W · 18 s = 1224 J

13. A set of pulleys lifts an 800 N crate 4 meters in 7 seconds. What power was used?

W = F · d = 800 N · 4 m = 3200 J

$\text{Power} = \frac{3200\ J}{7\ sec} =$ 457.1 Watts

time