

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## WORK, POWER, & ENERGY

### Calculations of WORK & POWER Part 1

#### Part 1: Linear Work and Power.

Linear or Mechanical Work happens when a parallel force displaces an object.

Power is defined as the rate at which work is performed.

Calculate work, force, distance or power.

#### Linear work

$$W = F \cdot d$$

#### Distance

$$d = \frac{W}{F}$$

#### Force

$$F = \frac{W}{d}$$

#### Power

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

W = work (J)

F = parallel force (N)

P = power (Watts)

t = time (s)

d = distance (m)

1. Joseph sweeps his sidewalk with a broom. Joseph pushes a pile of dead leaves for distance of 3 meters using a force of 2.0 N. It takes Joseph 12 seconds to push the leaves.



Calculate the mechanical work performed on the leaves. Report your answer in Joules.

Calculate the power used to push the leaves. Report your answer in Watts

2. A tractor pulls a hay wagon with a force of 500 N for a distance of 2000 meters. It takes the tractor 5 minutes to pull the hay wagon.

Calculate the work performed on the hay wagon. Report your answer in Joules.



Calculate the power used to pull the hay wagon. Report your answer in Watts.

3. A backhoe pushes a rubbish pile with a force of 1200 N for a distance of 400 meters. It takes the backhoe 30 seconds to move the rubbish pile.

Calculate the work performed by the backhoe on the rubbish pile.

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Calculate the power of the backhoe pushing the rubbish pile.

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4. Joseph sweeps his sidewalk with a broom. Joseph pushes a pile of dead leaves for distance of 10 meters. He performs 35 Joules of work.

Calculate the force Joseph uses to push the broom and leaves. Report your answer in Newtons.

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5. Joseph sweeps his sidewalk with a broom. Joseph performs 42 Joules of work pushing dead leaves with the broom with a force of 18 N.

Calculate the distance that Joseph pushed the dead leaves. Report your answer in meters.

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6. A tractor pulls a hay wagon with a force of 430 N. The tractor performs 760,000 Joules of work.

Calculate the distance that the tractor pulled the wagon. Report your answer in meters.

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7. A tractor pulls a hay wagon a distance of 1300 meters. The tractor performed 260,000 Joules of work.

Calculate the force that the tractor used to pull the wagon. Report your answers in Newtons.

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**Part 2: Work and Power.** Linear or Mechanical Work happens when a parallel force displaces an object. The force is applied at an oblique angle rather than parallel to motion. Calculate the parallel force first.

**Linear work**

**(push at an angle)**

$$W = F' \cdot \cos \theta \cdot d$$

$$W = F_x \cdot d$$

**Power**

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

$W$  = work (J)

$F_x$  = parallel force (N)

$F'$  = effort force (N)

$\theta$  = push or pull angle

$P$  = power (Watts)

$t$  = time (s)

$d$  = distance (m)



1. Baxter pushes his car (he ran out of gas) with a force of 300 N at 20° from parallel. He pushed his car 300 m to the filling station in 4 minutes.

Calculate the work Baxter made. \_\_\_\_\_

Calculate the power Baxter used to push the car. \_\_\_\_\_



2. Joshua pushed the block of ice with a force of 80 N at 25° from parallel. He pushed the ice 40 m in 1 minute.

Calculate the work Joshua made. \_\_\_\_\_

Calculate the power Joshua used to push the ice. \_\_\_\_\_



3. Rudolph pulled the wagon with a force of 100 N at 30° from parallel. He pulled the wagon 50 m in 2 minutes.

Calculate the work Rudolph made. \_\_\_\_\_

Calculate the power Rudolph used to pull the wagon. \_\_\_\_\_