

Additional Practice

Force Practice Problems: (hint: try writing out the equations here first)

1. A force of 20 N acts upon a 5 kg block. Calculate the acceleration of the object.

$$F = ma \quad \frac{F}{m} = a = \frac{20 \text{ N}}{5 \text{ kg}} = 4 \text{ N/kg}$$

2. An object of mass 300 kg is observed to accelerate at the rate of 4 m/s². Calculate the force required to produce this acceleration.

$$F = ma \\ = 300 \text{ kg} \times 4 \text{ m/s}^2 = 1200 \text{ N}$$

3. An object of mass 30 kg is in freefall in a vacuum on earth where there is no air resistance. Determine the acceleration of the object.

$$a \text{ or } g \text{ is } 9.8 \text{ m/s}^2 \text{ on Earth.}$$

4. A force of 200 N is exerted on an object of mass 40 kg that is located on a sheet of perfectly smooth ice.

a. Calculate the acceleration of the object.

$$F = ma \quad a = \frac{F}{m} = \frac{200 \text{ N}}{40 \text{ kg}} = 5 \text{ N/kg}$$

b. If a second object identical to the first object is placed on top of the first object, what acceleration would the 200 N force produce?

$$a = \frac{F}{m} = \frac{200 \text{ N}}{80 \text{ kg}} = 2.5 \text{ N/kg}$$

5. An object of mass 10 kg is accelerated upward at 2 m/s². What force is required?

$$F = ma = 10 \text{ kg} \times 2 \text{ m/s}^2 = 20 \text{ N}$$

6. A 5 kg block is pulled across a table by a horizontal force of 40 N with a frictional force of 8 N opposing the motion. Calculate the acceleration of the object. **Hint: Try drawing what this would look like first** (We will do this one as a class)

$$a = \frac{F}{m} = \frac{(40 + 8 \text{ N})}{5 \text{ kg}} = 9.6 \text{ N/kg}$$

Work Practice Problems: (hint: try writing out the equations here first)



1. Mr. Ewan uses 20N of force to push a lawn mower 10 meters. How much work does he do?

$$W = F \times d \\ = 20\text{N} \times 10\text{m} = 200\text{ N}\cdot\text{m or J}$$

2. How much work does an elephant do while moving a circus wagon 20 meters with a pulling force of 200N?

$$W = F \times d \\ = 200\text{N} \times 20\text{m} = 4000\text{ N}\cdot\text{m or J}$$

3. How much work is done when a force of 33N pulls a wagon 13 meters?

$$W = F \times d = 33\text{N} \times 13\text{m} = 429\text{ N}\cdot\text{m or J}$$

4. Taylor does 15 Joules of work to push Cody 6 meters. How much force did he use?

$$F = \frac{W}{d} = \frac{15\text{J}}{6\text{m}} = 2.5\text{N}$$

5. Matthew uses a force of 25 Newtons to lift Leo while doing 50 Joules of work. How far did he lift Leo?

$$d = \frac{W}{F} = \frac{50\text{J}}{25\text{N}} = 2\text{m}$$

6. Maddy throws a ball with 1237 Joules of work and the ball landed 40m away, how much force did she use to throw the ball?

$$F = \frac{W}{d} = \frac{1237\text{J}}{40\text{m}} = 31\text{N}$$

7. A 30kg mass is lifted and accelerates at 4m/s^2 . What are the total amount of Joules gained by this mass if it travels a distance of 36m?

$$F = m a \\ = 30\text{kg} \times 4\text{m/s}^2 \\ = 120\text{N}$$

$$W = F \times d \\ = 120\text{N} \times 36\text{m} \\ = 4320\text{J or N}\cdot\text{m}$$

↑
(work)

Power Practice Problems: (hint: write out the equations first)



What are the units for Power? W or J/s

1. If 4500 joules of work are done to lift an object in 5 seconds, what is the power?

$$P = \frac{\text{Work}}{\text{time}} = \frac{J}{s} = \frac{4500 J}{5 s} = 900 W$$

2. How much work does a 30W engine do if it operates for 40 seconds?

$$\begin{aligned} \text{work} &= \text{Power} \times \text{time} \\ &= 30 W \times 40 s \\ &= 1200 J \end{aligned}$$

3. During the staircase lab, Tigger runs up the stairs, elevating his 102 kg body a vertical distance of 2.29 meters in a time of 1.32 seconds at a constant speed.

a. Determine the work done by Tigger in climbing the staircase.

$$\begin{aligned} F &= mg = 102 \text{ kg} \times 9.8 \text{ N/kg} \\ &= 1000 \text{ N} \\ W &= F \times d = 1000 \text{ N} \times 2.29 \text{ m} = \underline{2290 \text{ J}} \end{aligned}$$

b. Determine the power generated by Tigger.

$$P = \frac{W}{t} = \frac{2290 \text{ J}}{1.32 \text{ s}} = 1734 \text{ W}$$

4. Hannah pushes a box across the floor a distance of 50 meters. Pushing the box required a force of 20 N and took the person 40 seconds.

a. What is the work? $W = F \times d = 20 \text{ N} \times 50 \text{ m} = 1000 \text{ J}$

b. What is the power? $P = \frac{W}{t} = \frac{1000 \text{ J}}{40 \text{ s}} = 25 \text{ W}$

5. A new conveyor system at the local packaging plant will utilize a motor-powered mechanical arm to exert an average force of 890 N to push large crates a distance of 12 meters in 22 seconds. Determine the power output required of such a motor.

$$\begin{aligned} W &= F \times d \\ &= 890 \text{ N} \times 12 \text{ m} \\ &= 10,680 \text{ J} \end{aligned}$$

$$P = \frac{W}{t} = \frac{10,680 \text{ J}}{22 \text{ s}} = 485 \text{ W}$$