1. In your own words, define the following terms. Include their equations and units:
	1. Work

***Work is defined as the transfer of energy through motion. Its equation is*** $W=F∙d∙\cos(θ)$ ***and the units are N∙m or Joules ( J )***.

* 1. Power

***Power is defined as the rate at which work is done. Its equation is*** $P=\frac{W}{t}$ ***and the units are*** $^{J}/\_{s}$ ***or Watts (W)***.

1. In your own words, what is the relationship between work and energy? What is this relationship called? What equation represents this relationship?

***Work is directly related to a change in kinetic energy. This is called the work-kinetic energy theorem. The equation for this is*** $W=∆E\_{K}=E\_{K2}-E\_{K1}$

1. A force sets an object in motion. When the force is multiplied by the time of its application, we call the quantity *impulse*, which changes the *momentum* of the object. What do we call the quantity *force \* distance*, and what quantity does this change?

***Force times distance is called work. It changes the kinetic energy or the potential energy of an object.***

1. Work is required to list a barbell. How many times as much work is required to life the same barbell three times as high?

***When lifting a barbell, it takes three times as much work to lift the barbell three times as high.***

1. Which requires more work: lifting a 10. kg sack a vertical distance of 2.0 m or lifting a 5.0 kg sack a vertical distance of 10. m?

***Using*** $W=F∙d$ **→ 2**$\overbar{0}$**0 *J of work is required to lift a 10. kg sack 2.0 m.* 5**$\overbar{0}$**0 *J of work is required to lift 5.0 kg sack 10. m.***

1. How many joules of work are done on an object when a force of 10.0 N pushes it a distance of 10.0 meters?

***Using*** $W=F∙d$ **→ *To push an object with 10.0 N of force 10.0 m requires 100. J of work.***

1. A bicycle is being pushed by its rider:
	1. How much power is required to do 100. J of work on the bike in a time of 0.50 s?

$$P=\frac{W}{t}=\frac{100. J}{0.50 s}=2\overbar{0}0 W$$

* 1. How much power is required to do the same amount of work in a time of 1.0 s?

$$P=\frac{W}{t}=\frac{100. J}{1.0 s}=1\overbar{0}0 W$$

1. You elevate a bucket of water and you do 100. J of work to do so:
	1. What is its gravitational potential energy relative to its starting position?

***If you do 100 J of work to elevate the bucket, it will have 100. J of potential energy. This is because work is equal to the change in kinetic energy and the change in potential energy is also equal to the change in kinetic energy from conservation of mechanical energy.***

* 1. What would its potential energy be if it was elevated twice as high?

***If the bucket were raised twice as high, it would have 200. J of potential energy.***

1. An engine is capable of bringing a car from 0 to 100. $^{km}/\_{hr} $in 10.0 seconds. If the engine has twice the power output (and all other characteristics of the engine remain the same), how many seconds would be required to accelerate to the same speed?

$$P=\frac{∆E\_{K}}{t}=\frac{E\_{K2}-E\_{K1}}{t}$$

***So, if power doubles and change in kinetic energy is the same (it’s accelerating to the same speed), the time it takes will be halved since power and time are inversely proportional. This means that the time required would be 5.00 seconds.***

1. If a car that travels 40. mph will skid 20. m when its brakes are locked, how far will it skid if it is traveling at 80. mph when its brakes are locked?

$$E\_{K1}=\frac{1}{2}mv^{2}$$

***The velocity is doubling, which means***$ \left(2v\right)^{2}=4v$**. So that means that** $E\_{K1} $***is also quadrupling.***

$$W=∆E\_{K}↝F∙d=E\_{K2}-E\_{K1}$$

***Since*** $E\_{K1} $***is quadrupling, F stays the same, and*** $E\_{K2}=0 in both cases, we see that E\_{K1}$***and displacement are directly proportional. This means the displacement will also quadruple. Thus, the car will skid for 80. meters.***