SCIENCE

NAME: PERIOD: DATE:

SIMPLE MACHINES CLASSWORK 99

PART ONE: Fill in the blanks.

1. A machine is a device that makes ________________ easier.

2. A simple machine is a device that makes work easier with one ________________.

3. A bar that pivots or rotates on a single point is called a _________________ and is a type of simple machine.

4. A ______________ is a fixed (meaning stuck in place, but can still spin) grooved wheel with a rope that can move over it, and is a type of simple machine.

5. An ____________________ ____________ is basically a ramp, and is a type of simple machine.

6. A ______________ & _____________ is a large radius circle attached to a small radius cylinder, and is a type of simple machine.

7. _____________________ ___________________ is the amount of times a machine multiplies your force.

PART TWO: True or False. Don't worry about fixing them.

8. True or False. I can't (even John the Legend can't) push a nail into a piece of wood with my finger or fist, but a machine (like a hammer) would allow me to do that.

9. True or False. I can't (even Grant the Legend can't) lift a car with my arms and legs, but a machine like a jack would allow me to do that.

10. True or False. Sometimes a machine just changes the direction of my force. Like when Kayla the farm girl pulls down on a rope, but the bucket of water comes up out of the well.

11. True or False. A machine does the same amount of work that I put into it, the machine just puts out that work in a different way. (Yes, Twisted, some work will be lost by friction.)

12. True or False. The work you put into a machine ='s the force you put in multiplied by the distance you did it over. (That's W=F x D, and the units are Joules, Jia)

13. True or False. The work that a machine does the force it puts out multiplied by the distance it does it over. (That's still W=F x D, and the units are still Joules, Erin)

14. True or False. If I put 100 Joules into the machine, (ignoring friction, Nate) then I should get 100 Joules out of the machine.

15. True or False. Depending on how that machine is set up, if Mikala puts in 100 Joules, she could get 2 Newtons over a distance of 50 meters, or 5 Newtons over a distance of 20 meters, or 100 Newtons over a distance of 1 meter, or even 1,000 Newtons over a distance of .01 meter, because they all multiply out to 100 Joules.

Let’s pretend to make a machine, and seeing what happens.

Allyssa makes a wheel and axle in her workshop. She makes the radius of the wheel 10 cm and the radius of the axle 5 cm.

What is the mechanical advantage of this machine?

HINT: Mechanical advantage of any machine can be found with one of two formulas, either:

MA = resistance force / effort force (that’s the force that comes out / the force that went in)

Or

MA = effort distance / the resistance distance (that’s how far you apply the force / how far the machine applies the force)

In this case, you don’t know any forces, you only know the radii. So you would use:

MA = effort distance / resistance distance (the distance you turn the wheel / the distance the axle will turn when you turn the wheel)

16. MA for Allyssa’s wheel and axle is: **Twigg & Lauren please trumpet out a reminder to all to show the formula, the substitutions, and circle the answer.** There is no label since MA has none.

Now let’s imagine that several classmates try Allyssa’s wheel and axle.

17. Emma will turn the wheel with her mighty force of 20 Newtons. How much force will she cause the axle to turn with? (All you have to do is know the MA of Allyssa’s wheel & Axle, and multiply Emma’s force by it. That’s how MA works. It tells you how much it multiplies the force you put in.)

18. Gavin will turn the wheel with his buffness at a force of 35 Newtons. How much force will he cause the axle to turn with?

19. Emma, furious that Gavin looked tougher than her, now cranks on the wheel with a force of 40 Newtons (even Caden is a little scared.) How much force does she make the axle turn with now?

Now let's pretend to make several machines and try them all with one person to see which is best.

Everyone breaks into Allyssa's workshop to make machines. It's a party. They decide to make crowbars.

Pew Pew makes a crowbar with an effort arm of 1 meter, and a resistance arm of 0.5 meters.

Kaydidi makes one twice as big as Pew Pew's to show off. Her effort arm is 2 meters, and her resistance arm is 1 meter.

Arianna was reading a book and made hers upside down. It has an effort arm of 0.5 meters, and a resistance arm of 1.5 meters.

Travis crafts a crowbar with an effort arm of 2 meters, and resistance arm of a wee 0.1 meter. Unfortunately, he loses it soon after finishing it.

In the space below order the crowbars from greatest mechanical advantage to least. (As Courtney would obviously point out if you forgot, you will need to calculate all those MA's first.)

So a machine's job is basically to take the work you put into it and swap the (force x distance) around to get the same work as you.

Maybe you put in 100 Joules of work and the Force you used was 5 Newtons and the distance was 20 meters.

The machine might give you:

1000 Newtons but only over 0.1 meter. (That's 200x more force, but $1/200^{th}$ the distance. Good for pulling out a stuck nail!)

10 Newtons but only over 10 meters. (You get 2x more force, but half as much distance. Maybe good for rolling up a wheel chair ramp. The person would feel half as heavy, but you'd have to roll twice as far.)

The machine can give you any combination of numbers that multiply to get 100 (or whatever work you put in.)

The work you put into the machine **$(Work_{in}) = (Work_{out})$** the work the machine does for you. It's the same work, but done with different force x distance.