Mechanics work energy and power worksheet answers

If you've read many HowStuffWorks articles, you've seen a lot of terminology thrown around – words like weight, power, torque, work, strength and energy. What do these words really mean and are interchangeable? In this article, we will help to combine all these terminologies together, give some examples when each of them is used, and even try a few calculations along the way to get to the bottom of it. Advertising In this article, we will refer to different types of units. In most of the world, the international unit system (SI - from Le Système International d'Unités in France), also known as the metric system, is accepted as a standard set of units. This system contains most of the metric units you are used to, such as meters and kilograms, but also units for many other physical and engineering properties. Even the United States has officially adopted the SI unit system, but English engineering units (like pounds and feet) are still in daily use. Before we begin to explain these concepts, we need to start with some basics. Let's start with the weight and work our way up to energy. Usually, when we talk about strength, more than one force is involved, and these forces are applied in different directions. Let's look at the scheme of the car. When the car sits still, gravity acts on the car downwards (this force acts everywhere on the car, but for simplicity we can stretch the force in the middle of the weight of the car). But the ground exerts the same and opposite force upwards on the tires, so the car does not move. This content is not compatible on this device. Figure 1. Animation forces on the car Advertising When the car starts to accelerate, some new forces come into play. The rear wheels exert force against the ground in a horizontal direction; thanks to this, the car starts to accelerate. When the car moves slowly, almost all the force goes into speeding up the car. The car withstands this acceleration by a force equal to its mass multiplied by acceleration. Figure 1 shows how the force arrow starts to get big as the car accelerates rapidly at first. As it begins to move, the air acts with force against the car, which increases as the car gains speed. This aerodynamic tractive force acts in the opposite direction to the tyre force that drives the car, so it is subtracted from this force, so there is less force available for acceleration. Finally, the car reaches its maximum speed, the point at which it can no longer accelerate. At this point, the driving force equals aerodynamic drag, and no force is left over to speed up the car. If you've ever tried to release a really tight lug nut on your car, you know a good way to do a lot of torque is to place the key so that it's horizontal, and then stand at the end of the key – this way you use it weight at a distance equal to the length of the key. If you were to place the key with the handle facing straight up, and then stand on top of the handle (assuming you could keep your balance), you wouldn't have a chance to release the chip. You can just stand right on the nut. This content is not compatible on this device. Figure 3. Simulated dynamometer test of two different engines Advertising Click here for the big version. Figure 3 shows the maximum torque and power generated by two different engines. One of the engines is the caterpillar c-12 turbocharged diesel engine. This engine weighs about 2,000 pounds, and has a displacement of 732 cubic inches (12 liters). The second engine is a highly modified Ford Mustang Cobra engine, with a displacement of 280 cubic inches (4.6 liters); it has an added supercharging charger and weighs about 400 pounds. Both produce a maximum of about 430 horsepower (hp), but only one of these engines is suitable for pulling a heavy car. This is partly due to the above-mentioned power and torque curve. When the animation pauses, you'll see that the Caterpillar engine produces 1,650 lb-ft of torque at 1,200 rpm, or 377 hp. At 5600 rpm, the Mustang engine also makes 377 horsepower, but it only does 354 lb-ft of torque. If you've read an article about gear ratios, you might be thinking of a way to help a Mustang engine produce the same 1,650 lb-ft torque. If you could zoom in on the Mustang by 4.66:1, the output speed would be (5,600/4.66 rpm) 1,200 rpm, and the torque would be (4.66*354 lb-ft) 1,650 lb-ft - exactly the same as a large Caterpillar engine. Now you may wonder why large trucks don't use small gas engines instead of large diesel engines? In the above scenario, the large Caterpillar engine loaths at 1200 rpm, nice and slow, producing 377 horsepower. Meanwhile, a small gas engine screams along at 5,600 rpm. A small gas engine will not last too long at this speed and power. The truck's large engine is designed to last for years and has run hundreds of thousands of miles every year. Thanks for all the emails, comments in the forum, and comments on other forums (I'm looking at you, Slashdot!). Since the article was so widely read-more widely read than the first two articles in the series–I got a number of questions and comments that deserve some processing. Let's dive into them. Cool article. Are there other articles? I'm glad you asked. Solar power: A month later is the third in a series of articles I've written on my personal exploration of solar power. The original article, Checking Out Solar Energy addressed my initial thinking on the subject, including the reasons why, plus the tender. The second in the series, Going Solar: Installation discussed the process of physical installation. How much did it cost? I'm talking about the cost in the first two articles, but put round numbers, the total cost of the system was roughly $55,000 before the discounts. The California Solar Initiative kicked in about $11,500, which brought our out-of-pocket cost up to $43,500. My wife's company has a deal with Sunpower, so she qualified for another $4,750 discount. This brought our final cost up to about $38,750. Again, these are round numbers, but quite close to the mark. We'll also get another $2,000 tax break when we file our 2009 tax return. Continued... Wind power is now as cheap as coal, and in some places solar power is cheaper than natural gas. But there's one thing that most people assume is still holding back renewable energy sources in the U.S.: power plants need a permanent source of energy, and there's not a cheap enough way to store wind or solar on a large scale anymore. But a new study suggests we don't really need to store that energy. Instead-because the wind is always blowing somewhere in the U.S., and a cloudy day in one city will be sunny elsewhere-researchers suggest that we just need a bigger grid, and better power lines that could send power where it's needed. By switching to a national grid and more renewable energy, electricity could actually become cheaper by 2030 and emissions would be reduced by 80% compared to 1990 levels. Sarin Kunthong via Shutterstock In the past, most research has sought to create better storage technology, not power lines. Storage is essential for other industries, such as electric vehicles, so it makes sense that research dollars would go on using the same technology for networks, says Christopher Clack, a researcher at the NOAA Earth System Research Laboratory and one of the paper's co-authors. When they looked at weather maps across the country, scientists noticed that there was a steady supply of wind, just not in one place. They built a detailed computer model that divided the country into 152,000 small squares, connected regions with new power lines, and then calculated the best locations for new wind or solar power plants. Then they told the model to find the cheapest way to reduce emissions. It is a conservative model, so if a similar system were actually built, it could actually reduce emissions even more. The model was a deliberately cost-optimized solution, clack says. This means that there was no carbon restriction and we did not invoke demand management or storage. Technologies will always improve, which will help reduce emissions. Sarin Kunthong via Shutterstock Since switching to a nationwide network would save an estimated $47 billion, this money could also be invested in new carbon-free technologies. The cost of electricity would remain the same as it is today, but emissions would fall more. If the net went even further-pulling in the water and other renewable sources can go even lower. Storage technologies are getting cheaper, and the World Energy Council predicts that it will fall by another 70% over the next 15 years. But the model looked at the high voltage lines that are available and affordable today. The technology is cheaper than storage, can be produced today in large quantities and has proven results here in the US and abroad, says Clack. It will also facilitate a much larger electricity market–as opposed to storage–so it will allow economies of scale, and access to higher production resources. Storage, on the other hand, will not give any access to cheap resources-it will simply allow the generation to shift over time. At the Paris climate talks, the U.S. pledged to cut total emissions by 28% by 2025. The shift in the electricity grid, which is responsible for 40% of all emissions, could go even further. However, this would be a major political challenge because of the fragmentation of the electricity networks that are now being set up. The researchers liken it to a project such as the construction of national railways or the interstate highway system. Doing that would be hugely ambitious at a time when the U.S. Congress is having trouble passing the annual federal budget, but Clack remains optimistic that this kind of network could be built. It creates a larger market and throughout history has helped economies grow and reduce electricity costs. The fact that it reduces electricity costs and reduces emissions is acceptable to everyone, he says. Says.

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