

POWER-WORK-ENERGY

Units 10 & 11 Dr. John P. Cise,

Professor of Physics, Austin Com. College, 1212 Rio Grande St., Austin Tx. 78701 jpcise@austincc.edu & New York Times, August 5, 2016 by Tom Voelk, Dedicated to my Brother Dr. M. D. Cise, who owns an efficient Prius.

Decent Handling in a Toyota Prius? Yes, the New One 2016



ANSWERS: (e) Comment: The computed efficiency of ~53 % computed is in the range the US EPA reports electric Hybrid car's efficiency are at. Gasoline Turbo cars are about 40% efficient. Fuel injected engines are about 40% or less efficient. All electric cars can be as high as 60 % efficient. The US government goal in the 2020s is to have cars at 54.5 MPG by 2025. This Prius is already at 54 MPG. This MPG is quite good. Dr. Cise

INTRODUCTION: Power output = work output/time = W_{OUT}/t
Power input = work input/time = W_{IN}/t

Efficiency = Power output/Power input = X

$$X = P_{OUT}/P_{IN}$$

Thus, $X P_{IN} = P_{OUT} = W_{OUT}/t$

$$\text{Efficiency} = X = W_{OUT} / P_{IN} t = [1/2 m V^2] / P_{IN} t = X \quad \text{eq. 1}$$

The work output of the Prius 121 HP(P_{IN}) engine (electric + gasoline) goes into useful kinetic energy: $\frac{1}{2} m V^2$. The Wikipedia stated weight of the 2016 Prius is 2903 lb.

QUESTIONS: (a) Find mass of Prius in slugs? (b) Find kinetic energy output of this Prius ? Find K in units of ft. lb., (c) Convert P_{IN} (121 HP) to ft./lb./s.? (d) Find efficiency X of this Prius?, (e) Comment on the efficiency obtained?

HINTS: See introduction. Mass = weight/g , $g = 32 \text{ ft./s.}^2$
1 HP = 550 ft. lb./s. , 60 mph = 88 ft./s. ,

ANSWERS: (a) 90.72 slugs , (b) 351,268 ft./lb.,
(c) 66,550 ft. lb./s., (d) ~ 0.528 or ~ 52.8 % efficient

Toyota has been promising better handling with its cars, and it has delivered with the fourth-generation Prius. While it still does not look like a conventional car, the Prius now handles more like one.

Embraced by progressives.. The new fourth-generation Prius has arrived, continuing the hybrid car's tradition of becoming stingier with gasoline than the previous version. A new Eco model even improves upon the E.P.A. fuel

economy rating of 54 city, 50 highway by an average of 4 miles per gallon. If Prius doesn't look like a traditional car, it drives more like one now. It's quieter with reduced engine roar and less moaning and droning from the continuously variable transmission. A new multilink rear suspension upgrades Prius's ride quality and handling to an average dynamic. The battery, moved from the cargo area to beneath the back seat, is a lithium-ion unit in all but the base model, which uses nickel-metal hydride. **(((Total power output from the 1.8-liter 4-**

cylinder gas engine and two motor-generators is 121 horsepower, so acceleration from 0 to 60 remains in the leisurely 10-second range.))) The

Prius does hybrid kinds of things. **Coasting and braking charges the battery, and the gas engine shuts down at stoplights.** Typically, the car initially pulls away on electric power before the gas engine smoothly feathers in. The EV Mode allows all-electric travel at low speeds for short distances.