

Force • Work • Power Sheet

(Assigned: 11 June 2009 • Due: Monday 22 June 2009)

Use the data you have entered on Worksheet 1 (parts 1 and 2) and find the following:

- 1.) Convert the vehicle's weight to a mass:

$$\text{_____ lbs} \div (2.2 \text{ lbs/kg}) = \text{_____ kg}$$

- 2.) Convert the vehicle's speed from acceleration run:

$$\text{_____ miles/hour} \times \left(\frac{1 \text{ hour}}{3600 \text{ sec}}\right) \times \left(\frac{1609 \text{ meters}}{1 \text{ mile}}\right) = \text{_____ m/s}$$

- 3.) Find the average acceleration of your vehicle:

$$\text{_____ m/s} \div \text{_____ seconds} = \text{_____ m/s}^2$$

- 4.) Find the average Force needed to accelerate your vehicle:

$$F = \text{_____ N}$$

- 5.) Find the distance traveled from rest to max speed:

$$d = \text{_____ meters}$$

- 6.) Find the Work needed to accelerate the car:

$$W = \text{_____ J}$$

- 7.) Find the average Power to accelerate the car:

$$P = \text{_____ Watts}$$

- 8.) Convert the car's maximum Power:

$$\text{_____ h.p.} \times 746 \text{ Watts/hp} = \text{_____ Watts}$$

- 9.) Is (7)
- \leq
- (8) ?

Fuel Economy Sheet

(Assigned: 11 June 2009 • Due: Monday 22 June 2009)

Use the data you have entered on Worksheet 1 (part 4) and find the following:

- 1.) Find the distance traveled on your tank of gas:

$$\text{_____ miles} - \text{_____ miles} = \text{_____ miles}$$

ODOMETER 2ND FILL ODOMETER 1ST FILL MILES TRAVELED

- 2.) Use the number of gallons pumped on your 2
- nd
- fill and find the m.p.g.:

$$\text{_____ miles} \div \text{_____ gallons} = \text{_____ m.p.g.}$$

- 3.) Find the energy content of the gasoline you used:

$$\text{_____ gallons} \times 1.32 \times 10^8 \text{ J/gal.gas} = \text{_____ J}$$

- 4.) Find the approximate number of seconds driving on this tank of gas:

$$\text{_____ minutes} \times 60 \text{ seconds/minute} = \text{_____ seconds}$$

- 5.) Find the Power available from the gasoline used on this tank of gas:

$$\text{_____ J} \div \text{_____ seconds} = \text{_____ Watts}$$

- 6.) Convert the Power from Watts to horsepower:

$$\text{_____ Watts} \div 746 \text{ Watts/h.p.} = \text{_____ h.p.}^\dagger$$

- 7.) Compare this horsepower to the maximum horsepower of your car.

- 8.) Compare this horsepower to the 15 to 50 h.p. needed to cruise at speed.

[†] Note: This horsepower will NOT be correct, which affects the answers to (7) and (8). Why? (Your grade does not depend on answering this question, but you should think about it! This material will be covered when we do Thermodynamics.)

Average Speed Sheet

(Assigned: 11 June 2009 • Due: Monday 22 June 2009)

Use the data you have entered on Worksheet 1 (part 3) and find the following:

1.) Find the distance traveled on your trip:

$$\underline{\hspace{2cm}} \text{ miles} - \underline{\hspace{2cm}} \text{ miles} = \underline{\hspace{2cm}} \text{ miles}$$

ODOMETER END ODOMETER START MILES TRAVELED

2.) Find the clock time traveled on your trip: Estimate?

_____ hours : _____ minutes

- _____ hours : _____ minutes

_____ hours : _____ minutes

3.) Convert the time to seconds:

$$(\underline{\hspace{2cm}} \text{ hours} \times 3600 \text{ sec/hour}) + (\underline{\hspace{2cm}} \text{ min} \times 60 \text{ sec/min}) =$$

_____ seconds

4.) Adjust (3) by subtracting approximate seconds for any stops:

$$\underline{\hspace{2cm}} \text{ seconds} - \underline{\hspace{2cm}} \text{ seconds} = \underline{\hspace{2cm}} \text{ seconds}$$

FROM (3)

STOPS

ADJUSTED TIME

5.) Average Speed in miles per hour:*

$$(\underline{\hspace{2cm}} \text{ miles} \times 3600 \text{ sec/hour})$$

$$= \underline{\hspace{2cm}} \text{ m.p.h.}$$

(_____ sec)

6.) Average Speed in meters per second:

$$(\underline{\hspace{2cm}} \text{ miles} \times 1609 \text{ meters/mile})$$

$$= \underline{\hspace{2cm}} \text{ m/s}$$

(_____ sec)

7.) If you had to adjust the values in (4), recalculate (5) and (6) using the TOTAL time, including the time stopped. Should these speeds be higher or lower?

8.) Consider the route that this trip represents. What was the typical speed limit for this trip? Compare your values from (5)-(7) to this value here.

* Parts 5 and 6 are EQUATIONS. The big line means DIVIDE. Somehow no one figures this out (grin).