

Quiz 1  
February 7, 2005

Name KEY

Score \_\_\_\_\_

Time Started \_\_\_\_\_ Time Finished \_\_\_\_\_

Quiz time is 15 min. Each extra 2 min is 10 % penalty.

1. (2) ~~Work~~ is defined as ~~force~~ times ~~displacement~~. ~~Force~~ is defined as ~~mass~~ times ~~acceleration~~. ~~Acceleration~~ is ~~velocity~~ change in ~~time~~. ~~Velocity~~ is change of ~~displacement~~ in ~~time~~. In the sentences above circle all the physical quantities that have not fundamental units in SI. What is expression of Joule, unit of work, in fundamental SI units?

$$\underline{\text{Joule} = \text{kg} \frac{\text{m}^2}{\text{s}^2}}$$

2. (2) What physical quantity has units of  $[M] [L]^2 / [T]^3$ ?

This is *energy* over *time*, hence this is *power*.

3. (3) For each quantity below write down generic units. Which two of them can be compared? Compare them. For reference: 1 mile = 1.609344 kilometers, 1 gallon = 3.7854118 liters, 1 liter =  $10^{-3} \text{ m}^3$ , 1 lb = 0.45359237 kg.

$$2000 \frac{\text{kg}}{\text{m}^3} = \frac{[M]}{[L]^3}$$

$$30 \frac{\text{mile}}{\text{gallon}} = \frac{1}{[L]^2}$$

$$10 \frac{\text{lb}}{\text{gallon}} = \frac{[M]}{[L]^3}$$

Can compare only first and third.

$$10 \frac{\text{lb}}{\text{gallon}} = 10 \frac{\text{lb}}{\text{gallon}} \cdot 0.453 \frac{\text{kg}}{\text{lb}} \frac{1}{3.785} \frac{\text{gallon}}{\text{liter}} 10^3 \frac{\text{liter}}{\text{m}^3} = 1196 \frac{\text{kg}}{\text{m}^3} \text{ - it is smaller than the first.}$$

4. (3) In the example below express the answer in SI units.

$$4\pi(2 \text{ cm}^2) / (4 \text{ m}^2) = 4\pi \frac{2 \text{ cm}^2}{4 \text{ m}^2} \frac{1}{100^2} \frac{\text{m}^2}{\text{cm}^2} \approx 0.00063 \text{ - (no units!)}$$