

Physics I (PHYS1210)

Sheet (1)

Physics and Measurement

1. Show that the expression  $\mathbf{v} = \mathbf{at}$  is dimensionally correct, where  $v$  represents speed,  $a$  acceleration, and  $t$  an instant of time.
2. On an interstate highway in a region of KSA, a car is traveling at a speed of 38.0 m/s. Is this car exceeding the speed limit of 75.0 mi/h?

3. Newton's law of universal gravitation is represented by:

$$F = \frac{GMm}{r^2}$$

Here  $F$  is the magnitude of the gravitational force exerted by one small object on another,  $M$  and  $m$  are the masses of the objects, and  $r$  is a distance. Force has the SI units  $\text{kg}\cdot\text{m}/\text{s}^2$ . What are the SI units of the proportionality constant  $G$ ?

4. The volume of a wallet is  $8.50 \text{ in}^3$ . Convert this value to  $\text{m}^3$ , using the definition  $1 \text{ in} = 2.54 \text{ cm}$ .
5. Assume that it takes 7.00 minutes to fill a 30.0-gal gasoline tank. (a) Calculate the rate at which the tank is filled in gallons per second. (b) Calculate the rate at which the tank is filled in cubic meters per second. (c) Determine the time interval, in hours, required to fill a  $1\text{-m}^3$  volume at the same rate. (1 U.S. gal =  $231 \text{ in}^3$ )