

PHYSICS 180

Problem set #1

due: 5 PM, Monday, Sept 17th

*"I hear and I forget.
I see and I remember.
I do and I understand."
...anonymous*

(SI units used throughout)

- 1) Megan and Emily read in the *Globe and Mail* that if all the ice (average thickness= 10 km) that currently covers Greenland melts due to global warming, ocean levels around the world will rise by 10 m. Is this plausible?

- 2) i) A particle moves under a set of forces with its position (x) in 1-D as a function of time (t) given by

$$x = am^2t^3 - bc^3Gv^2$$

where m is its mass, c is the speed of light, G is the universal gravitational constant and v is its speed. What are the dimensions of a and b ?

- ii) After a series of experiments, Constantine guesses that the period (T) of a simple pendulum depends on its length (L), the mass of the bob (m), and the acceleration due to gravity at the Earth's surface (g). He postulates that $T = kL^x g^y m^z$ where k is a (dimensionless) number. What are the values of x , y and z and what is the explicit functional form that he deduces for the period?

- 3) i) Alex drops a stone (from rest) off a bridge which is 40 m above a river. He throws a second stone straight down 1 s later and both stones hit the water at the same time. What was the initial speed of the second stone?

- ii) A train is moving along a track with constant speed v_1 . At a certain time its engineer sees a slower train moving with speed v_2 a distance d ahead. What maximum constant acceleration must the engineer employ to avoid a collision?

- 4) Trevor is watching a block on a spring oscillate in one dimension with position as a function of time given by $x = 0.3 \sin 2\pi t$. What is the speed and acceleration of the block at $t = 1$ s? What is the distance the block moves between $t = 0$ and $t = 4.3$ s? What is the average velocity and average speed of the block during this time interval?

Suggested practice problems from Serway-Jewett (S-J):

ch 1: 4, 7, 9, 13, 17, 24, 28, 45, 50, 52, 56

ch 2: 3, 5, 8, 15, 19, 21, 24, 28, 32, 39, 42, 53, 58