Momentum

$J = F \cdot t$

1. A 20kg block sliding at 10m/s hits a wall coming to a stop?
   a. What is the blocks momentum before and after the collision?

   $m \cdot v = p$ $\quad 20 \cdot 10 = 200\ kg\,m/s$ $\quad$ zero.

   b. Was this an elastic or inelastic collision?

   inelastic – loss of all energy

   c. What is the change in energy of the collision?

   $\frac{1}{2}mv^2 = \frac{1}{2}(20)(10)^2 = 1000\ J$

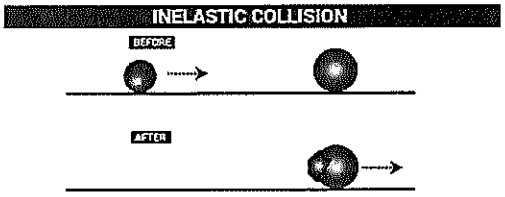
   d. What is the impulse provided by the wall?

   200

   e. The total time of the collision is 0.05sec. What is the force experience by the wall?

   $F \cdot t = J$ $\quad \frac{J}{t} = F$ $\quad \frac{200}{.05} = 4000\ N$

   f. For letter "e" what is the force experience by the block?



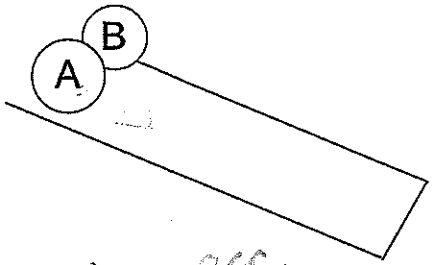
2. A stationary blue ball is hit by a red ball on a frictionless surface. The red ball is moving a Vm/s and has a mass of M_1. The mass of the blue ball is 2M. Derive a formula for velocity of the final mass after the collision? (3 parts)

   $P_i = P_f$

   $m \cdot v + 2M \cdot v = 3M \cdot v_2$

   $\frac{m_1 v_1}{3M} = v_2 = \frac{v_1}{2m} = v_2$

3. Two balls are rolled down a ramp. Ball A is solid ($I = 2/5mr^2$) and ball B is hollow ($I = 2/3mr^2$) Both balls have the same mass and radius.
   a. Which ball will reach the bottom first (A) B, same)
   b. Justify your answer



PE = KE_R + KE_T

↑ ↓

Increased less

KE_R = KE_T

$T = I\alpha$

$\frac{T}{I} = \alpha$ ← equal

↑ Larger I = Slower acc.

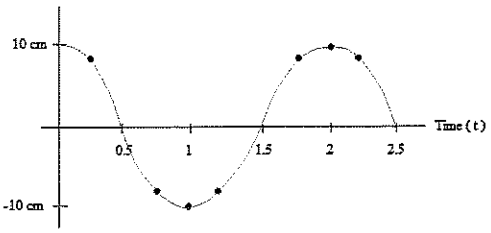
Test ticket: Simple Harmonic Motion and Momentum

Simple Harmonic Motion

*Simple harmonic motion can be simplified down to the tracking the movement around a circle. I turn out that the track also mimics the movement of a pendulum and a spring vibrating. Tracking the movement around a circle (in my opinion) is extremely useful... Sin and cosine wave are simply simple harmonic motion.

.5kg

Above a student sets a block on a horizontal spring and sets it in motion. The motion is tracked a moments later and graphed above. Answer the following questions



a. What is the period of the mass?

2sec

b. What is the frequency?

$\frac{1}{2} = 0.5$Hz

c. What is the spring constant? (Think about what information you have and what formula you might use to find this value?)

$T = 2\pi\sqrt{\frac{m}{k}}$ $\quad \frac{T}{2\pi} = \sqrt{\frac{m}{k}} \Rightarrow \frac{T^2}{4\pi^2} = \frac{m}{k} \Rightarrow k = \frac{m4\pi^2}{T^2}$ $\quad \frac{.5 \cdot 4\pi^2}{4} = 4.9$N/m

d. Using your spring constant, what is the maximum energy stored in the spring?

$U_s = \frac{1}{2}kx^2 = \frac{1}{2}(4.9)(.05m)^2 = 0.006125$J

e. At what time is this much energy stored in the spring? (2 times)

0 sec, 1 second

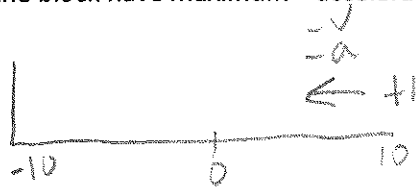
f. If you wanted to find the mass of the block, what piece of information would you need to figure determine? If you don't need anything, then calculate the mass.

g. At what time does the block have maximum + force. (Standard frame of reference.)

@ Max Compression

1 second

h. At what time does the block have maximum – acceleration?



$F \propto a$ $\quad F = ma$