Tute 01- Simple harmonic motion

01. The displacement of a particle   is given by the expression
$x = 1.5 \, \text{Sin} \, (2\frac{\pi}{15} \, t + \frac{\pi}{6})$, where x is in meters and t is in seconds. Determine
(a) the frequency and period of the motion,
(b) the amplitude of the motion,
(c) the phase angles
(d) the displacement of the particle at t = 2 s
(e)The acceleration of the particle at t=5s

02. A 100g particle moves in simple harmonic motion with a period of time 3.0s   and an amplitude of 15.0 cm. Find the force and the acceleration of the particle at the moment of displacement 5cm. calculate the minimum time need to show this displacement.

03. A block of 400g mass is attached to a spring of spring constant 10 N/m and undergoes simple harmonic motion on a horizontal smooth table.
   (a) Find the period of the motion
       If the object stretched 5cm from the equilibrium position
   (b) Find the maximum speed of the object
   (c) Find the maximum acceleration of the object
   (d) Write an expression to show the displacement and the acceleration

04. A mass 3.95kg is oscillating freely on a vertical spring of spring constant 50Nm^{-1}.
A bullet of mass 50g is fired vertically with speed 150ms^{-1} at a wooden block. The bullet hits the block and becomes completely embedded within it. Then the system undergoes simple harmonic motion.
(a) what total distance does the particle move during one cycle of its motion?
(b) What is its maximum speed? Where does that occur?
(c) Find the maximum acceleration of the particle. Where does that occur?
(d) Find the energy loss of the bullet

05. Consider a cylinder of mass M , floating in a liquid of density d. Let the cylinder have a cross-sectional area A and let a length l be below the surface when the cylinder is at rest. It shows simple harmonic motion, when a small force applied on the top of the cylinder. Write an expression for the mass of the cylinder. Show t the cylinder undergoes the simple harmonic motion.