PHYS1131 and PHYS1141 Practice test 1 out of 30

Question 1 (13 marks)

A 2.0 kg particle moves along an *x* axis, being propelled by a variable force directed along that axis. Its position is given by:

$$x(t) = 3.0\ \text{m} + (4.0\ \text{ms}^{-1})t + ct^2 - (2.0\ \text{ms}^{-3})t^3$$

With *x* in meters and *t* in seconds. The factor *c* is constant.

i) Write an expression for the velocity of the particle.

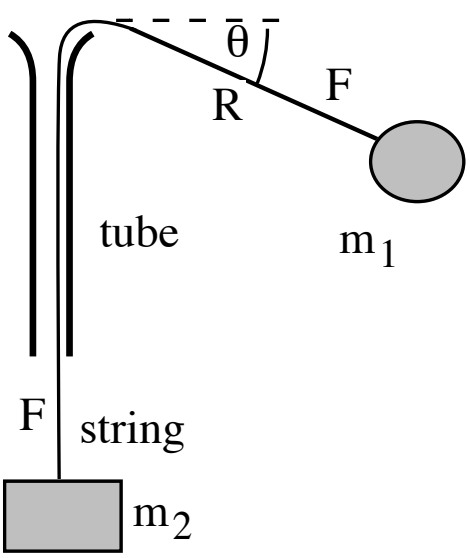
ii) Write an expression for the acceleration of the particle.

iii) At t = 3.0 s, the force has a magnitude of 36 N and is directed in the negative direction of the axis. What is *c?*

iv) At what position on the axis will the particle be at t = 5.5 s?

v) What is the kinetic energy of the particle at this time?

Question 2 (17 marks)



Two masses, m_1 and m_2, are attached to opposite ends of a string that passes through a tube, whose upper end has been smoothed to reduce the sliding friction with the string. The string has tension F. The tube is held vertically and stationary. m_1 is caused to travel in a horizontal circle, in such a way that m_2 does not move. Neglecting the friction between string and tube,

i) Derive an equation for θ in terms of m_1 and m_2.

ii) Derive an expression for the period T of the circular motion of m_1 in terms of the variables given in the question.

iii) State the direction for the normal force N exerted by the tube on the string. Give your answer as Φ, the angle N makes with the vertical. Derive an expression for N in terms of F and Φ. (You may find a it helpful to draw a diagram).

iv) What would be the physical consequence of $m_1 > m_2$ in this experiment, in the case where friction is negligible? A sentence or two is required.

v) Now let's consider finite friction between tube and string. Qualitatively, explain how this affects the answer to part (i). Explain your reasoning clearly.

vi) Think now about your answer to part (i). Comment on the limits of the ratio m_1/m_2 in case of friction between the tube and string.