TUTORIAL QUESTIONS_DYNAMICS 2

Question 1

a.) Distinguish between the mass and weight of a body. State the unit in which each is measured.

b.) In Malaysia, plans are under consideration for launching a satellite by use of a space 22gun. The satellite, of mass 2000 kg, accelerates uniformly along a tube of length 1200 m and reaches a speed of 8000 ms^{-1}. Calculate:

i.) the momentum of the satellite as it leaves the tube

ii.) the time it takes to accelerate along the tube

iii.) the force causing the acceleration

iv.) the acceleration

c.) It would be impossible to use the space gun in (c) for manned space flights. Suggest a reason.

Question 2

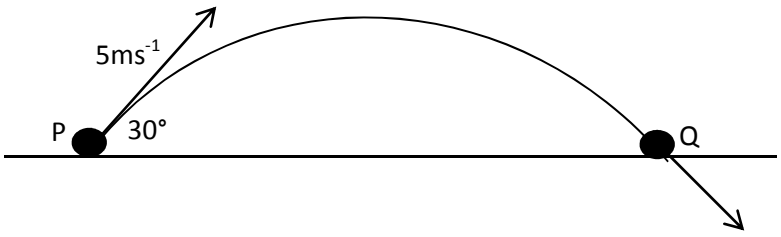
A model helicopter of mass 5.0 kg rises with constant acceleration from rest to a height of 60 m in 10 s. Find the thrust force exerted by the rotor blades during the ascent.

Question 3

A sphere of mass *m* is travelling in a straight line with speed u_1 collides head-on with a stationary sphere, also of mass *m.* The collision is elastic. The final speeds are v_1 and v_2 respectively. Find v_1 and v_2 in terms of u_1.

Question 4

An object of mass 10 kg is thrown from an inclined of 30° from the horizontal with an initial velocity of 5 ms^{-1}.



Find:

a.) The change in momentum of the object at point P and Q.

b.) Find the time taken for the whole projectile.

c.) Using Newton 2nd Law (force = rate of change of momentum), find the magnitude of the force acting on the object.

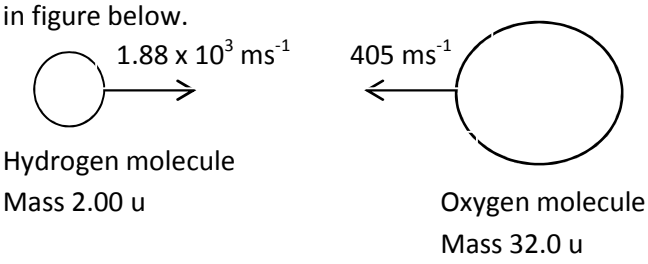
d.) The acceleration of the object.

Question 5

A proton of mass 1.01u travelling with a speed of 3.60×10^4 ms^{-1} has an elastic head-on collision with a Helium (He) nucleus of mass 4.00u, initially at rest. What are the velocities of the proton and helium nucleus after the collision?

Question 6

In a gas a hydrogen molecule, mass 2.00u (unified atomic mass units) and velocity 1.88×10^3 ms^{-1} collides elastically and in a straight line (head-on) with an oxygen molecule, mass 32.0u and velocity 405 ms^{-1} as illustrated in figure below.



Determine the velocities of both the molecules after collision.