

PHYS 1001 - PHYSICS 1 (REGULAR)

Sample Progressive Test

Answers

These are not all full solutions, but answers to let you check to see if you are on the right track. To gain full marks solutions must include explanations, mathematical working etc as appropriate.

Q1

A ball falls because it experiences a downward gravitational force, which gives a downward acceleration. A satellite also experiences a downward gravitational force and thus is continuously falling downward.

In the case of the ball we can assume a flat earth while in the case of the satellite we can't, this is because of the relative height of the two objects. For the ball the curvature of the earth can be ignored. For the satellite, taking the curvature of the earth into account, the direction of the acceleration down keeps changing and is always towards the centre of the earth. The downward gravitational force is towards the centre of the earth, however the satellite has sufficient tangential speed, for it to fall but never reach earth.

Or ANS 2

The satellite is an extension of projectile motion. A satellite is continuously free falling as any object undergoing projectile motion free falls. Keep increasing the range (by increasing initial velocity) and we reach the case of a satellite orbiting the earth.

In the case of the ball we can assume a flat earth while in the case of the satellite we can't.

The satellite has a large enough sideways (or horizontal) velocity that the change in direction of motion (while falling) is such that it stays in orbit.

Q2.

(a) The puck which has the greater acceleration will have the higher average velocity and hence reach the finish line first. Since the pucks are subjected to the same force but have different masses the less massive puck will have the greatest acceleration and will finish first.

(b) By Newton's second law, change in momentum equals the impulse acting. Impulse is force X time. Since the larger mass takes a longer time to reach the finish line and the force is the same for both then the impulse is greater for the larger mass and so is the momentum gained by the larger mass is greater.

As equal forces have moved through equal distances, the same amount of work has been done and the same amount of kinetic energy gained.(Work energy theorem).

$$(K.E.)_{4m} = (K.E.)_m$$

Q3

(c) $h = 2.75 R$