Kinematics Conceptual Questions

Multiple choice Questions

Question 1: A ball of mass *M is* suspended by a string from the ceiling. The Earth pulls down on the ball with a force of magnitude *Mg*. Consider this to be the *action* force in Newton's 3rd Law. What is the *reaction* force?
(A) The string pulling upward on the object with a force of magnitude *mg*.
(B) The ceiling pulling upward on the string with a force of magnitude *mg*.
(C) The string pulling downward on the ceiling with a force of magnitude *mg*.
(D) The ball pulling upward on the Earth with a force of magnitude very much less than *mg*.
(E) The ball pulling upward on the Earth with a force of magnitude *mg*.

Solution -1 (E)
Explanation
When the ball is pulled by the earth with a force of magnitude, as per newton's third law, the earth is also pulled back by the same force

Question 2: Which one of the following pairs of concepts cannot **both simultaneously** be constant and nonzero for a body?

(A) The speed and velocity.
(B) The total distance covered and the displacement.
(C) The magnitude of the acceleration and the acceleration.
(D) The velocity and the acceleration.
(E) None of these.

Solution -2 (d)

Explanation

Speed and velocity can be both simultaneously constant and non zero. Example, Motion in a straight line with constant velocity
Distance covered and displacement velocity can be both simultaneously constant and non zero. Example, Motion in a straight line with constant velocity

The magnitude of the acceleration and the acceleration can also be simultaneously constant and non zero
Velocity is constant when acceleration is zero, so acceleration and velocity cannot both simultaneously be constant and nonzero for a body

True or False statement

3) It is easier to pull the roller on the road then to push
4) Magnitude of Vector **A** –**B** is equal to magnitude of vector **B** –**A** but direction is opposite
5) The speed of the falling object is proportional to its weight or mass
6) A object can have variable speed but constant velocity
7) X and Y are two vectors and **X**.**Y**=-**Y**.**X**

Solution 3 (True)
Explanation
When the roller is pushed, the vertical components of the force applied acts in the direction of gravity and weight of the roller is apparently increased, thereby increasing the friction force. But when the roller is pulled, the vertical components of the velocity acts in opposite direction of weight and weight of the roller is apparently decreased, thereby decreasing the friction force

Solution 4 (True)
Explanation
It is clear from vector diagram

Solution 5 (False)
Explanation
The acceleration of the all falling objects is same, so speed is also constant

Solution 6 (False)
Explanation
By definition of velocity, Constant velocity means speed and direction remains constant. So it is not possible

Solution 7 (False)
Explanation
$X.Y=XY\cos\theta$
$Y.X=XY\cos(360-\theta)=XY\cos\theta$

Multiple choice Questions

Question 8 Two vectors X and Y are there. Vector P = X + Y. when is the resultant vector P having greatest magnitude?

a) When X and Y are perpendicular to each other
b) When X and Y are parallel to each other but in opposite direction
c) When X and Y are parallel to each other and are in same direction
d) The magnitude of P does not depend on the direction of vector X and Y

Solution -8 ©
Explanation
Resultant vector magnitude is given by

$$P = \sqrt{X^2 + Y^2 + 2XYcos\theta}$$

Clearly it will be maximum when θ=0 i.e. Vector are parallel and in same direction

Question 9 When a object is thrown vertically upward, the object will return to its original location. How is the return speed in both the cases given below?
Case I: Air friction is absent
a) Same speed as launch speed
b) Lower speed then launch speed

Solution -9 (a)
Explanation
With air friction absent, the acceleration would be same in both the upward and downward journey, so return speed will be same as launch speed

Question 10 Case II : Air friction is Present
a) Same speed as launch speed
b) Lower speed then launch speed

Solution 10 (b)
Explanation
With air friction present, as an object rises with air resistance, the acceleration is larger in magnitude than g, because both gravity and air resistance will be causing a downward acceleration. As the object falls with air resistance, the acceleration will be smaller in magnitude than g, because gravity and resistance will be opposing each other. Because of the smaller acceleration being applied over the same distance, the return speed will be slower than the launch speed