

Kinematics

Problems

Question: A particle moves in a straight line according to the relation

$$x=t^3-4t^2+3t$$

Find the acceleration of the particle at displacement equal to zero.

Solution

We need to make use of differential calculus in such question. So acceleration can be found out like this

$$\frac{dx}{dt} = 3t^2 - 8t + 3$$

$$\frac{d^2x}{dt^2} = 6t - 8$$

So it is clear, we can find acceleration if we know the value of t.

Now we need to find the value of t where x=0.

So

$$t^3-4t^2+3t=0$$

$$t(t-1)(t-3)=0$$

so, t=0,1,3

So displacement becomes zero at these values of t

Now acceleration can be found out by using the above derived equation

so, at t=0, a=-8 : t=1, a=-2 : t=3, a=10

Question: Which of the following remain constant during the motion of a projectile fired from a planet?

- A) Kinetic energy
- B) Momentum
- C) Vertical component of velocity
- D) Horizontal component of velocity

Solution (d)

$$KE = (1/2)mv^2$$

$$\text{Momentum} = mv$$

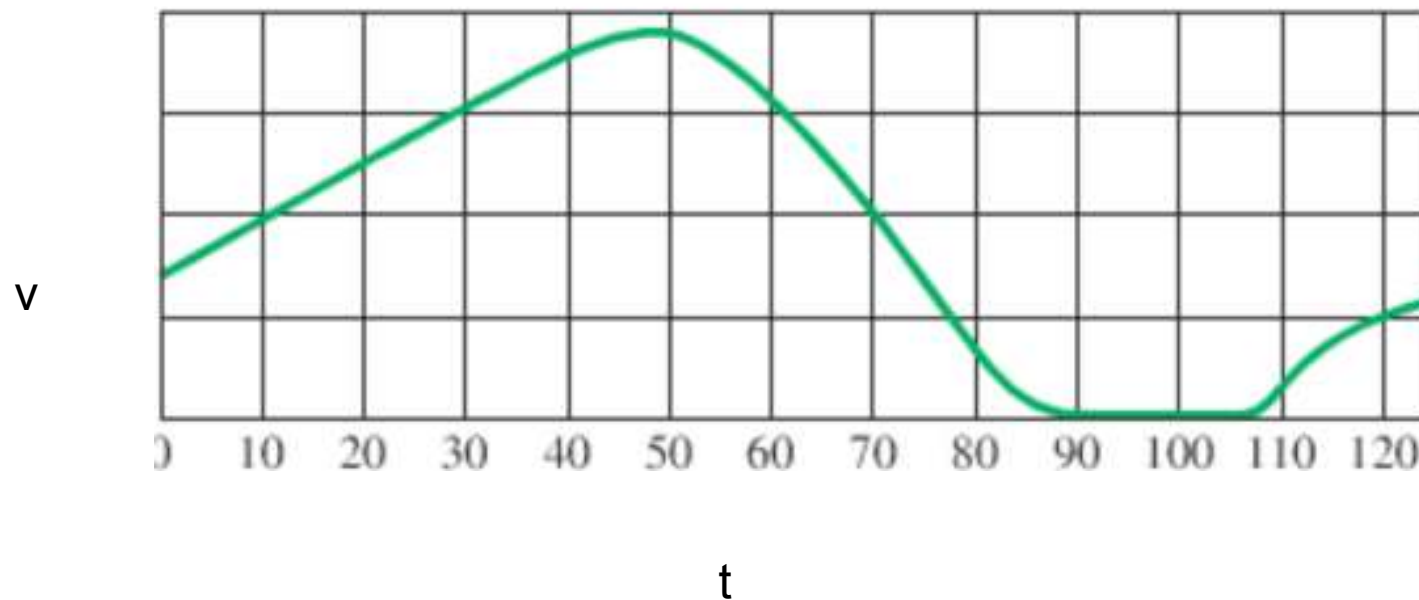
Since acceleration due to gravity acts during the motion, velocity of the body changes through out the motion.

So KE and momentum changes

Now Acceleration due to gravity acts in vertical direction, so vertical component of velocity changes

Since there is no horizontal acceleration, horizontal components remains constant

Graphical question



Explain the acceleration during the motion