

HW  
3/7/2021

# Equations of motion using graphical analysis :-

## Home Assignment

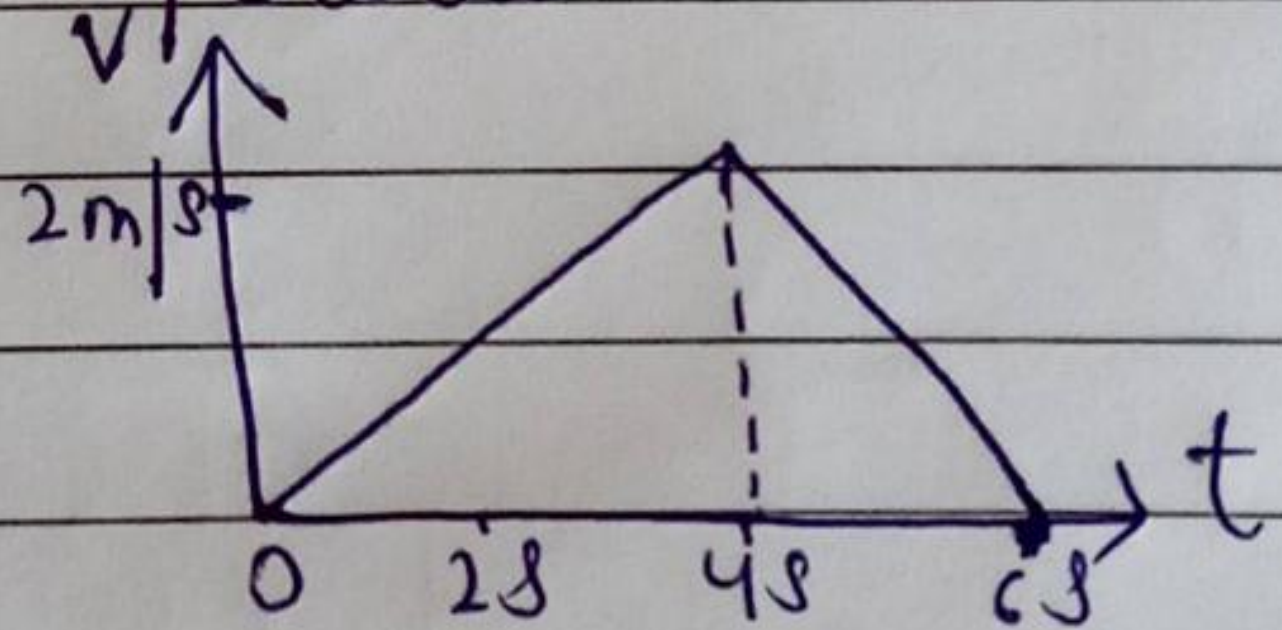
1) The velocity-time graph of a particle moving along a straight line is as shown in figure. Which of the following is/are incorrect for this motion?

Ans) 1) The motion is uniform.

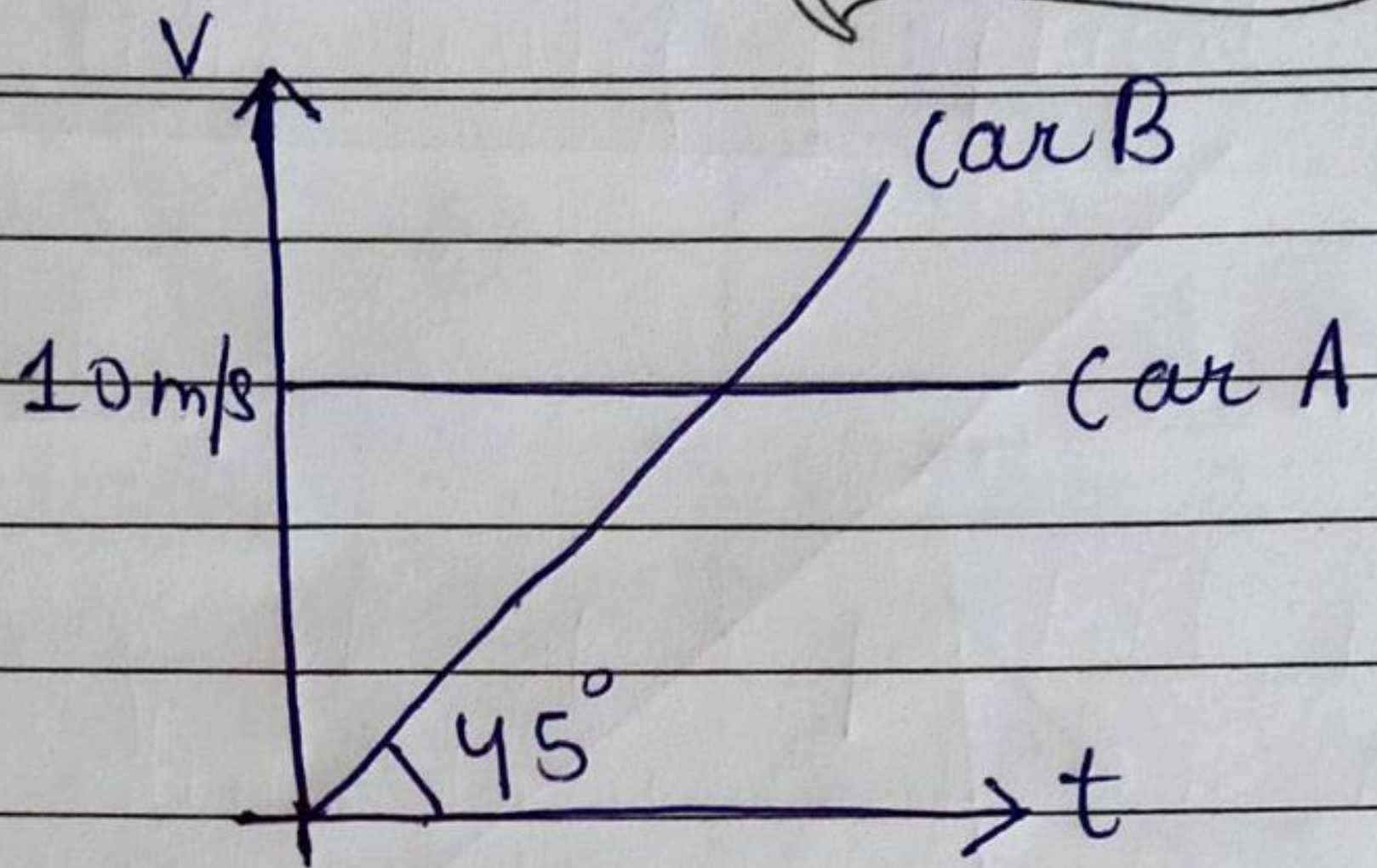
2) The acceleration is uniform.

3) The particle changes its direction of motion.

4) The displacement during the period 0-4 s is equal to the area under the velocity-time graph for this period.



2) Initially car A is 10.5 m ahead of car B. Both start moving at time  $t=0$  in the same direction along a straight line. The velocity-time graph of two cars is shown in figure. Find the time (in sec) when the car B will catch the car A.



Ans) The distance travelled by A is calculated as  $s_A = 10t$  (velocity is given as  $10 \text{ m/s}$ )  
 B is calculated as  $s_B = \frac{1}{2}at^2 = \frac{1}{2}t^2$   
 ( $a_{\text{B}} = \tan 45^\circ = 1$ )

Initially A is  $10.5 \text{ m}$  ahead of B, thus we get

$$\Rightarrow s_A + 10.5 = \frac{1}{2}t^2$$

$$\Rightarrow 10.5 + 10t = \frac{1}{2}at^2$$

$$\Rightarrow t^2 - 20t - 21 = 0$$

$$\Rightarrow t = \frac{20 + \sqrt{400 + 84}}{2}$$

$$\Rightarrow t = 21 \text{ sec}$$

So, the time (in sec) when the car B will catch the car A is 21 sec.

3) Match the situation given in column I with the possible curves in column II

Column - I

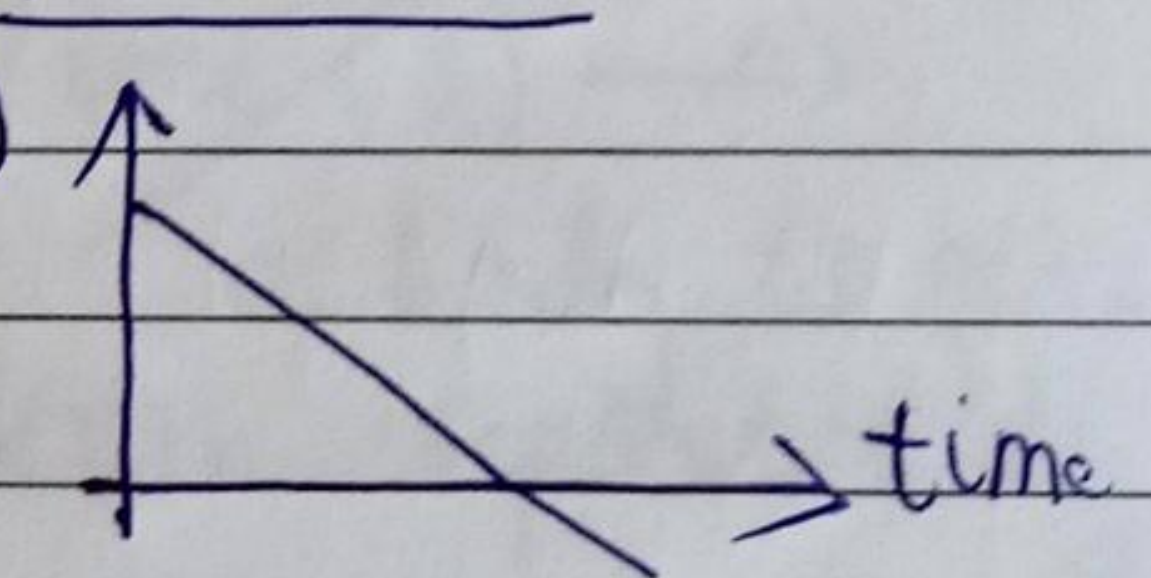
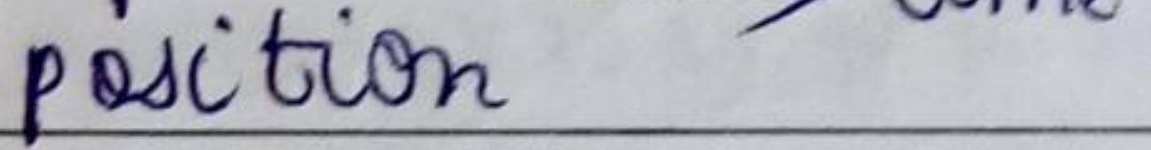
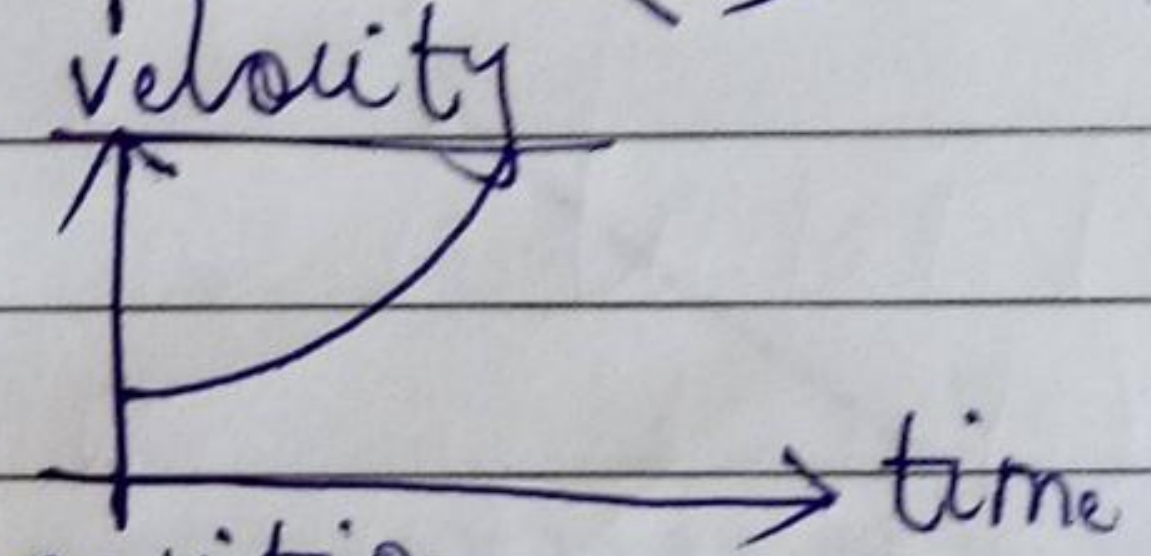
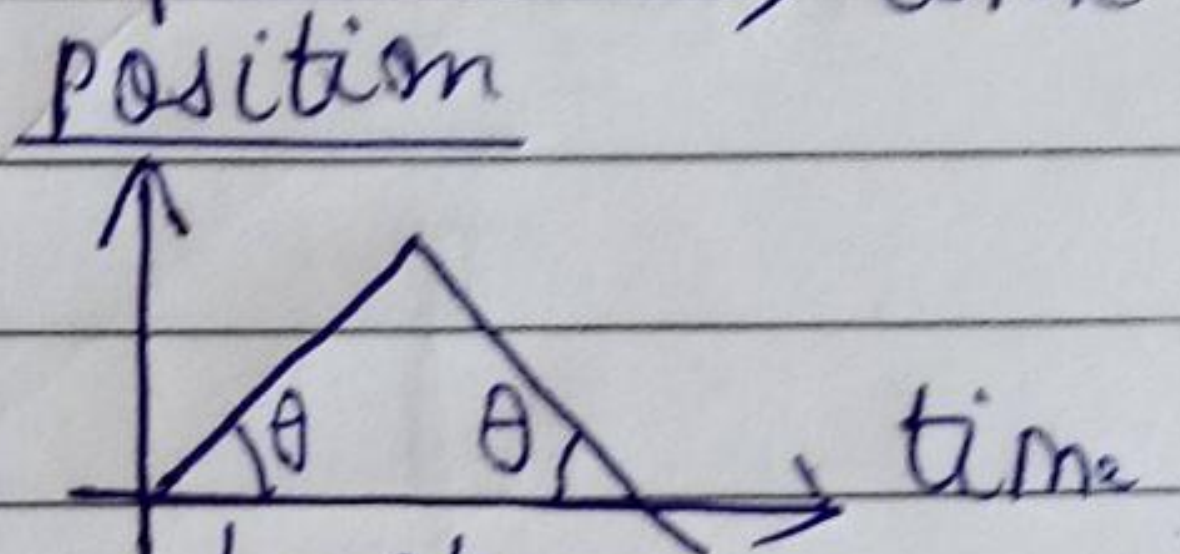
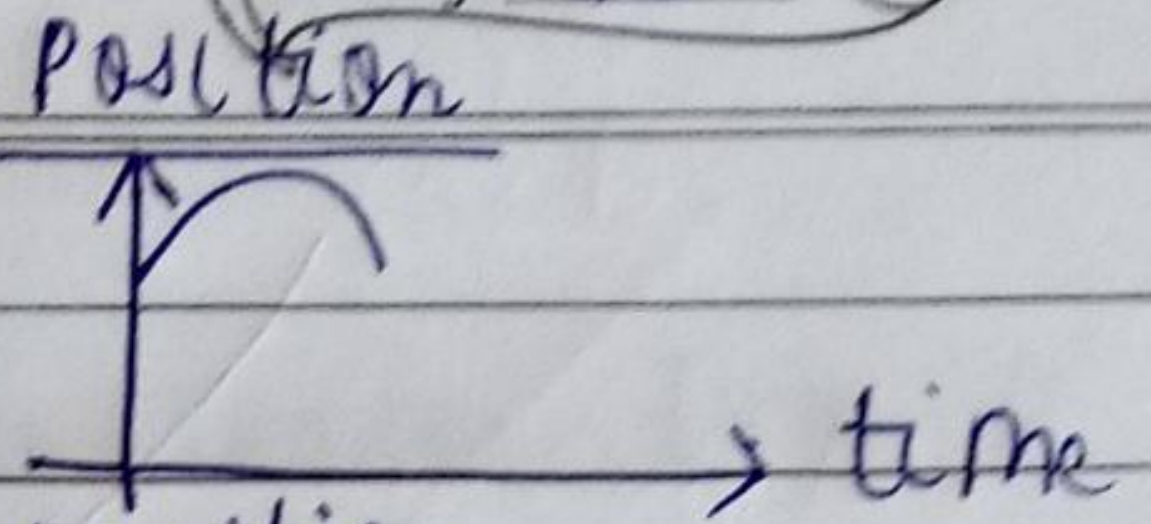
Column II

a) Particle moving with constant speed.

b) Particle moving with constant increasing acceleration.

c) Particle moving with constant negative acceleration.

d) Particle moving with zero acceleration.



4) The velocity - time graph of an object is shown in the figure.

a) State the kind of motion that object has, from A to B and from B to C.

Ans) Uniform motion from A to B and non uniform motion from B to C.

b) Identify the part of graph where the object has zero acceleration. Give reason for your answer.

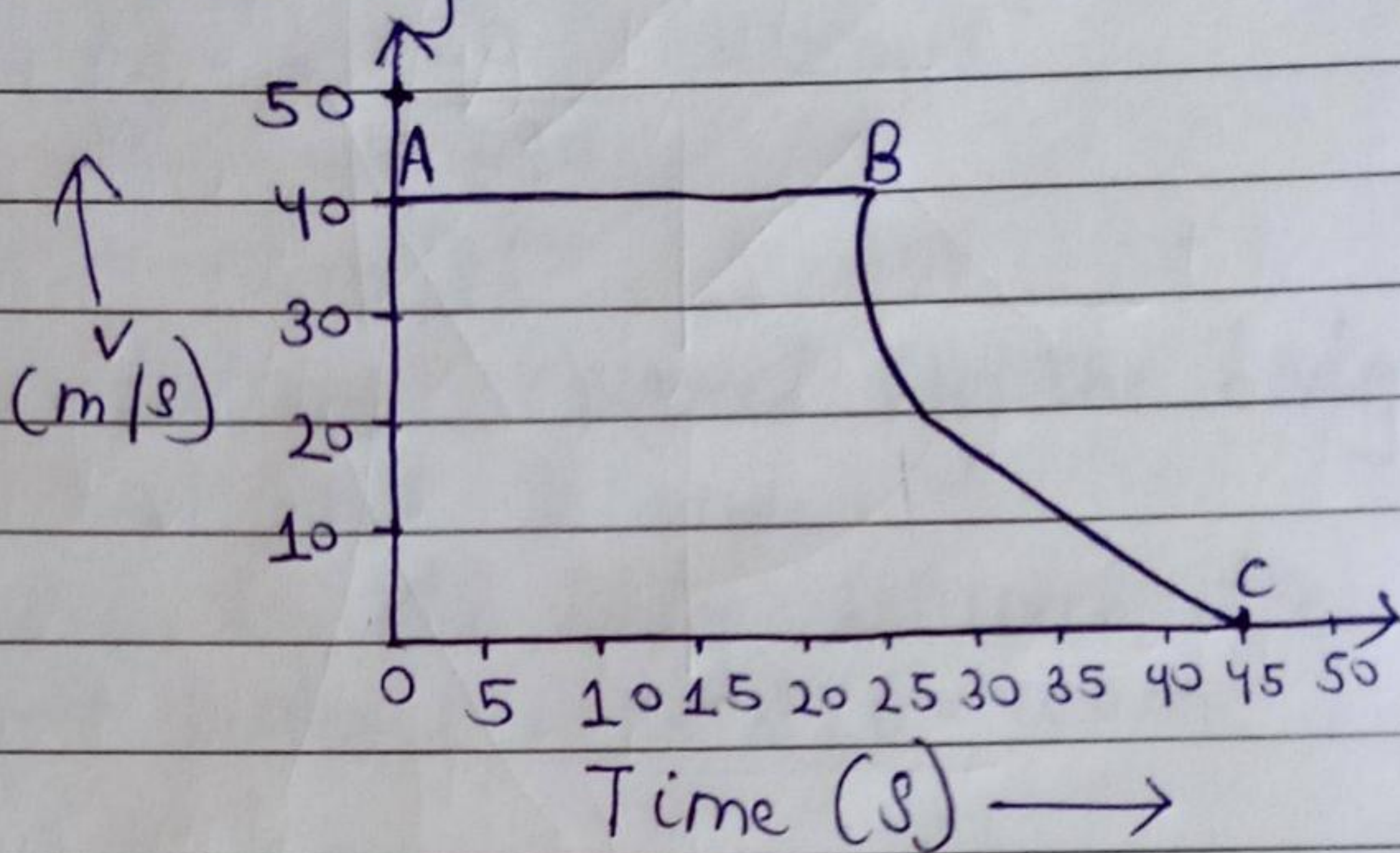
Ans) AB because velocity remains constant from A and B.

c) Identify the part of graph where the object has zero acceleration. Give reason.

for your answer.

Ans) BC because velocity decreases from B to C.

5)



5) The velocity-time graph of a body is given  
i) State the kind of motion reported by OA, AB.

Ans) OA represents uniform acceleration since the slope of OA in the velocity-time graph is having a uniform positive slope. AB represents the uniform velocity of 20 m/s. Since the slope of AB is zero, hence, acceleration is zero.

ii) What is the velocity of the body after 10s and after 40s?

Ans) After 10s, the velocity is 20 m/s up to 30s and after 30s the velocity is uniformly restarted to zero after 40s.

iii) Calculate negative acceleration of the body.

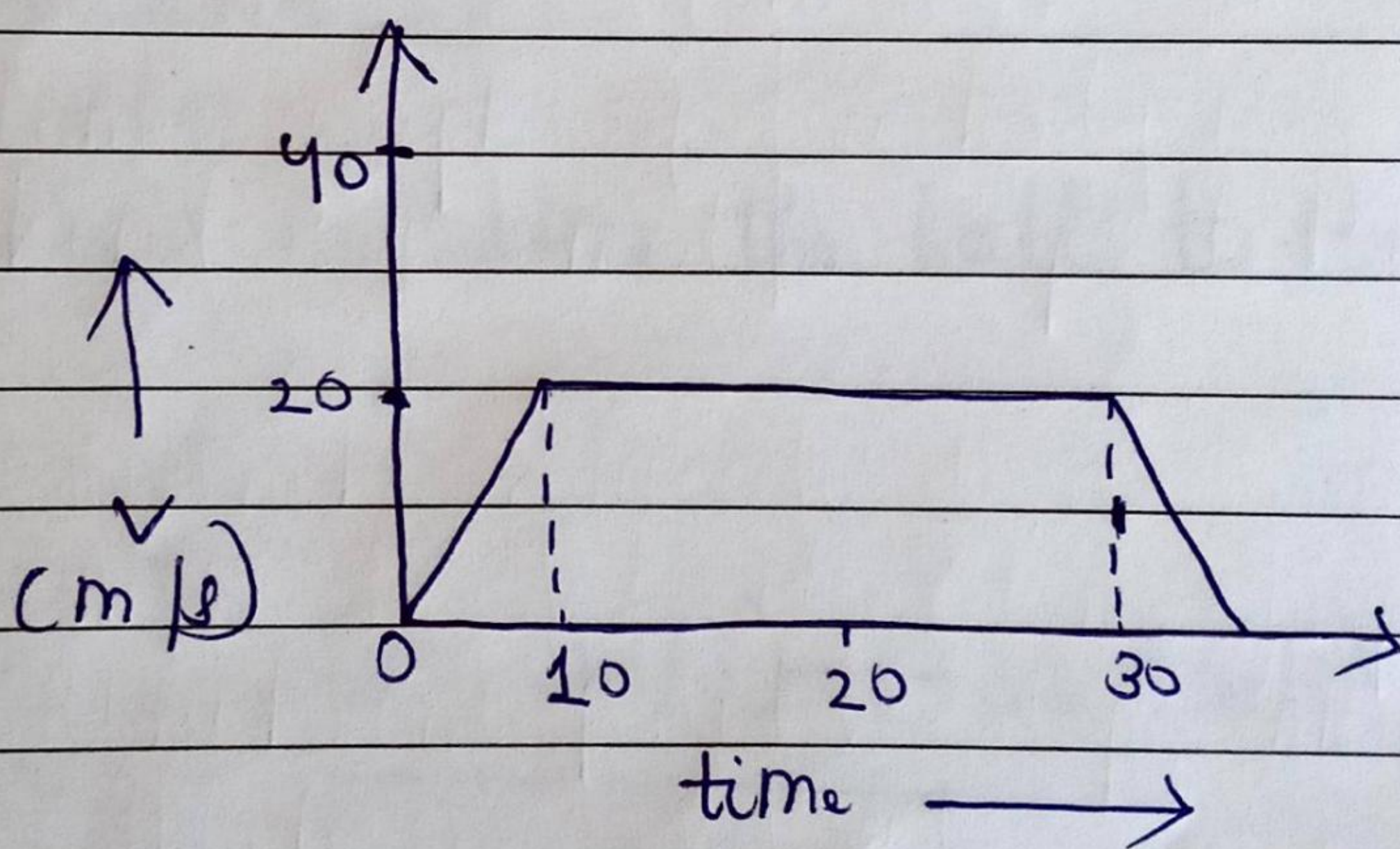
Ans) Retardation is uniform and it is equal to the slope of BC :-

$$\text{Slope of BC} = \frac{BD}{DC} = \frac{20}{40-30} = 2 \text{ m/s}^2$$

$$\text{Acceleration} = -2 \text{ m/s}^2$$

iv) Calculate the distance covered by the body between 10th and 30th second.

Ans) Distance covered by the body between the 10th and 30th second =  $20 \times 20 = 400 \text{ m}$



Ex. Ball