

### QUES 03:-

Particles of masses  $2M$ ,  $m$  and  $M$  are respectively at points A, B and C with  $AB = \frac{1}{2}(BC)$ .  $m$  is much smaller than  $M$  and at time  $t = 0$ , they are all at rest (Figure). At subsequent times before any collision takes place:



- 1)  $m$  will move towards  $2M$
- 2)  $m$  will move towards  $M$
- 3)  $m$  will have oscillatory motion
- 4)  $m$  will remain at rest

**Sol.** 1)  $m$  will move towards  $2M$

We know that gravitational force between two masses separated by a distance  $r$  is given by

$$F = \frac{Gm_1m_2}{r^2}$$

Now,

Force due to  $2M$  at A on B =

$$F_1 = \frac{G(2M)m}{AB^2} \text{ towards A}$$

Force due to  $M$  at C on B =

$$F_2 = \frac{G(M)m}{BC^2} \text{ towards C}$$

Therefore, net force on B

$$F_{\text{net}} = \frac{G(2M)m}{AB^2} - \frac{G(M)m}{BC^2}$$

$$F_{\text{net}} = \frac{4G(2M)m}{BC^2} - \frac{G(M)m}{BC^2} = \frac{7GMm}{BC^2}$$

Towards A

Therefore,  $m$  will move towards A