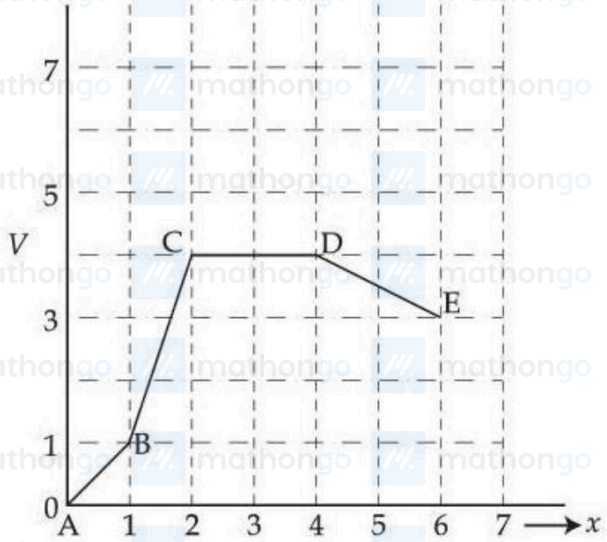
Q1. 21 January Shift 1

Potential energy (V) versus distance (x) is given by the graph. Rank various regions as per the magnitudes of the force (F) acting on a particle from high to low.



(1) $F_{CD} > F_{AB} > F_{BC} > F_{DE}$ (2) $F_{CD} > F_{DE} > F_{AB} > F_{BC}$

(3) $F_{BC} > F_{CD} > F_{DE} > F_{AB}$ (4) $F_{BC} > F_{AB} > F_{DE} > F_{CD}$

Q2. 21 January Shift 2

A body of mass 2 kg is moving along x-direction such that its displacement as function of time is given by $x(t) = \alpha t^2 + \beta t + \gamma$m, where $\alpha = 1$ m/s^2, $\beta = 1$ m/s and $\gamma = 1$ m. The work done on the body during the time interval $t = 2$ s to $t = 3$ s, is ____ J.

(1) 12 (2) 49 (3) 42 (4) 24

Q3. 22 January Shift 2

Given below are two statements :

Statement I: An object moves from position r_1 to position r_2 under a conservative force field $\vec{F}$. The work done by the force is $W = -\int_{r_1}^{r_2} \vec{F} \cdot \overrightarrow{dr}$.

Statement II: Any object moving from one location to another location can follow infinite number of paths. Therefore, the amount of work done by the object changes with the path it follows for a conservative force.

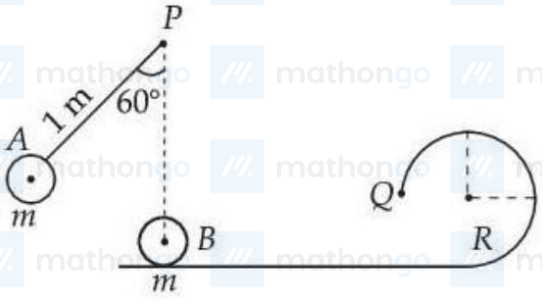
In the light of the above statements, choose the correct answer from the options given below :

(1) Both Statement I and Statement II are false (2) Statement I is false but Statement II is true

(3) Statement I is true but Statement II is false (4) Both Statement I and Statement II are true

Q4. 23 January Shift 1

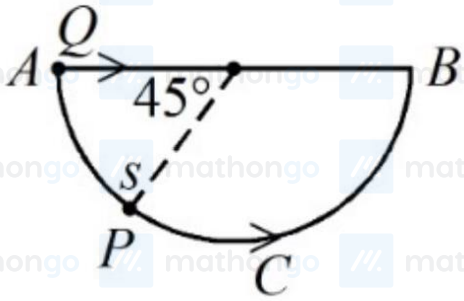
A small bob A of mass m is attached to a massless rigid rod of length 1 m pivoted at point P and kept at an angle of 60° with vertical as shown in figure. At distance of 1 m below point P, an identical bob B is kept at rest on a smooth horizontal surface that extends to a circular track of radius R as shown in figure. If bob B just manages to complete the circular path of radius R upto a point Q after being hit elastically by bob A, then radius R is ____ m.



(1) $\frac{1}{5}$ (2) $\frac{2-\sqrt{3}}{5}$ (3) $\frac{3}{5}$ (4) $\frac{2+\sqrt{3}}{5}$

Q5. 23 January Shift 2

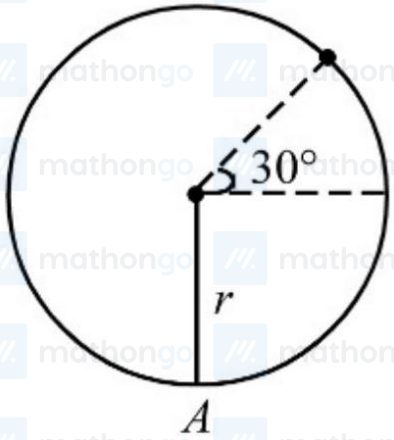
A bead P sliding on a frictionless semi-circular string (ACB) and it is at point S at $t = 0$ and at this instant the horizontal component of its velocity is v. Another bead Q of the same mass as P is ejected from point A at $t = 0$ along the horizontal string AB, with the speed v, friction between the beads and the respective strings may be neglected in both cases. Let t_P and t_Q be the respective times taken by beads P and Q to reach the point B, then the relation between t_P and t_Q is



(1) $t_P < t_Q$ (2) $t_P > t_Q$ (3) $t_P = t_Q$ (4) $t_P > 1.25t_Q$

Q6. 24 January Shift 2

In case of vertical circular motion of a particle by a thread of length r if the tension in the thread is zero at an angle 30° shown in figure, the velocity at the bottom point (A) of the circular path is (g = gravitational acceleration)



(1) $\sqrt{\frac{7}{2}gr}$ (2) $\sqrt{5gr}$ (3) $\sqrt{4gr}$ (4) $\sqrt{\frac{5}{2}gr}$

ANSWER KEYS

1. (4) **2.** (4) **3.** (3) **4.** (2) **5.** (1) **6.** (1)