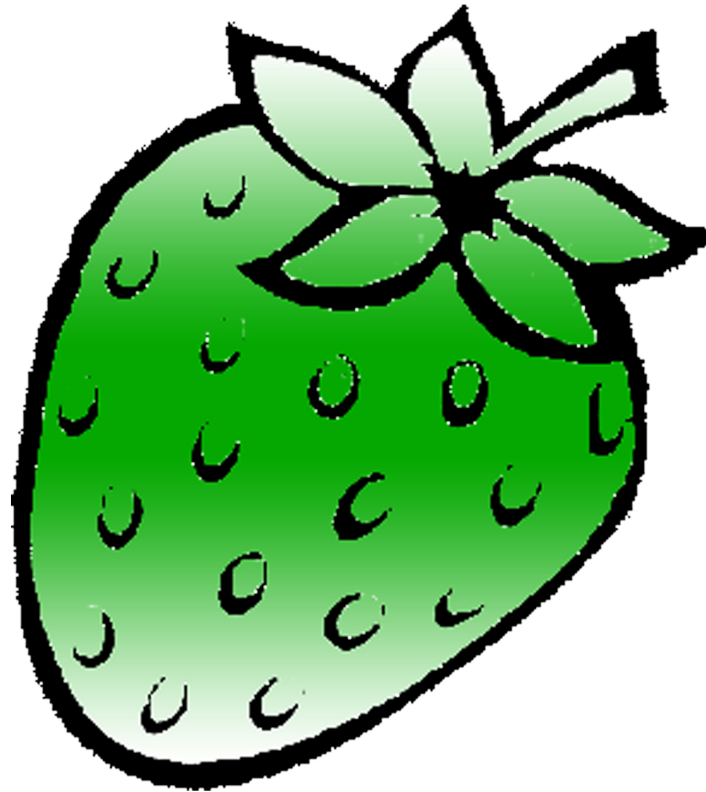


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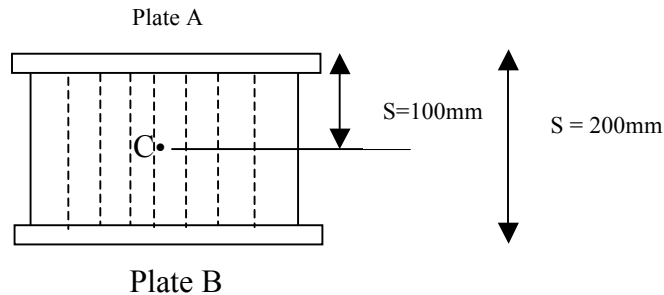
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KINEMATICS OF PARTICLES

1. The acceleration of a particle is defined by $a = kt^2$ (a) knowing that $v = -32$ m/s when $t = 0$ and that $v = 32$ m/s when $t = 4$ sec. Determine k . (b) Write the equations of motion also knowing that $x = 0$ when $t = 4$ sec.
 Ans.: $k = 3$, $a = 3t^2$, $v = t^3 - 32$ m/s, $x = t^4 / 4 - 32t + 64$ m.
2. The acceleration of the particle is defined by the relation $a = 25 - 3x^2$ mm/s². The particle starts with no initial velocity at the position $x = 0$. (a) Determine the velocity when $x = 2$ mm (b) the position when velocity is again zero (c) position where the velocity is maximum.
 Ans. : 9.1655mm/s, $x = 5$ mm, 2, 886mm
3. A particle moving in the +ve x direction has an acceleration. $a = 100 - 4v^2$ m/s². Determine: [a] the time interval and displacement of a particle when speed changes from 1m/s to 3m/s.
 Ans.: $t = 0.245$ s, $x = 0.0506$ m
4. The car moves in a straight line such that for a short time its velocity is defined by $v = (9t^2 + 2t)$ ft/s. Where t is in seconds. Determine its position and acceleration when $t = 3$ sec.
 Ans.: $s = 90$ ft, $a = 56$ ft/s²
5. A metallic particle is subjected to the influence of a magnetic field such that it travels vertically through a fluid that extends from plate A to plate B. If particle is released from rest at C, $s = 100$ m, and the acceleration is measured as $a = (4s)$ m/s², where s is in meters, determine the velocity of a particle when it reaches plate B, $s = 200$ mm, and the time it needs to travel from c to the plate B.
 Ans. : $v_B = 0.346$ m/s ↓, $t = 0.657$ s



6. A particle moves along a horizontal straight line such that its velocity is given by $v = (3t^2 - 6t)$ m/s, where t is the time in seconds. If it is initially located at the origin O, determine the distance travelled during the time interval $t = 0$, to $t = 3.5$ s, the average velocity, and the average speed of the particle during this time interval.
 Ans.: $s_t = 14.1$ m, $v_{avg} = 1.75$ m/s, $(v_{sp})_{avg} = 4.03$ m/s
7. When a train is travelling along a straight track at 2m/s, it begins accelerating at $a = (60 v^{-4})$ m/s², where v is in m/s. determine the velocity and the position of the train 3 s after the acceleration. $V=3.86$ m/s, $x=14.033$ m (T)
8. A particle travels along a straight line path such that in 4 seconds it moves from an initial position $S_a = -8$ m to position $S_b = +3$ m . Then in another 5 seconds it moves from S_b to $S_c = -6$ m. Determine the particles average velocity and average speed during 9 seconds interval.
 Ans. : (i) 8/9 m/s, (ii) 20/9 m/s