Answer on Question #59053 – Math – Differential Equations

Question

1. H grams of artificial sugar in water are being converted into dextrose at a rate which is proportional to the square of the amount unconverted. Find the differential equation expressing the rate of conversion after v minutes given that s grams is converted in v minutes and c being the constant of proportionality.
(a)ds/dv = c(H−s)2
(b) ds/dv = c(H−s)^2
(c) ds/dv/= (s−H)^2
(d) dv/ds/= c(H−s)

Solution

Let amount converted be s, amount unconverted be H-s. Then $\frac{ds}{dv} = c(H-s)^2$.

Answer: (b) $\boldsymbol{\frac{ds}{dv}} = c(H-s)^2$.

Question

2. A vehicle of mass m moves along a straight line (the – axis) while subject to a force indirectly proportional to its displacement x from a fixed point O in its path and 2) a resisting force proportional to its acceleration. Express the total force as a differential equation.

(a) 7md^2/xdt^2=k1/t − k2dx/dt
(b) Md^2x/dt^2=−k1/t−k2d^2x/dt^2
(c) m d^2x/dt^2=−k1/x−k2d^2x/dt^2
(d) M d^−2x/dt^2=−2 k1/x − k2 d^2x/dt^2

Solution

$F = ma.$

$F = -\frac{k_1}{x} - k_2 a; \;\; a = \frac{d^2x}{dt^2}.$

Thus, $m\frac{d^2x}{dt^2} = -\frac{k_1}{x} - k_2\frac{d^2x}{dt^2}$.

Answer: (c) $m\frac{d^2x}{dt^2} = -\frac{k_1}{x} - k_2\frac{d^2x}{dt^2}$.