

ANSWER 1. +

APPLY THE INTEGRAL FORM OF MASS CONSERVATION TO THE CONTROL VOLUME INDICATED BY DASHES.

(A)
$$\frac{d}{dt} \int_{CV} C dV = - \int_{CS} C \vec{V} \cdot \vec{n} dA + \int_{CS} D_n \frac{dC}{dn} dA + S$$

Annotations for (A):

- Under the first term: \emptyset , b/c WE ASSUME steady state
- Under the second term: EVALUATE AT SURFACE SECTIONS ①, ②
- Under the third term: \emptyset , b/c WE PLACE SURFACES ①, ② WHERE $dC/dn = 0$
- Under the fourth term: given

(B)
$$0 = u_1 C_1 A_1 - u_2 C_2 A_2 + S$$

Annotation for (B): $C_1 = 0$

NOTE: FROM CONTINUITY, $u_2 = u_1$, BECAUSE $A_2 = A_1$

(C)
$$C_2 = \frac{S}{u_2 A_2} = \frac{S}{u_1 A_1} = \frac{5^g/s}{(10 \frac{cm}{s})(10 cm^2)} = 50 mg/cm^3$$