

Calculating Total Pressure After Reaction

<https://gemini.google.com/app/7edb574ed2a314c3>

Response: Here is the step-by-step solution to the question:

1. Identify the Reaction Order

Since $A(g) \rightarrow B(g) + C(g)$ is an **elementary reaction** involving a single reactant molecule, it is a **first-order reaction**.

2. Partial Pressure of $A(g)$ After Two Half-Lives

- Initial pressure of $A(g)$ ($t = 0$):

$$P_{A,0} = 2P_0$$

- After 1st half-life ($t = t_{1/2}$):

$$P_A = \frac{2P_0}{2} = P_0$$

- After 2nd half-life ($t = 2t_{1/2}$):

$$P_A = \frac{P_0}{2}$$

3. Partial Pressures of Products $B(g)$ and $C(g)$

The amount (pressure) of $A(g)$ that reacted after two half-lives is:

$$\Delta P_A = 2P_0 - \frac{P_0}{2} = \frac{3P_0}{2}$$

From the stoichiometry of the reaction ($A \rightarrow B + C$):

- $P_B = \Delta P_A = \frac{3P_0}{2}$
- $P_C = \Delta P_A = \frac{3P_0}{2}$

4. Calculate Total Pressure

$$P_{\text{total}} = P_A + P_B + P_C$$

$$P_{\text{total}} = \frac{P_0}{2} + \frac{3P_0}{2} + \frac{3P_0}{2} = \frac{7P_0}{2}$$

Correct Option:

(5) $\frac{7P_0}{2}$
