If 1 l. of gas A combines entirely with 1 l. of gas B to form 2 l. of the gaseous compound C (and all gases are at STP), we can conclude that

a) \( C = A_2B_2 \)
b) \( C = AB \)
c) \( C = AB, \) & the A and B gases’ particles are diatomic molecules.
d) None of the above fits the data given.
The correct answer is (c): \{C = AB, and A and B gases consist of diatomic molecules\} because:

1) The equal volumes of A and B imply the same number of A particles as of B's so that in \(C = A_nB_m\) n must be the same as m. But if \(n = m = 1\) then the C-volume would be 1 l., and not 2 l. as specified. But \(n = m = 2, 3, 4, \ldots\) makes this discrepancy worse, yielding \(\frac{1}{2}, \frac{1}{3}, \ldots\) l. as the final volume. The hypothesis of diatomic A and B molecules provides a resolution by yielding 2 atoms per particle (molecule), twice as many as the same volume of monatomic gas. This provides the needed factor of two in the final 2 l. volume.

2) Also, answer (a), \{C = A_2B_2\} would yield \(\frac{1}{2}\) l. of C, as noted above, not 2 l., and answer (b), C =AB would yield a final C volume of 1 l., not 2 liters.

3) Note that \{diatomic molecules and the formula, C = A_2B_2\}, yield a final C-volume of 1 l., the same as \{C=AB and monatomic A and B\}, so that these resolutions are sometimes not unique. Then other knowledge is needed to resolve the ambiguity. (E.g., What happens if A were diatomic and B monatomic?)