

Find the middle terms in the expansion of $(2x + \frac{1}{x})^8$

1. ${}^8C_4 \times 2^4$

2. ${}^8C_4 \times 2^5$

3. 8C_4

4. None of the above

Concept:

General term: General term in the expansion of $(x + y)^n$ is given by

$$T_{(r + 1)} = {}^n C_r \times x^{n-r} \times y^r$$

Middle terms: The middle terms in the expansion of $(x + y)^n$ depends upon the value of n .

- **If n is even**, then total number of terms in the expansion of $(x + y)^n$ is $n + 1$. So there is only one middle term i.e. $\left(\frac{n}{2} + 1\right)^{\text{th}}$ term is the middle term.
- **If n is odd**, then total number of terms in the expansion of $(x + y)^n$ is $n + 1$. So there are two middle terms i.e. $\left(\frac{n + 1}{2}\right)^{\text{th}}$ and $\left(\frac{n + 3}{2}\right)^{\text{th}}$ are two middle terms.

Calculation:

Here, we have to find the middle terms in the expansion of $(2x + \frac{1}{x})^8$

Here $n = 8$ (n is even number)

\therefore Middle term = $(\frac{n}{2} + 1) = (\frac{8}{2} + 1) = 5\text{th term}$

$$T_5 = T_{(4+1)} = {}^8C_4 \times (2x)^{(8-4)} \times (\frac{1}{x})^4$$

$$T_5 = {}^8C_4 \times 2^4$$