A bag contains 4 red and 6 black balls. A ball is drawn at random from the bag, its colour is observed and this ball along with two additional balls of the same colour are returned to the bag. If now a ball is drawn at random from the bag, then the probability that this drawn ball is red, is

A $\dfrac{1}{5}$

B $\dfrac{3}{4}$

C $\dfrac{3}{10}$

D $\dfrac{2}{5}$

Correct option is D)

Hint: Using conditional probability method.

Step 1: Find the probability of first ball drawn is red or black.

$$P(\text{Second ball red / First ball drawn is black}) = \frac{4}{4+8} = \frac{1}{3}$$

Step 2: Find the probability of second ball drawn is red or black.

$$P(\text{Second ball red / First ball drawn is red}) = \frac{4+2}{6+6} = \frac{1}{2}$$

Step 3: Calculate the probability of second ball being red.

$$\Rightarrow P(\text{First ball black}) \times P(\text{Second ball red / First ball black})$$

$$+ P(\text{First ball red}) \times P(\text{Second ball red / First ball red})$$

$$\Rightarrow \frac{6}{10} \times \frac{1}{3} + \frac{4}{10} \times \frac{1}{2}$$

$$\Rightarrow \frac{2}{5}$$

Hence, $\frac{2}{5}$ is the required probability.