Sometimes it is convenient to construct a system of units so that all quantities can be expressed in terms of only one physical quantity. In one such system, dimensions of different quantities are given in terms of a quantity X as follows: [position] = [position] = $[X^{\alpha}]$; [speed] = $[X^{\beta}]$; [acceleration] = $[X^{p}]$; [liner momentum] = $[X^{q}]$; [force] = $[X^{r}]$. Then

This question has multiple correct options

A $\alpha + p = 2\beta$

B $p + q - r = \beta$

C $p - q + r = \alpha$

D $p + q + r = \beta$

(a, b) Given position, $L = [X^{\alpha}]$

Speed, $LT^{-1} = [X^{\beta}]$

Acceleration, $LT^{-2} = [X^{p}]$

Linear momentum, $MLT^{-1} = [X^{q}]$

Force, $MLT^{-2} = [X^{r}]$

$$\frac{\text{Position}}{\text{Speed}} = \text{time, } T = -\frac{[X^{\alpha}]}{[X^{\beta}]} = X^{\alpha-\beta}$$

$$\text{Acceleration} = \frac{\text{Speed}}{\text{Time}} = \frac{X^{\beta}}{X^{\alpha-\beta}} = X^{p}$$

$X^{\alpha-\beta+p} = X^{\beta}$

$\therefore \alpha + p = 2\beta$

Hence option (a) is correct.

$$\text{Force} = \frac{\text{linear momentum}}{\text{time}}$$

$$[X^{r}] = \frac{[X^{q}]}{[X^{\alpha-\beta}]}$$

$\Rightarrow r = q + \beta - \alpha \Rightarrow r = q + \beta - (2\beta - p)$

$\Rightarrow r = q - \beta + p \Rightarrow p + q - r = \beta$

Hence option (b) is correct.