5.6 A hockey player is moving northward and suddenly turns westward with the same speed to avoid an opponent. The force that acts on the player is

(a) frictional force along westward.

(b) muscle force along southward.

(c) frictional force along south-west.

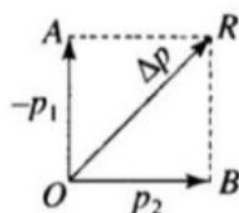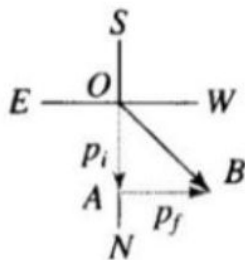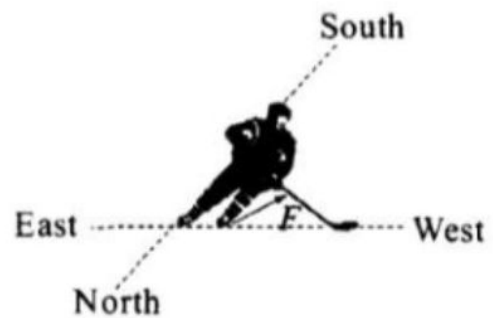(d) muscle force along south-west.

Key concept: According to Newton's second law of motion only external forces can change linear momentum of the system. The internal forces cannot change linear momentum of system under consideration. If we take hockey player as a system, the external force which can change the direction of motion of the player is the force must be friction between the ground and shoes of player. The muscle force is the internal force, this cannot change the linear momentum of the player. According to Newton's Second Law, The rate of change of linear momentum of a body is equal to the external force applied on the body or F = dp/dt .So, the external force must be in the direction of change in momentum.

As shown in the diagram,

Let $OA = p_1$
   = Initial momentum of player northward

$AB = p_2$ = Final momentum of player towards west

Clearly $OB = OA + AB$
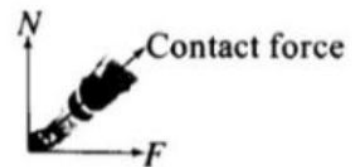
Change in momentum $= p_2 - p_1$
$$= AB - OA = AB + (-OA)$$
$=$ Clearly the change in momentum is OR will be along south-west, so direction of force will also be along south-west.