**Applying Newtons Three Laws to sporting Actions**

In the exam you will be required to relate the laws to a sporting action

**High Jumping**

* The performer applies muscular force to the ground at the point of take off – this results in Ground Reaction Force (3rd Law)
* This alters the performers state of motion (1st law)
* The Ground Reaction Force has large vertical component , which changes the direction of performer from horizontal to vertical.
* The magnitude of the vertical component of GRF governs magnitude of vertical component of the vertical acceleration (2nd law)
* The sprinter uses the same leg muscles but a horizontal force, where as a high jumper uses vertical force.
* The direction in which force is applied governs direction of GRF and therefore the performer.

Sprinting

The performer generates and action/ muscular force that is applied to the ground (3rd law)

This will generate equal and opposite GRF causing the performer to accelerate with a magnitude and direction dependent on the action force.

Whilst the performer is running they are subject to forces such as gravity, friction and air resistance.

Can you draw a free body diagram to show this?

Kicking a ball

Performer kicks the ball and applies a force via muscles and the ball will accelerate (1st law). The magnitude and size of acceleration depends on the magnitude and direction of the applied force.

The ball accelerates in the direction of the applied force (2nd law)

At the same time muscle force applied to the ball, an equal and opposite reaction force is applied by the ball to the foot (3rd law)

As soon as the ball has left the foot it is subject to friction forces.

Use Newtons three laws of motion to explain how a high jumper takes off from the ground (8)

Explain how an ice skater is able to alter her speed of rotation by changing their body shape while spinning (6)