3.2.2 Biomechanical movement

**3.2.2.1 Biomechanical principles**

**Force**

Definition:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

A force might be internal or external. In the human body, muscles act as internal forces, whereas the effect of gravity is external.

The effect that a force has on a body is influenced by three factors:

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (measured in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ). The magnitude of the force refers to the weight of a body. A muscle’s force is determined by the size and number of the fibres contained within any one muscle.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ . If a single force is applied to a body through its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the body will move in the same direction as the force.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ . Applying the force slightly off-centre will produce angular motion - e.g. hitting a snooker ball off centre will create spin.

In sport, a performer must gauge how much force to apply in any given situation. Accuracy relies on good technique.

Select a practical skill of your choice:

1. outline common faults due to poor force application \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. what is the result of this poor technique \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. what coaching points would help to improve the skill \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Newton’s Laws of Motion**

**Newton’s First Law:**

Every object will continue in its state of \_\_\_\_\_\_ or \_\_\_\_\_\_\_, in a straight line, unless acted upon by an external \_\_\_\_\_\_.

(If an object is speeding up, slowing down and/or changing direction, then a force must be acting upon it – consider such forces and their effects in your sport)

**Newton’s Second Law:**

The \_\_\_\_\_\_\_\_\_\_\_ of an object is directly proportional to the \_\_\_\_\_\_\_causing the change, and takes place in the \_\_\_\_\_\_\_\_\_in which the force was applied.

(Consider how, in terms of correct technique, maximum acceleration can be achieved in your sport)

**Newton’s Third Law:**

To every \_\_\_\_\_\_\_\_\_there is an \_\_\_\_\_\_\_\_and \_\_\_\_\_\_\_\_\_reaction.

*(eg drive backwards to move forwards / downwards to move upwards / left to move right etc. Also consider that the reaction force (although opposite in direction) is* ***equal*** *in size therefore the size of the force applied determines the resulting movement)*



Drive left to move right when side-stepping

**STABILITY: INCREASING BALANCE**

1. Push a partner, who takes the following stances:
2. Standing feet together
3. Standing feet apart
4. Bent down on hands and knees spread
5. Standing on one foot

Rank each position, least stable to most stable below:

Least stable 1

2

3

Most stable 4

1. Stand against a wall with your back touching it. Touch your toes.

What happens?

Why?

1. In gymnastics, why is a handstand position a more difficult position than a headstand?
2. You have suffered a knee injury. The doctor provides crutches so that your body’s weight will not be supported by the injured leg. How do crutches provide a useful by-product of increased total body stability?
3. Why is it difficult to walk on stilts?
4. Decide on a sport and think of a situation when the performer needs to be stable.
5. Draw a pin diagram to show the position of the performer.
6. Draw a dot to show the position of the centre of mass.
7. Draw a line of gravity.

KEY POINTS:

|  |  |  |
| --- | --- | --- |
| **FACTORS** | **TO BE UNSTABLE** | **TO BE STABLE** |
| **Size of base** |  |  |
| **Height of Centre of Mass** |  |  |
| **Points of Balance** |  |  |
| **Position of Centre of Mass** |  |  |

Explain how the gymnast is able to hold this balance.

Explain, with reference to stability & balance, why this is a good rugby tackle.

