TEACHERS NOTES:

Science & Diving – Gravity and weight

Sport: Diving

Age group: 7 -11

These notes are designed as a guide on how to lead the session, and are written in a script format. If you wish to lead the session in a different way please feel free to do so.

The **red text** indicates what each slide includes, while the **blue text** highlights the key points being discussed in each slide. The **owl symbol** demonstrates where students are required to perform a task (eg questions, experiment, etc.). These are used to help you observe the students learning and recap any information which the students have found difficult to understand.

Depending on the level of student understanding this module may require two lessons to complete.

Slide 1

Opening slide containing title of session and a picture introducing the subject visually.

The first slide provides the title of the session and a visual introduction to the sport of diving.

Slides 2 & 3 – Diving

A brief introduction to the sport of diving, exploring its history and its inclusion in the Summer Olympic Games.

The sport of diving involves the performing of acrobatics whilst jumping or falling into water, from a platform or springboard of varying heights.

Diving, as an activity, has been around since ancient times and many historical artifacts show this.

Diving as the sport we now recognise, developed in Europe between the late 17th century and the early 19th century. The Swedes and the Germans are credited with pioneering early techniques, turning the sport into a global activity.

The sport has many competitions world wide but is probably most viewed during the Olympic Games. Although diving is not a particularly popular participant sport, diving is very popular with spectators. This is due to the athletes displaying many of the same characteristics and skills as dancers and gymnasts. Divers must have strength, flexibility, grace and be both very physically and technically able.

Fact
Tom Daley competed for Great Britain at the Beijing Olympic Games 2008, in several different diving events. He was only 14 years old when he competed.

The 1904 Summer Olympic Games in St Louis, USA, was the first time diving was included in the Olympic Games roster, where the 10 m platform for men was won by home-town hero George Sheldon, a 30-year-old eye doctor. The 2000 Summer Olympic Games in Sydney saw the men's and women's synchronised diving events added to the schedule and in the Beijing Olympic Games in 2008 all but one of the diving competitions were won by Chinese athletes.

Tom Daley, a British competitor at the Beijing Olympic Games, took part in a number of the diving competitions including a synchronized event and the individual 10 m platform event. He was only 14 years old when he competed at the Beijing Olympic Games.

Diving is not just a sport, it is extremely popular as a recreational activity and people can be seen all over the world having fun jumping and diving into water. It is extremely important that the water is deep enough to dive into and should always be done under supervision.

Slide 4 – Diving and how it links to science through gravity

Diving, which is considered to be one of the most spectacular sports, especially from the world of water sports, can only happen due to science.

The world of science is responsible for the forces which act on us everyday and some of these forces we are not even aware of. Have you ever wondered why we don't just float up off the ground or why we can't fly? The reason for this is because of an invisible force which acts on us all of the time. This force is known as Gravity.

The link between the sport of diving and science through exploring the force of gravity is examined in this slide.

Gravity can basically be described as an attractive force between two objects with mass. The gravity we experience on Earth is the force between an object and the Earth pulling each other towards themselves. As the Earth is so big in comparison to the objects on it, it appears as though an object is attracted towards the Earth, when an object falls or is dropped. In fact the Earth is also being pulled toward that object but the force is so small in comparison that the Earth is not appearing to move at all.

Gravity therefore appears to pull an object towards the centre of the Earth. The force is not so strong that things actually keep heading right for the centre of the Earth as opposite forces react against this force and stop this happening. It is easy to see this force in action by doing something as simple as dropping your pencil from your hand. The pencil does not float in the air, it falls until it either hits the ground or something else breaks its fall.

The force of gravity is essential to the sport of diving. Just imagine if someone jumped off the diving board and then never fell towards the water...

Gravity acts on the diver pulling them towards the water. The force is strong but not so strong that the diver hits the water instantly. Gravity pulls the diver towards the water and as the diver falls they accelerate, or fall faster, as the effects of gravity take greater affect. The diver has to perform their dive, with twists, turns and somersaults before they have been pulled into the water by the force of gravity.

Slides 5 – Weight

Exploring weight and explaining that weight is actually a force.

Key Point
Weight is measured in Newtons. Kilograms and stone are actually measurements of mass.

Gravity is a force which acts on an object or person, such as a diver, and gives that object weight. Weight is actually a force and is measured in Newtons. Often it is mistakenly given in measurements such as kilograms or stone. These measurements actually refer to the mass of an object. The weight of an object can change depending on other forces acting on the object, whereas the mass of an object stays the same no matter what other forces are acting on that object.

The weight of an object on Earth is the force that object is applying (or pushing downwards) towards the Earth's centre. The more mass an object has on Earth the greater the force downwards towards the Earths centre it has and therefore it is considered to have a greater weight.

Slide 6 – Different weights under different gravitational situations

Gravity on Earth and on the Moon.

Gravity is the force which pulls an object towards the earth as we have discussed. Gravity doesn't just occur on the earth however. It can be seen in action, for example, on the moon, but to a lesser extent.

Have you ever seen a clip of a spaceman walking on the Moon? Here the spaceman can take giant steps and can jump much further than they could on Earth. This is because the gravitational force on the Moon is less than on Earth, meaning that the weight of the spaceman is much less so they can move much greater distances. To give the spacemen more weight they add items of clothing with big masses. An example of this being the space or moon boots the spacemen wear. These items have a very large mass and if worn on Earth would be far too heavy for the spacemen to move about with them on.

Key Point
Gravity does not just occur on the Earth. The Moon, for example, is another place where gravity occurs. The force of gravity on the Moon is less than on the Earth.

The reduced force of gravity on the Moon means that objects are pulled toward the Moon with less force and so more slowly than they are on Earth. Therefore if a diver was to perform a dive on the Moon they would have far more time to do their somersaults, twists and turns. More extravagant and spectacular dives could therefore be performed. The divers would have a few other problems however, as there is no oxygen on the Moons surface for them to breath, and no water for the divers to land in.

Slide 7 – Weight in water

The effect water has on an objects weight.

Why is water important to divers? Water acts as a cushion to the divers, acting against the force of gravity and slowing the divers down as they enter the water.

Key Point
An object weighs the same in water as it does in air. The object appears to weigh less in water than in air because the up thrust of water – the force of water acting against an object upwards – is greater than the up thrust of air. This up thrust of force on the object against the downward pull of gravity on the object gives the effect of an object weighing less.

If gravity is always pulling things towards the centre of the Earth then how does water slow the diver down when they enter the pool and why do divers not go straight into the bottom of the dive pool?

Water actually provides an upward up thrust of force. The divers' weight stays the same and gravity is still pulling the diver downwards. However the upward force of the water is stronger than the downward pull of gravity meaning that the diver is actually pushed upwards. (This takes a bit of time as the diver first slows down and then is pushed back up). The diver appears to weigh less in water, but actually they weigh the same as in air. The difference is that the upward thrust of water is much stronger than the upward thrust of air.

Distribute the 'student handout worksheet' and allocate 20 minutes for the students to attempt the questions on the worksheet. The questions are related to the all of the slides.

Slides 8 - 11 – Worksheet answers

Go through the answers to the worksheet, with the students, with the use of these slides. Recap any areas where students have particularly struggled, to ensure learning takes place.

The slides can be used to cover the answers to the questions in a group situation or can be printed off and kept by the students for revision purposes.

1. What is the invisible force that pulls objects towards the Earth or causes objects to fall?

The invisible force that pulls things downwards towards the Earth is gravity.

2. Weight is actually a force acting on an object. What is this force measured in?

Weight is measured in Newtons.

3. Why can a spaceman take such giant steps on the Moon and what do spacemen do to overcome the reduced gravity they experience on the Moon?

The force of gravity is weaker on the Moon than it is on Earth allowing spacemen to take much bigger steps or jump further before they are pulled back to the ground again. To try and overcome this space or moon boots, which have a very large mass, are worn. The increase of mass this provides effectively gives the spacemen more weight, as there is a greater mass for the gravity on the Moon to act on.

4. Would it be possible for a spaceman to perform a more or less complicated dive on the Moon, if there was air and water present, or on the Earth? Explain your answer.

If a spaceman could dive on the Moon, then they would be able to perform a far more complicated dive. This is because there is a smaller force of gravity acting on the diver, on the moon, meaning they would be pulled back towards the ground more slowly than if on Earth. The extra time in the air would allow them to complete more twists, turns and somersaults and so a more complicated dive.

5. Explain why objects appear to weigh less in water than they do in air.

An object weighs the same in water as it does in air as it is still experiencing the same gravitational force on it pulling it towards the centre of the Earth. Water produces an upward force, known as up thrust, against an object placed in/on it. This force can be strong enough to act against the downwards force of gravity causing the object to appear to have less weight than when in air. Air also produces an up thrust force on an object but this is far less than the force water produces.