Get Started: Workbook and Worksheet Resource Pack. Written to match the 2016 Edexcel specification

Maarit Edy and Matthew Hunter
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Levers

A lever system is a rigid bar or object that moves around a fixed fulcrum with two forces applied to it.

All levers have three key elements to them. Explain, in your own words, the role of each of the elements in a lever.

Fulcrum: .................................................................................................................................

Effort: ........................................................................................................................................

Load: ...........................................................................................................................................

There are three classes of lever. It is the positioning of each element that determines which type of lever it is. Sketch out a lever diagram for each class of lever, labelling the fulcrum, effort and load and giving an example from the human body.

First class lever

Example from the human body: ...................................................................................................

Second class lever

Example from the human body: ...................................................................................................

Third class lever

Example from the human body: ...................................................................................................
2.1 Levers

A lever system is a rigid bar or object that moves around a fixed fulcrum with two forces applied to it.

All levers have three key elements to them. Complete the sentences to explain the role of each of the elements in a lever.

**Fulcrum:** A fulcrum is a fixed ..........................................................................................................

**Effort:** The effort is the source of the ..........................................................................................

that will do the ...............................................................................................................................

**Load:** The load is the ................................................................. to be moved.

There are three classes of lever. It is the positioning of each element that determines which type of lever it is. Sketch a diagram for each class of lever, labelling the fulcrum, effort and load and giving an example from the human body.

**First class lever**

Example from the human body: ........................................................................................................

**Second class lever**

Example from the human body: ........................................................................................................

**Third class lever**

Example from the human body: ........................................................................................................
There are two main benefits of lever systems:

1. ............................................................................................................................
   ............................................................................................................................

2. ............................................................................................................................
   ............................................................................................................................

The benefit of a lever is tied to whether it operates at mechanical advantage or mechanical disadvantage. This is determined by the length of the load arm and the length of the effort arm.

Complete the flow diagram to outline the link between levers and mechanical advantage/disadvantage.

Explain why mechanical disadvantage can have sporting benefits.

........................................................................................................................................
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There are two main benefits of lever systems:

1. Large ________________ can be moved with a relatively small amount of ________________.

2. The ________________ a load can be moved or the ________________ with which it can be moved can be increased without an increase in ________________.

The benefit of a lever is tied to whether it operates at mechanical advantage or mechanical disadvantage. This is determined by the length of the load arm and the length of the effort arm.

Complete the flow diagram to outline the link between levers and mechanical advantage/disadvantage.

### LEVERS

#### Load arm longer than effort arm
- Does this give mechanical advantage or mechanical disadvantage?
- __________________________________________________________________________
- __________________________________________________________________________
- Which lever class/classes give this?
- __________________________________________________________________________
- __________________________________________________________________________
- Where is an example in the body?
- __________________________________________________________________________
- __________________________________________________________________________

#### Effort arm longer than load arm
- Does this give mechanical advantage or mechanical disadvantage?
- __________________________________________________________________________
- __________________________________________________________________________
- Which lever class/classes give this?
- __________________________________________________________________________
- __________________________________________________________________________
- Where is an example in the body?
- __________________________________________________________________________
- __________________________________________________________________________

Explain why mechanical disadvantage can have sporting benefits.
- __________________________________________________________________________
- __________________________________________________________________________
- __________________________________________________________________________
- __________________________________________________________________________
- __________________________________________________________________________
- __________________________________________________________________________
Starting in the middle of the concept spiral and working outwards, write down everything you know about levers. The further you get from the middle, the more detailed your knowledge should become. Use a pencil, so that you can make corrections.

Revision technique: concept spiral
Writing down everything you know about a topic helps you commit it to memory, and using a concept spiral, or something similar, encourages you to think about what you know in a logical order beginning with general information and getting more specific and detailed.

Do you like this technique? Does it work for you? 😊😊😊
2.4 Exam practice: levers

Here is a chance to practice a couple of exam questions. Make sure you consider the command word used and look at how many marks the question is worth.

1. Which one of the following describes a third class lever?

<p>| | |</p>
<table>
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<tbody>
<tr>
<td>A</td>
<td>The load is to the right of the fulcrum</td>
</tr>
<tr>
<td>B</td>
<td>The effort is in the middle of the lever</td>
</tr>
<tr>
<td>C</td>
<td>The load is in the middle of the lever</td>
</tr>
<tr>
<td>D</td>
<td>The fulcrum is on the left of the lever</td>
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(Total for Question 1 = 1 mark)

2. When sprinting, the knee joint of a footballer uses a third class lever system. Examine the role of the lever in affecting the footballer’s running performance. (3)

(Total for Question 2 = 3 marks)
Planes and axes can be used when describing movement patterns. Explain what a plane and an axis are:

**Plane:**

**Axis:**

Using the human outlines below, draw on the planes and axes.

<table>
<thead>
<tr>
<th>Frontal plane and sagittal axis</th>
<th>Transverse plane and vertical axis</th>
<th>Sagittal plane and frontal axis</th>
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<tr>
<td><img src="image1" alt="Frontal plane and sagittal axis" /></td>
<td><img src="image2" alt="Transverse plane and vertical axis" /></td>
<td><img src="image3" alt="Sagittal plane and frontal axis" /></td>
</tr>
</tbody>
</table>

There are three very well-known examples of whole body movements that use planes and axes.

- Cartwheel  frontal plane  sagittal axis
- Twist  transverse plane  vertical axis
- Somersault  sagittal plane  frontal axis

Construct a memory aid for each example to help you link the information and allow you to remember the plane, axis and example together.

C  F  S

T  T  V

S  S  F
2.6 Planes and axes: extended writing answer analysis

Let’s have a look at an extended writing question for planes and axes of movement.

Read the high-level answer provided below and:

1) Highlight the key terms and important information.
2) Add notes around the outside to define key terms, add any extra detail and comment on things you like about the style of the answer. Imagine you are marking this person’s answer for them.
3) Use the ‘2.7 Planes and axes: extended writing planning sheet’ to reverse plan an answer. Transfer the key information from the answer into the planning sheet. This will help you think about how you might approach answering a similar question in a structured way.

Using examples, evaluate how knowledge of different movement planes and axes can assist a gymnast in performing specific movements correctly. (9)

There are three planes and three axes, which are used to describe movements. A plane is an imaginary line dividing the body into two, and an axis is an imaginary line around which the body can turn. Movements occur around axes and within planes.

When looking at planes, there is the frontal plane, dividing the body into front and back, the transverse plane, which splits the body into top and bottom, and the sagittal plane, which splits the body into left and right. The axes are the sagittal axis, which goes through the body from front to back, the vertical axis, which goes from head to toe, and the frontal axis, which goes through from side to side.

Within gymnastics, different skills will operate around different axes and within different planes. Many moves will use a combination of planes and axes, like a twisting somersault, for example. However, three moves take place very clearly in planes and around axes.

A good cartwheel or side somersault should take place in the frontal plane, around the sagittal axis. This means that the skill will take place in a side-to-side rotation without movement forwards or backwards. A good twist jump or pirouette spin should take place in the transverse plane around the vertical axis. Finally, a good tucked front somersault should take place in the sagittal plane around the frontal axis, which will mean that there is no sideways movement or twisting. Knowledge of this will allow the gymnast to perform movements correctly.

When trying to perform movements correctly, planes and axes are important. They are also considered when a routine is being marked. Movements should take place in a neat manner. The cartwheel, twist jump and front somersault should be seen to occur purely around the one axis and perfectly within the specific plane that they should move in. If movements stray into the wrong plane, then the skill cannot have been perfectly performed and, therefore, scores will be lower. The best routines will have no unwanted movements and will contain movements that take place purely in the desired planes and around the desired axes.
Let’s have a look at an extended writing question for planes and axes of movement.

Read the high-level answer provided below, paying particular attention to the key terms and important information that has been highlighted. Then use the '2.7 Planes and axes: extended writing planning sheet' to break the question down by transferring the key information from the answer into the planning sheet. This will help you to think about how you might approach answering a similar question in a structured way.

Using examples, evaluate how knowledge of different movement planes and axes can assist a gymnast in performing specific movements correctly. (9)

First part, which goes into top box (A01) on planning sheet.
There are three planes and three axes, which are used to describe movements. A plane is an imaginary line drawn dividing the body into two, and an axis is an imaginary line around which the body can turn. Movements occur around axes and within planes.

When looking at planes, there is the frontal plane, dividing the body into front and back, the transverse plane, which splits the body into top and bottom, and the sagittal plane, which splits the body into left and right. The axes are the sagittal axis, which goes through the body from front to back, the vertical axis, which goes from head to toe, and the frontal axis, which goes through from side to side.

Second part, which goes into middle box (A02) on planning sheet.
Within gymnastics, different skills will operate around different axes and within different planes. Many moves will use a combination of planes and axes, like a twisting somersault for example. However, three moves take place very clearly in planes and around axes.

A good cartwheel or side somersault should take place in the frontal plane, around the sagittal axis. This means that the skill will take place in a side-to-side rotation without movement forwards or backwards. A good twist jump or piroouette spin should take place in the transverse plane around the vertical axis. Finally, a good tucked front somersault should take place in the sagittal plane around the frontal axis, which will mean that there is no sideways movement or twisting. Knowledge of this will allow the gymnast to perform movements correctly.

Final part, which goes into bottom box (A03) on planning sheet.
When trying to perform movements correctly, planes and axes are important. They are also considered when a routine is being marked. Movements should take place in a neat manner. The cartwheel, twist jump and front somersault should be seen to occur purely around the one axis and perfectly within the specific plane that they should move in. If movements stray into the wrong plane, then the skill cannot have been perfectly performed and, therefore, scores will be lower. The best routines will have no unwanted movements and will contain movements that take place purely in the desired planes and around the desired axes.
It is almost certain that AO1 (knowledge and understanding), AO2 (application) and AO3 (analysing and evaluating) will all be tested in an extended writing question. To make sure that you can access all nine marks, you should consider how you tackle each Assessment Objective in your answer.

To practice this, transfer the key information from the answer on ‘2.6 Planes and axes: extended writing answer analysis’ into the planning boxes below in bullet point format.

<table>
<thead>
<tr>
<th>AO1: Knowledge and understanding of the raw content</th>
<th>AO2: Application of planes and axes knowledge to gymnastics example</th>
<th>AO3: Conclusion highlighting importance of planes and axes in assessment of gymnastics routine</th>
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<tr>
<td>Discussion of planes and axes in general terms</td>
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<tr>
<td>Using examples, evaluate how knowledge of different movement planes and axes can assist a gymnast in performing specific movements correctly. (9)</td>
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