**Y13 A level Mathematics**

**41 Moments 1 week**

## Teaching objectives

**a** To realise that a force can produce a turning effect

**b** To.know that a moment of a force is given by the formula force × distance giving Nm and know what the sense of a moment is

**c** To understand that the force and distance must be perpendicular to one another

**d** To.be able to draw mathematical models to represent horizontal rod problems

**e** To realise what conditions are needed for a system to remain in equilibrium

**f** To be able to solve problems when a bar is on the point of tilting

**Resources for advance preparation:**

**Mechanics powerpoints free on TES -** [**https://www.tes.com/teaching-resource/mechanics-1-powerpoints-6395198**](https://www.tes.com/teaching-resource/mechanics-1-powerpoints-6395198)

**Lots of A level resources for mechanics -** [**http://www.resourceaholic.com/p/mechanics.html**](http://www.resourceaholic.com/p/mechanics.html)

**sets of questions on moments -** [**https://www.tes.com/teaching-resource/a-level-maths-mechanics-moments-worksheets-6147420**](https://www.tes.com/teaching-resource/a-level-maths-mechanics-moments-worksheets-6147420)

**questions by topic -** [**http://www.physicsandmathstutor.com/past-papers/a-level-physics/aqa-unit-2-by-topic/**](http://www.physicsandmathstutor.com/past-papers/a-level-physics/aqa-unit-2-by-topic/)

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|  | **Starter** | **Main teaching**  Including key questions, key teaching points, models and resources | **Notes**  Including Support and Extension | **Consolidation/Plenary**  Including key questions and homework |
| **1** | Have metre rules / counting sticks on desks. Students hold a ruler for 30 secs in different places. Once at the end, once ¼ in and once in the middle. Discuss how they found each situation | From the starter discuss moments as turning forces about a fixed point. Then formalise how to calculate a moment and the units used.  Use diagrams on the board and emphasise that the force and distance must be perpendicular. Mymaths has some good interactive diagrams on this [https://app.mymaths.co.uk/892-resource/moments sections 1,2](https://app.mymaths.co.uk/892-resource/moments%20sections%201,2) of the lesson  Ask students to think about and discuss any real life uses or examples of moments. Use the classroom door to further emphasise the ease with which you can open it if far from the hinge.  Then look at more than 1 force – use the introduction part of the interactive activity below to explore moments using more than 1 force and balancing <https://phet.colorado.edu/sims/html/balancing-act/latest/balancing-act_en.html> | Ensure that from the very start a moment is always referred to as a turning force and that it also has a direction of either clockwise or anti clockwise. | As a class play the ‘balance me’ game from phetcolarado  <https://phet.colorado.edu/sims/html/balancing-act/latest/balancing-act_en.html> |
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| **2** | Use some of the higher level balancing questions from the phet colarado game either print out for groups to do or discuss as a class. | Start with consolidation of more than 1 force on a light rod. Using questions from the textbooks / online / mymaths or just put on the board.  <https://app.mymaths.co.uk/892-resource/moments>  Then use the MEI investigating moments investigation to further consolidate the concepts so far.  <http://mei.org.uk/files/sow/40-moments-res.pdf>  only basic resources needed such as rulers, weights, bluetack | Extend to giving the moment and students find a missing force / distance. A good opportunity for them to make up questions for each other.  Ensure students consider accuracy of their findings and consider ways to improve their experiments. They can then consider how they would extend these experiments | As a class discuss / review some of the questions students made for each other involving missing distances / weights.  Homework – practice from old book resources before moving onto pivots next lesson |
| **3** | Have a ruler /rod set up with two pivots under it set up and a weight on the ruler. Students draw a diagram of it with all forces acting on it. Then discuss as a class and draw out the concept of the reactions at the pivots | Following the starter introduce resolving as a key strategy in questions involving rods on pivots.  Look again at the 2 pivots and a weight. Explore with the class what happens as the weight is moved about, and its effect on the reactions at the pivots.  Explore the concept of tilting about a pivot - Where to move the weight to get a zero reaction at a pivot? And what assumptions have you made?  Consolidate this through questions from old resources | Make sure to discuss any assumptions such as a uniform rod, fixed pivots etc. | Following the homework from last lesson this would be a good time to set 2 differentiated homeworks students can choose from. |
| **4** | Discuss as a class the meaning of non uniform relating to a rod or beam. Put on the board a simple one pivot problem for students involving a single weight and non uniform beam to go through. | Consolidate questions and introduce non uniform bodies with multiple forces / more than one pivot.  Mymaths homework would be good to spend time looking at now  <https://app.mymaths.co.uk/892-homework/moments>  also nice structured questions to go through on this TES powerpoint <https://www.tes.com/teaching-resource/mechanics-1-powerpoints-6395198> | If using the powerpoint avoid the examples involving forces at angles as they are no longer needed | Go back to the <https://phet.colorado.edu/sims/html/balancing-act/latest/balancing-act_en.html>  And play the highest level of the game to consolidate so far. |
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| **5** | Students write down the hardest question they have been able to do so far and also a specific concept of moments they still think they need to work on. Discuss as a class. | Questions / assessment to finish the topic  Lots of good questions here <https://www.tes.com/teaching-resource/a-level-maths-mechanics-moments-worksheets-6147420> | Students should be working to support each other on these questions with those who have really grasped this topic helping others. | An end of topic assessment would be good here. There are some on TES to buy or making use of old resources / textbooks would also work. |