

# **DYNAMICS**

## **Lesson plans**

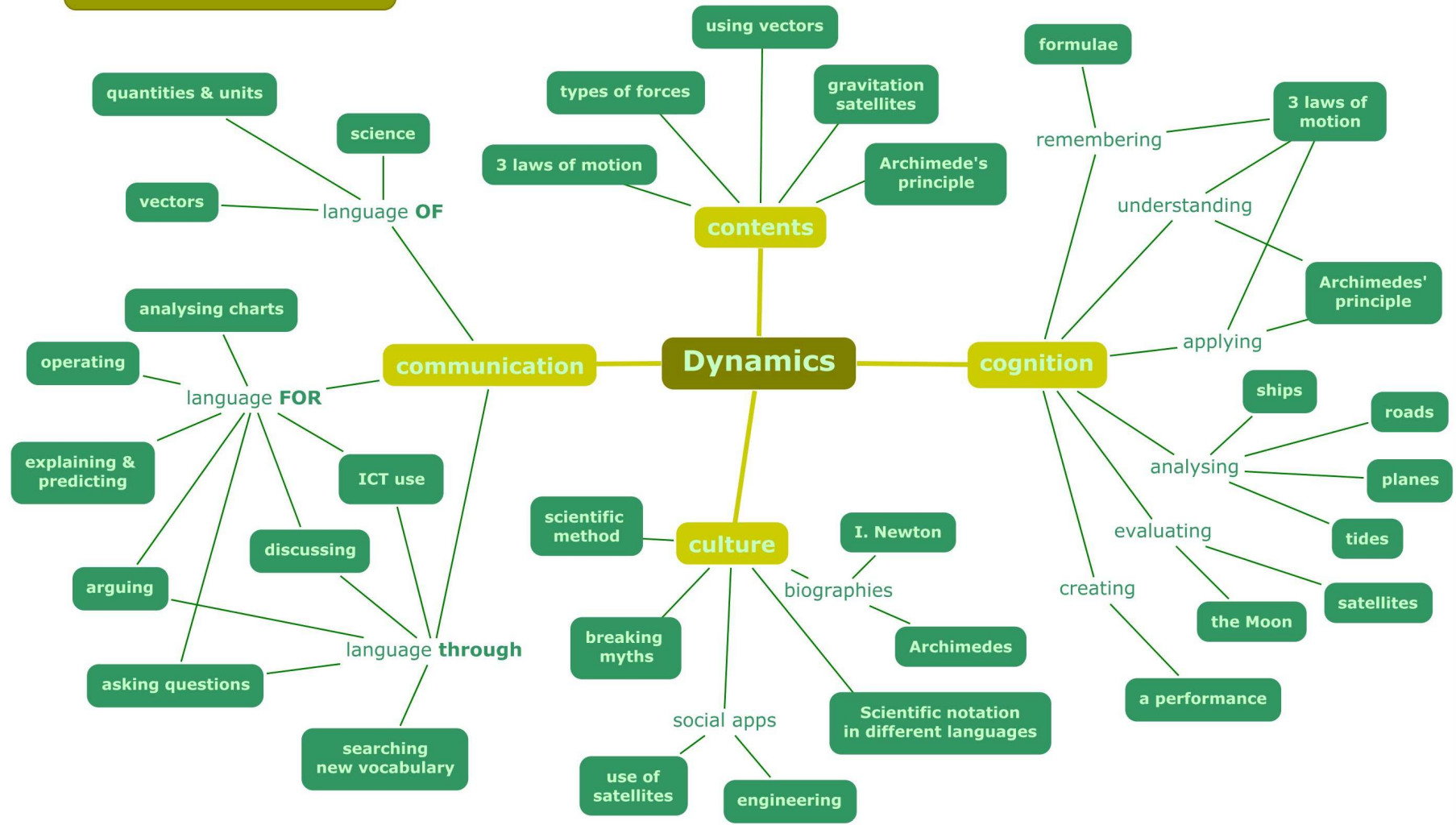
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- Autumn 2009 -

**Vision:**  
Students discovering the basis of classical physics



It is not easy to find a universal way to present a lesson plan, so that the ones being described in this file can be adapted to the teacher preferences. I've chosen this structure based on the 4 Cs, the language OF, FOR and THROUGH and the Cummin's matrix. The lesson plans have been organised as follows:

## Unit 2: Dynamics

### Lesson X:

|                |                     |
|----------------|---------------------|
| <b>Topic</b>   |                     |
| <b>Subject</b> | Physics & Chemistry |
| <b>Level</b>   | 4 <sup>th</sup> ESO |
| <b>Timing</b>  |                     |
| <b>Aims</b>    |                     |

| Content                    |  |                          |  |
|----------------------------|--|--------------------------|--|
| <b>Teaching Objectives</b> |  | <b>Learning Outcomes</b> |  |

| Cognition                  |  |                          |  |
|----------------------------|--|--------------------------|--|
| <b>Teaching Objectives</b> |  | <b>Learning Outcomes</b> |  |

| Communication      |                     |                         |
|--------------------|---------------------|-------------------------|
| <b>Language OF</b> | <b>Language FOR</b> | <b>Language THROUGH</b> |

| Culture |  |
|---------|--|
|         |  |

| Assessment Criteria |  |
|---------------------|--|
|                     |  |

| Tasks |  |  |  |  |
|-------|--|--|--|--|
|       |  |  |  |  |

| Cummins matrix |                                                                                                                                                                                                                                                                                                                                    |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                | <p>The Cummin's matrix enables the teacher to locate each activity in a chart such as the shown on the left.</p> <p>Activities are then categorised according to its linguistic content (high or low) and the kind of thinking involved (HOT or LOT).</p> <p>Idealistically, activities should evolve from point 1 to point 2.</p> |



## Unit 2: Dynamics

### Lesson 1: Newton's laws of motion

|                |                                                    |
|----------------|----------------------------------------------------|
| <b>Topic</b>   | The 3 laws of motion                               |
| <b>Subject</b> | Physics & Chemistry                                |
| <b>Level</b>   | 4 <sup>th</sup> ESO                                |
| <b>Timing</b>  | 3 h                                                |
| <b>Aims</b>    | To introduce some principles of classical physics. |

| Content                    |                                                                                                                      |                          |                                                                                                                                                                                                                                     |
|----------------------------|----------------------------------------------------------------------------------------------------------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Teaching Objectives</b> | To introduce: <ul style="list-style-type: none"> <li>the 3 laws of motion.</li> <li>the nature of forces.</li> </ul> | <b>Learning Outcomes</b> | Students will be able to: <ul style="list-style-type: none"> <li>describe the three laws of motion.</li> <li>understand force and its effects.</li> <li>define inertia.</li> <li>distinguish action and reaction forces.</li> </ul> |

| Cognition                  |                                                                                                                                                                   |                          |                                                                                                                                                                                             |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Teaching Objectives</b> | <ul style="list-style-type: none"> <li>to describe phenomena.</li> <li>to encourage critical thinking.</li> <li>to relate an image to its description.</li> </ul> | <b>Learning Outcomes</b> | <ul style="list-style-type: none"> <li>to describe and classify phenomena.</li> <li>to compare and synthesise visual and written skills.</li> <li>to work in groups effectively.</li> </ul> |

| Communication                                                                                     |                                                                                                                                           |                                                                                             |
|---------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| <b>Language OF</b>                                                                                | <b>Language FOR</b>                                                                                                                       | <b>Language THROUGH</b>                                                                     |
| <ul style="list-style-type: none"> <li>scientific vocabulary.</li> <li>ICT vocabulary.</li> </ul> | <ul style="list-style-type: none"> <li>writing definitions and conclusions.</li> <li>cause and effect.</li> <li>Hypothesising.</li> </ul> | <ul style="list-style-type: none"> <li>asking questions.</li> <li>story telling.</li> </ul> |

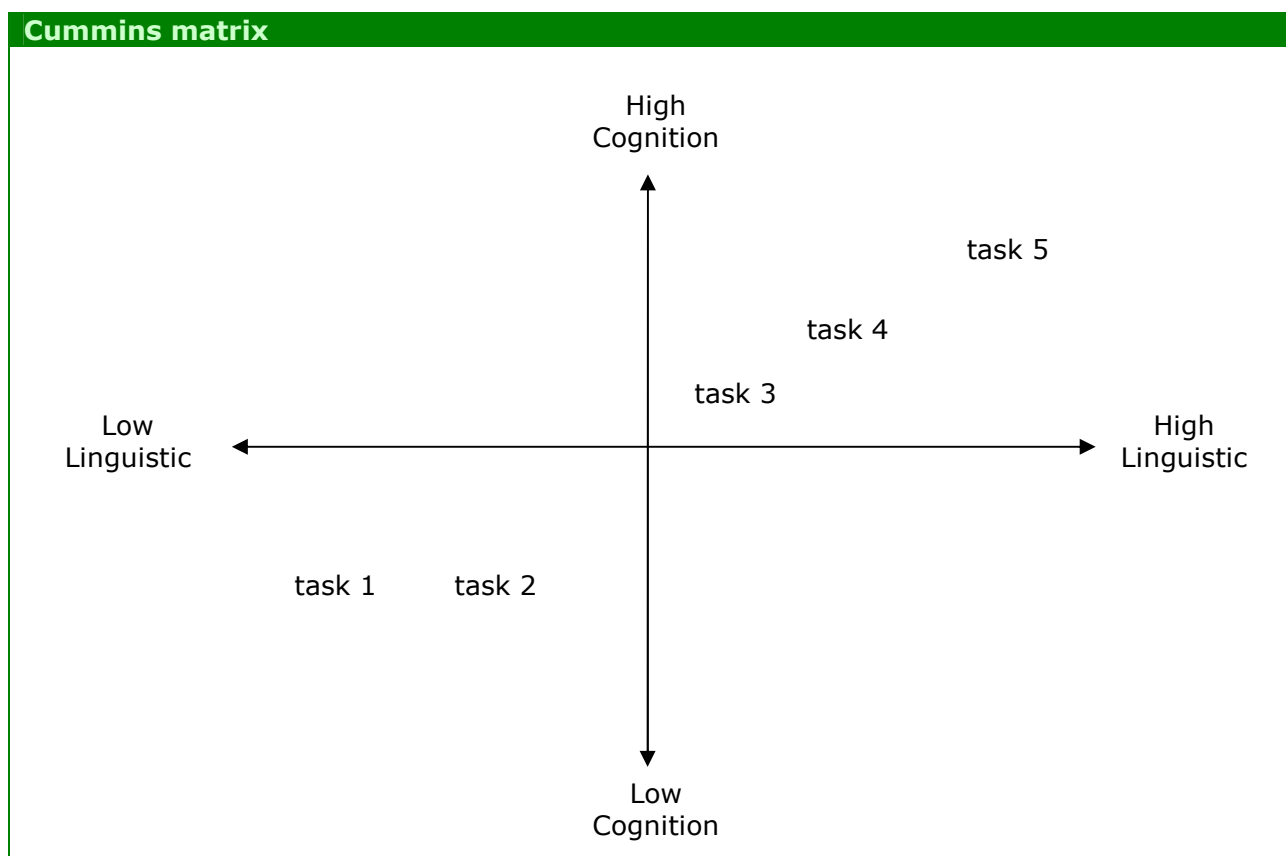
| Culture                                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>To be aware of the relevance of scientific thinking.</li> <li>To explore scientific misconceptions.</li> <li>To recognise the contribution of scientists in physics. (Sir I. Newton's biography)</li> <li>To identify forces in the daily routine.</li> </ul> |

| Assessment Criteria                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Students should be able to:</p> <ul style="list-style-type: none"> <li>recognise the three laws of motion in different situations.</li> <li>use the scientific vocabulary related to forces appropriately.</li> <li>distinguish between action and reaction forces.</li> <li>use the word 'inertia' appropriately.</li> </ul> <p>Assessment is monitored by the teacher throughout the different tasks since the very first steps.</p> |



| Tasks |                                 |    |     |              |          |                |          |
|-------|---------------------------------|----|-----|--------------|----------|----------------|----------|
| 1.1   | Taking notes + fill in the gaps | FA | LOT | individually | FA       |                |          |
| 1.2   | Crosswords                      | FA | SA  | LOT          | In pairs | FA<br>SA       |          |
| 1.3   | Describing cards                | FA | LOT | HOT          | In pairs | FA             |          |
| 1.4   | Subtitling                      | FA | SA  | HOT          | ICT      | In groups of 4 | FA<br>SA |
| 1.5   | Performing                      |    | SA  | HOT          | ICT      | In groups of 4 | SA       |

See the [teaching notes](#) for timing.



## Unit 2: Dynamics

### Lesson 2: Types of forces and vectors

|                |                                                            |
|----------------|------------------------------------------------------------|
| <b>Topic</b>   | Types of forces - vectors                                  |
| <b>Subject</b> | Physics & Chemistry                                        |
| <b>Level</b>   | 4 <sup>th</sup> ESO                                        |
| <b>Timing</b>  | 3 h                                                        |
| <b>Aims</b>    | To make an introduction to the use of vectors in mechanics |

| Content                    |                                                                                                                                                                              |                          |                                                                                                                                                                                                                                        |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Teaching Objectives</b> | To introduce: <ul style="list-style-type: none"> <li>force as a vector.</li> <li>different types of forces.</li> <li>the resultant force and calculate its value.</li> </ul> | <b>Learning Outcomes</b> | Students will be able to: <ul style="list-style-type: none"> <li>represent forces effectively.</li> <li>distinguish between weight and mass.</li> <li>work out the resultant force.</li> <li>predict the effects of forces.</li> </ul> |

| Cognition                  |                                                                                                                                                                                                                                          |                          |                                                                                                                                                                                                                                |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Teaching Objectives</b> | <ul style="list-style-type: none"> <li>to describe and draw different types of forces.</li> <li>to encourage critical thinking.</li> <li>to relate an image to its description.</li> <li>to apply formulae to solve problems.</li> </ul> | <b>Learning Outcomes</b> | <ul style="list-style-type: none"> <li>to describe and classify forces.</li> <li>to sketch force diagrams.</li> <li>to compare and synthesise visual and written skills.</li> <li>To problem-solve collaboratively.</li> </ul> |

| Communication                                                                                                               |                                                                                                                                                           |                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| <b>Language OF</b>                                                                                                          | <b>Language FOR</b>                                                                                                                                       | <b>Language THROUGH</b>                                             |
| <ul style="list-style-type: none"> <li>scientific vocabulary.</li> <li>calculations.</li> <li>using mathematics.</li> </ul> | <ul style="list-style-type: none"> <li>describing graphs.</li> <li>expressing calculations.</li> <li>cause and effect.</li> <li>hypothesising.</li> </ul> | <ul style="list-style-type: none"> <li>asking questions.</li> </ul> |

| Culture                                                                                                                                                                                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>To recognise science as a multidisciplinary field.</li> <li>To explore scientific misconceptions.</li> <li>To relate maths to physics.</li> <li>To compare the different scientific notation used in every country.</li> </ul> |

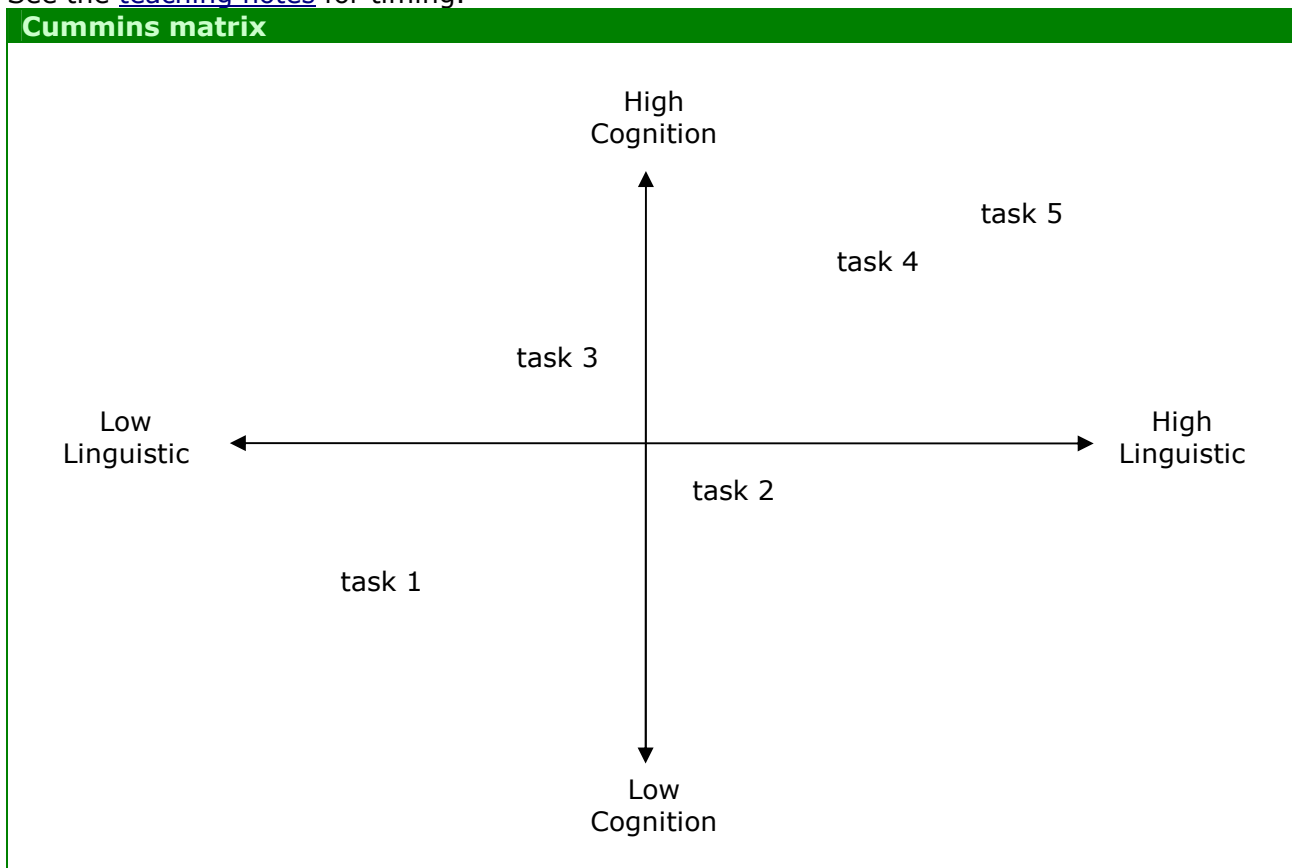
| Assessment Criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Students should be able to:</p> <ul style="list-style-type: none"> <li>express a real situation where forces are involved using vectors and simple graphs.</li> <li>operate with vectors representing forces appropriately.</li> <li>decompose a force into its two components.</li> <li>find the resultant force acting on a body and its acceleration.</li> <li>calculate different forces such as weight, normal, tension or friction.</li> </ul> <p>Assessment is monitored by the teacher throughout the different tasks since the very first steps.</p> |



| Tasks |                             |    |     |                            |              |
|-------|-----------------------------|----|-----|----------------------------|--------------|
| 2.1   | Making notes + jigsaw       | FA | LOT | Individually               |              |
| 2.2   | Making notes + representing | FA | LOT | Individually (or in pairs) |              |
| 2.3   | Matching cards              | FA | LOT | In pairs                   |              |
| 2.4   | Problem-solve               | SA | HOT | Individually               |              |
| 2.5   | Problem-creation            | SA | HOT | ICT                        | Individually |

Formative assessment (FA)      Summative assessment (SA)      Low Order Thinking (LOT)      High Order Thinking (HOT)      Information and Communication Technologies (ICT)

See the [teaching notes](#) for timing.



## Unit 2: Dynamics

### Lesson 3: Archimedes' Principle

|                |                                                          |
|----------------|----------------------------------------------------------|
| <b>Topic</b>   | Archimedes' Principle                                    |
| <b>Subject</b> | Physics & Chemistry                                      |
| <b>Level</b>   | 4 <sup>th</sup> ESO                                      |
| <b>Timing</b>  | 2 h                                                      |
| <b>Aims</b>    | To realise the approaches of Archimedes' work in physics |

| Content                    |                                                                                                                                         |                          |                                                                                                                                                                                                               |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Teaching Objectives</b> | To introduce: <ul style="list-style-type: none"> <li>the buoyancy.</li> <li>the difference between density, volume and mass.</li> </ul> | <b>Learning Outcomes</b> | Students will be able to: <ul style="list-style-type: none"> <li>understand Archimedes' principle.</li> <li>predict the buoyancy of an object in a liquid.</li> <li>know the ships building basis.</li> </ul> |

| Cognition                  |                                                                                                                                                                                                                                        |                          |                                                                                                                                                                                                                                     |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Teaching Objectives</b> | <ul style="list-style-type: none"> <li>to describe buoyancy with words and diagrams.</li> <li>to encourage critical thinking.</li> <li>to relate an image to its description.</li> <li>to apply formulae to solve problems.</li> </ul> | <b>Learning Outcomes</b> | <ul style="list-style-type: none"> <li>to classify buoyancy as a force.</li> <li>to compare and synthesise visual and written skills.</li> <li>to work in groups effectively.</li> <li>to problem-solve collaboratively.</li> </ul> |

| Communication                                                            |                                                                                                                                           |                                                                                             |
|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| <b>Language OF</b>                                                       | <b>Language FOR</b>                                                                                                                       | <b>Language THROUGH</b>                                                                     |
| <ul style="list-style-type: none"> <li>scientific vocabulary.</li> </ul> | <ul style="list-style-type: none"> <li>writing definitions and conclusions.</li> <li>cause and effect.</li> <li>hypothesising.</li> </ul> | <ul style="list-style-type: none"> <li>asking questions.</li> <li>story telling.</li> </ul> |

| Culture                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>To be aware of the relevance of scientific thinking.</li> <li>To explore scientific misconceptions.</li> <li>To recognise the contribution of scientists in physics. (Archimedes' biography )</li> <li>To introduce to ship and plane engineering and its importance in daily life.</li> </ul> |

| Assessment Criteria                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Students should be able to:</p> <ul style="list-style-type: none"> <li>calculate the buoyancy acting on a body when placed in a fluid.</li> <li>understand Archimedes' principle.</li> <li>distinguish clearly between density, volume and mass.</li> </ul> <p>Assessment is monitored by the teacher throughout the different tasks since the very first steps.</p> |





| Tasks |               |       |         |                |
|-------|---------------|-------|---------|----------------|
| 3.1   | Letter        | FA SA | HOT     | In pairs       |
| 3.2   | Problem-solve | SA    | HOT     | individually   |
| 3.3   | Research      | SA    | HOT ICT | In groups of 4 |

Formative assessment



Summative assessment



Low Order Thinking



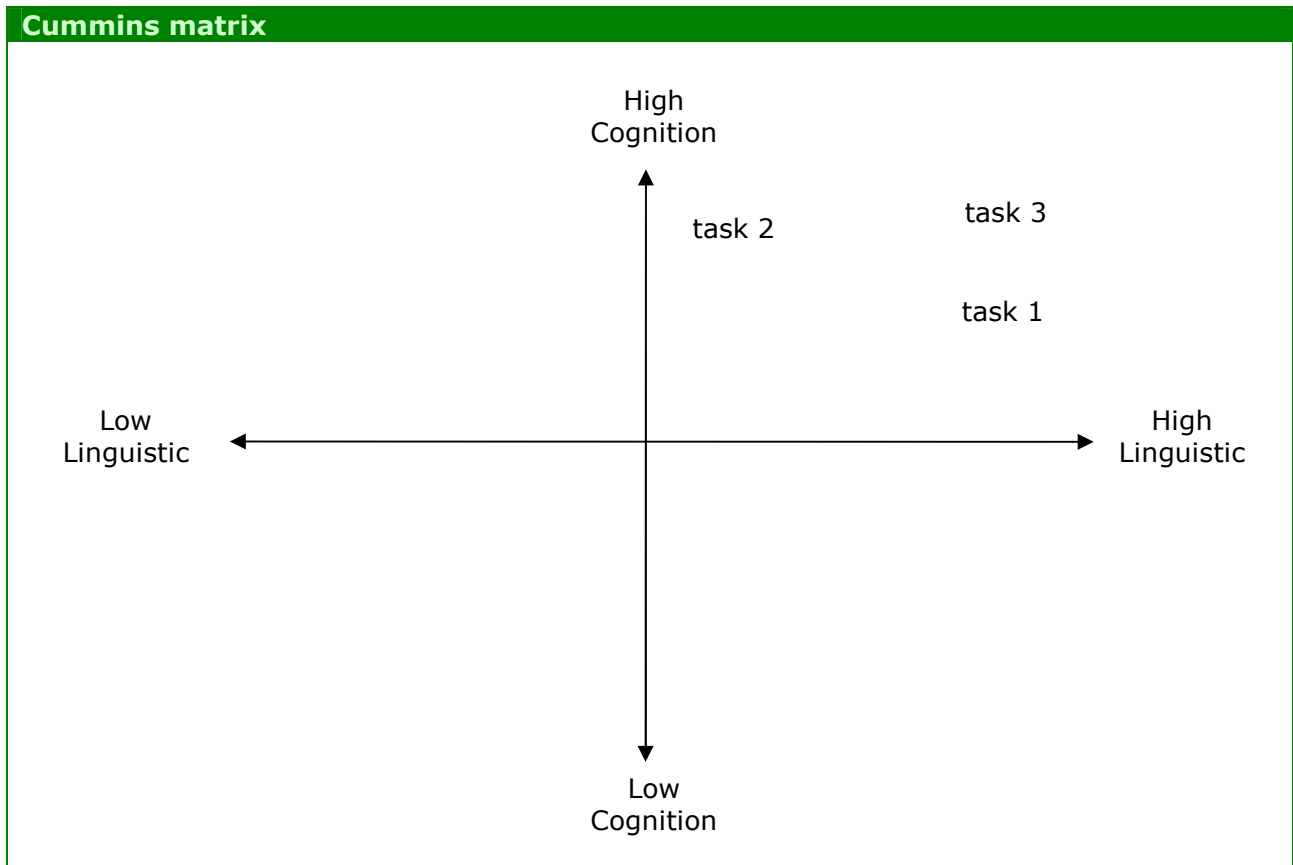
High Order Thinking



Information and Communication Technologies



See the [teaching notes](#) for timing.



## Unit 2: Dynamics

### Lesson 4: Satellites

|                |                                                   |
|----------------|---------------------------------------------------|
| <b>Topic</b>   | Newton's law of universal gravitation             |
| <b>Subject</b> | Physics & Chemistry                               |
| <b>Level</b>   | 4 <sup>th</sup> ESO                               |
| <b>Timing</b>  | 2 h                                               |
| <b>Aims</b>    | To describe Newton's law of universal gravitation |

| Content                    |                                                                                                                                                                                  |                          |                                                                                                                                                                                                                                 |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Teaching Objectives</b> | To introduce: <ul style="list-style-type: none"> <li>the law of universal gravitation.</li> <li>tides.</li> <li>satellites' motion.</li> <li>the geostationary orbit.</li> </ul> | <b>Learning Outcomes</b> | Students will be able to: <ul style="list-style-type: none"> <li>understand the law of universal gravitation.</li> <li>explain tides.</li> <li>describe satellites' motion.</li> <li>locate the geostationary orbit.</li> </ul> |

| Cognition                  |                                                                                                                                                                              |                          |                                                                                                                                                                     |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Teaching Objectives</b> | <ul style="list-style-type: none"> <li>to extract information from graphs.</li> <li>to apply formulae to solve problems.</li> <li>to encourage critical thinking.</li> </ul> | <b>Learning Outcomes</b> | <ul style="list-style-type: none"> <li>to classify satellites' motion.</li> <li>to work in groups effectively.</li> <li>to organize and manipulate data.</li> </ul> |

| Communication                                                                                |                                                                                                                                     |                                                                                    |
|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| <b>Language OF</b>                                                                           | <b>Language FOR</b>                                                                                                                 | <b>Language THROUGH</b>                                                            |
| <ul style="list-style-type: none"> <li>scientific vocabulary.</li> <li>astronomy.</li> </ul> | <ul style="list-style-type: none"> <li>writing definitions and conclusions.</li> <li>describing.</li> <li>hypothesising.</li> </ul> | <ul style="list-style-type: none"> <li>asking questions.</li> <li>news.</li> </ul> |

| Culture                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>To be aware of the relevance of scientific thinking.</li> <li>To explore scientific misconceptions.</li> <li>To recognise the contribution of scientists in physics. (Cavendish' biography)</li> <li>To develop a growing curiosity and interest in the motion of objects.</li> <li>To realise the relationship between physics and astronomy.</li> </ul> |

| Assessment Criteria                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Students should be able to:</p> <ul style="list-style-type: none"> <li>make simple calculations from the universal gravitation formula.</li> <li>interpret correctly the motion of satellites and the forces involved.</li> <li>use the word 'gravity' appropriately.</li> </ul> <p>Assessment is monitored by the teacher throughout the different tasks since the very first steps.</p> |



| Tasks |                                |    |    |     |          |                |
|-------|--------------------------------|----|----|-----|----------|----------------|
| 4.1   | Houston!! We have a problem... | FA | SA | HOT | In pairs |                |
| 4.2   | Tidal dance                    | FA | SA | HOT | In pairs |                |
| 4.3   | On air...                      |    | SA | HOT | ICT      | In groups of 4 |

Formative assessment



Summative assessment



Low Order Thinking



High Order Thinking



Information and Communication Technologies



See the [teaching notes](#) for timing.

