Buckswood School

IB Diploma Programme

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| Subject | Physics |
| HL / SL | SL |
| Text book | IB Physics (OUP) |
| Lesson per week | 3 hours |
| Teacher | Mr Jones |
| Students | TBC |

**Christmas Term**

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| **Week** | **Topics covered** | **TOK Question** | **Connections** | **Recommended Extra Reading** |
| 1  (11 Sept) | * 1. Measurements in Physics   1.2 Uncertainties and Errors | **Theory of knowledge:**  • What has influenced the common language used in science? To what extent does having a common standard approach to measurement facilitate the sharing of knowledge in physics?  **Theory of knowledge:**  • “One aim of the physical sciences has been to give an exact picture of the material world. One achievement of physics in the twentieth century has been to prove that this aim is unattainable.” – Jacob Bronowski. Can scientists ever be truly certain of their discoveries? |  |  |
| 2  (18 Sept) | 1.3 Vectors and Scalars | **Theory of knowledge:**  • Can scientists ever be truly certain of their discoveries? |  |  |
| 3  (25 Sep) | 2.1 Motion | **Theory of knowledge:**  • The independence of horizontal and vertical motion in projectile motion seems to be counter-intuitive. How do scientists work around their intuitions?  How do scientists make use of their intuitions? |  |  |
| 4  (02 Oct) | 2.2 Forces | Aristotle and the concept of Force  Discussion on the concept of what is meant by a force go back to the dawn of scientific thought. Aristotle, a Greek philosopher who live around2300 years ago, had an overarching view of the world 9called an Aristotelian cosmology0 and he can be regarded as being an important factor in the development of science.  What do you think students in 50, 100, or even a 1000years will make of our century? |  |  |
| 5  (09 Oct) | 2.3 Work, Energy and Power |  |  |  |
| 6  (16 Oct) | **Assessment week** | | | |
| 7  (23 Oct) | **Half term** | | | |
| 8  (30 Oct) | 2.4 Momentum | **Theory of knowledge:**  Helpful or not?  Are conservation laws helpful to scientists. On the one hand they allow the prediction of yet untested cases but on the other hand they may restrict the progress of science. This can happen if scientists are not prepared to challenge the status quo. |  |  |
| 9  (06 Nov) | 3.1 Temperature and Energy Changes | **Theory of knowledge:**  • Observation through sense perception plays a key role in making  measurements. Does sense perception play different roles in different areas of knowledge? |  |  |
| 10  (20 Nov) | 3.2Modelling a Gas | **Theory of knowledge:** |  |  |
| 11  (20 Nov) | 4.1 Oscillations | **Theory of knowledge:**  • The harmonic oscillator is a paradigm for modelling where a simple equation  is used to describe a complex phenomenon. How do scientists know when a simple model is not detailed enough for their requirements? |  |  |
| 12  (27 Nov) | 4.2 Travelling Waves | **Theory of knowledge:**  • Scientists often transfer their perception of tangible and visible concepts to explain similar non-visible concepts, such as in wave theory. How do scientists explain concepts that have no tangible or visible quality?  **Theory of knowledge:**  • Wavefronts and rays are visualizations that help our understanding of reality, characteristic of modelling in the physical sciences. How does the  methodology used in the natural sciences differ from the methodology used in the human sciences?  • How much detail does a model need to contain to accurately represent  reality? |  |  |
| 13  (04 Dec) | Revision |  |  |  |
| 14  (11 Dec) | **Assessment Week** | | | |

**Spring Term**

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| **Week** | **Topics covered** | **TOK Question** | **Connections** | **Recommended Extra Reading** |
| 1  (08 Jan) | 4.3 Wave Characteristics |  |  |  |
| 2  (15 Jan) | 4.4 Wave Behaviour | **Theory of knowledge:**  • Huygens and Newton proposed two competing theories of the behaviour of light. How does the scientific community decide between competing theories? |  |  |
| 3  (22 Jan) | 4.5 Standing Waves | **Theory of knowledge:**  • There are close links between standing waves in strings and Schrodinger’s theory for the probability amplitude of electrons in the atom. Application to superstring theory requires standing wave patterns in 11 dimensions. What is  the role of reason and imagination in enabling scientists to visualize scenarios that are beyond our physical capabilities? |  |  |
| 4  (29 Jan) | Revision |  |  |  |
| 5  (05 Feb) | Assessment Week | | | |
| 6  (12 Feb) | **Half Term** | | | |
| 7  (19 Feb) | 5.1 Electric Fields | **Theory of knowledge:**  • Early scientists identified positive charges as the charge carriers in metals; however, the discovery of the electron led to the introduction of “conventional” current direction. Was this a suitable solution to a major shift in thinking? What role do paradigm shifts play in the progression of scientific knowledge?  Inverse-square laws.  Forces between charged objects is one of several examples of inverse-square laws that you meet in this course. They are of great importance in physics.  Inverse-square laws model a characteristic property of some fields, which is that as distance doubles, observed effects go down by one quarter.  Is this idea of field a human construct or does it reflect the reality of the universe. |  |  |
| 8  (26 Feb) | 5.1 Electric Fields | So why use K?  James Maxwell, working in the middle of the nineteenth century, realised that there was an important connection between electricity and magnetism.  If the numbers are different is the physics the same? |  |  |
| 9  (05 Mar) | 5.2 Heating Effect of an Electric Current | **Theory of knowledge:**  • Sense perception in early electrical investigations was key to classifying the effect of various power sources; however, this is fraught with possible irreversible consequences for the scientists involved. Can we still ethically and safely use sense perception in science research?  But is it a law.  This rule of Ohm is called a law- but is it? In reality it is an experimental description of how a group of materials behave under rather restricted conditions. Does that make it a law? You decide. |  |  |
| 10  (12 Mar) | Revision |  |  |  |
| 11  (19 Mar) | **Assessment Week** | | | |

**Summer Term**

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| **Week** | **Topics covered** | **TOK Question** | **Connections** | **Recommended Extra Reading** |
| 1  (16 April) | 5.3 Electric Cells | **Theory of knowledge:**  • Battery storage is seen as useful to society despite the potential environmental issues surrounding their disposal. Should scientists be held morally responsible for the long-term consequences of their inventions and discoveries?  Simple assumptions.  The model of a cell with a fixed internal resistance and a constant emf is an example of modelling. In this case the model is a simple one that cannot be realised in practice.  Do the simplifications and assumptions of ideal behaviour form a suitable basis for modelling? |  |  |
| 2  (23 Apr) | 5.4 Magnetic Effects of Electric Fields | **Theory of knowledge:**  • Field patterns provide a visualization of a complex phenomenon, essential to an understanding of this topic. Why might it be useful to regard knowledge in a similar way, using the metaphor of knowledge as a map – a simplified representation of reality?  Why direction rules.  During this sub-topic we have introduced two direction rules, the corkscrew rule for magnetic fields around wires and Fleming’s rule for the motor effect. What is the status of these rules? Are they implicit in the way the universe operates, or are they simply indications that depend on the way we define current direction and other fundamental quantities in physics? |  |  |
| 3  (30 Apr) |  |  |  |  |
| 4  (07 May) |  |  |  |  |
| 5  (14 May) | Revision |  |  |  |
| 6  (21 May) | **Assessment week** | | | |
| 7  (28 May) | **Half term** | | | |
| 8  (04 Jun) | Revision |  |  |  |
| 9  (11 Jun) | Revision |  |  |  |
| 10  (18 Jun) | Revision | | | |
| 11  (25 Jun) | School Exam week | | | |