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| **Lesson Number: 28.6** | |
| **Lesson Title: Black body radiation** | |
| **Specification Reference** | **3.9.2.3, 3.9.2.4** |
| **Learning Objectives** | |
| Stefan’s law and Wien’s displacement law.  General shape of black-body curves, use of Wien’s displacement law to estimate black-body temperature of sources.  Experimental verification is not required.    Assumption that a star is a black body.  Inverse square law, assumptions in its application.  Use of Stefan’s law to compare the power output, temperature and size of stars    Description of the main classes:  **Spectral**    Temperature related to absorption spectra limited to Hydrogen Balmer absorption lines: requirement for atoms in an state. | |
| **Opportunities for Assessment** | |
| Calculations of luminosity and flux | |

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| **Starter:** | Slide #1 enables a general discussion as to why stars shine, why we cannot see their cores, that they are opaque and hence a black body |
| **Main:** | Slides #2 - #4 explain what is meant by a black body emitter and how the emission strength curve can be used to find the peak wavelength. This then leads to Wien’s displacement law and calculations on the approximate temperature of some stars  Slide #5 is a list of the spectral classes – Students can try to come up with their own sentence to remember the order  Slide #6 shows the general absorption lines that would be found in different classes of stars – Students could copy this, adding the temperature scale  *The tutor may wish to print out the data sheet from the syllabus above for this lesson or have the students copy it down*  Perform demonstration of emission lines from gas lamps  Slides #7 - #8 explain flux and enable the calculation of flux from the sun at different planets – Extension; assume the sun is 4 ly away, what would the flux be here?  Perform demonstration of inverse square law of light intensity with distance |
| **Plenary:** | Slide #9 is a summary |

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| **Homework:** | Research on the temperature of nearby stars and their classification – write a report on the history of stellar classification; write a report on a single star and its properties | |
| **Differentiation / Extension / S&C** | | |
| Flux calculations for stars and galaxies | | |
| **Numeracy / Literacy** | | **SMSC / Fundamental British Values** |
| Power calculations and use of SI units | | History of stellar classifications; several scientists theories being used in one discipline (Wein, Stefan, Boltzmann) |
| **RESOURCES:** | | |
| Demonstration 1   * Various gas lamps (Sodium, Neon, Oxygen) * High voltage supply * Diffraction grating * Spectra-scope   Demonstration 2   * Desk lamp * Light meter | | |
| **Risk Assessment** e.g. CLEAPSS card reference | | |
| Ensure high voltage supply to lamps is fully insulated  Test classroom RCD system prior to use | | |
| **Working Scientifically (HSW)** | | |
| None | | |

Pictures courtesy of:

Slide #1 (Black hole) – NASA via <https://commons.wikimedia.org/wiki/File:Black_Hole_in_the_universe.jpg>

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