YEAR: 11 Science (Double Award) Physics

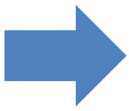
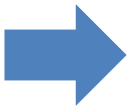
Knowledge Focus: 6.3 Work & Energy, 6.4 Stars & planets, 6.5 Types of radiation, 6.6 Half-life

Skills, knowledge and understanding to be developed in this Learning Plan:

The relationship between work and energy. The equations for kinetic energy and change in gravitational potential energy are developed. The principles of force, energy and motion are used to analyse such safety features of cars as air bags and crumple zones. The main features of our solar system & the life cycle of stars of different masses. The nature of nuclear decay and the nature of alpha, beta and gamma radiation. Plot decay curves and use them to determine the half-lives of radioactive materials.

Key terms to be learned in this LP: Work, kinetic, Elastic, Gravitational Potential Energy, spring constant, force-extension, astronomical unit, light-year, protostar, supernova, nucleon, background radiation, random, decay curve, half-life

Week 1 - 2 Learning Objectives: **6.3 Work & Energy** How much energy do moving objects have? work = force x distance W = Fd work = energy transfer (in the absence of thermal transfer) Use Hooke's Law to describe the extension of a spring. force = spring constant × extension; F = kx How the energy efficiency of vehicles can be improved The principles of forces and motion to an analysis of safety features of cars e.g. air bags and crumple zones	Assessment 6.3 End of Topic	***Objective assessments:*** Be able to: Calculate work done. Recognise that energy transferred is equal to work. Investigation of the force-extension graph for a spring **(*specified practical*)** Link energy to case study of cars and safety (air bags etc.)	**Homework:** Set: Due: **Homework:** Set: Due:
Week 3 - 4 Learning Objectives: **6.4 Stars & Planets** What are the main features of our solar system? What are the main features of the observable universe? Space is vast, what are the appropriate units of distance: astronomical units (AU) and light years (l-y) What are the stages in the life cycle of stars of different masses? The stability of stars depends upon a balance between gravitational force and gas and radiation pressure. The return of material, including heavy elements, into space during the final stages in the life cycle of giant stars. The origin of the solar system from the collapse of a cloud of gas and dust, including elements ejected in supernovae. **The Hertzsprung-Russell (H-R) diagram as a means of displaying the properties of stars, depicting the evolutionary path of a star**	Assessment 6.4 End of Topic	***Objective assessments:*** Be able to: Describe the trends in the data of planets and stars. Describe objects in the universe such as planetary systems and galaxies. Know the units of distance and be able to use standard form to describe distances in space. Know the stages of the life-cycle of stars for both Sun-sized stars and X8 sized stars. Explain the changes in the stages of the life-cycle of stars using the **H-R diagram**.	**Homework:** Set: Due: **Homework:** Set: Due:

Week 5 - 6 Learning Objectives: **6.5 Types of radiation** What is an 'isotope' and a 'radioactive isotope'? What to do with waste materials from nuclear power stations and nuclear medicine? Is 'background radiation' dangerous and what are the sources of this? Know the natural and artificial sources of background radiation What is the differences between alpha, beta and gamma radiation? Alpha radiation as a helium nucleus, beta radiation as a high energy electron and gamma radiation as electromagnetic **Producing** and balancing nuclear equations for radioactive decay.	 Assessment 6.5 End of Topic	***Objective assessments:*** Be able to: Tell the number of protons and neutrons from the nucleon and proton number. Understand the long-term implications of radioactive material for health & storage. Calculate radiation levels, taking background radiation into account. Remember the 3 types of nuclear radiation. Balance nuclear equations.	**Homework:** Set: Due: **Homework:** Set: Due:
Week 7 Learning Objectives: **6.6 Half-life** Model the decay of atoms using a constant probability of decay. Dice investigation. How to plot or sketch decay curves for radioactive materials. Know that radioactive material has a characteristic half-life and determine the half-life of a material from the decay curve. What are the real-life uses of different uses of radioactive materials? For example, radioactive tracers and cancer treatment.	 Assessment 6.6 End of Topic	***Objective assessments:*** Be able to: Plot and sketch decay curves. **(*specified practical*)** Determination of the half-life of a model radioactive source, e.g. using dice. Perform simple calculations of activity and half-life of radioactivity. Link properties and penetrating power to uses of radioactive materials. For example, gamma radiation for medical tracers, alpha for smoke alarms.	**Homework:** Set: Due: