A Level Physics Online

Eduqas Physics – Component 2

Module 8: Orbits and the wider universe

This topic covers Kepler's laws of planetary motion and circular orbits of satellites, planets and stars. It explores the evidence for the existence of dark matter and examines the Doppler shift of spectral lines. It discusses how the Hubble constant relates galactic radial velocity to distance and how a knowledge of the Hubble constant can give an approximation to the age of the universe.

You should be able to demonstrate and show your understanding of:	**Progress and understanding:**			
	1	**2**	**3**	**4**
Kepler's three laws of planetary motion				
Newton's law of gravitation $F = G\frac{M_1 M_2}{r^2}$ in simple examples, including the motion of planets and satellites				
How to derive Kepler's 3rd law, for the case of a circular orbit from Newton's law of gravity and the formula for centripetal acceleration				
How to use data on orbital motion, such as period or orbital speed, to calculate the mass of the central object				
How the orbital speeds of objects in spiral galaxies implies the existence of dark matter				
How the recently discovered Higgs boson may be related to dark matter				
How to determine the position of the centre of mass of two spherically symmetric objects, given their masses and separation, and calculate their mutual orbital period in the case of circular orbits				
The Doppler relationship in the form $\frac{\Delta\lambda}{\lambda} = \frac{v}{c}$				
How to determine a star's radial velocity (i.e. The component of its velocity along the line joining it and an observer on the earth) from data about the doppler shift of spectral lines				
The use of data on the variation of the radial velocities of the bodies in a double system (for example, a star and orbiting exo-planet) and their orbital period to determine the masses of the bodies for the case of a circular orbit edge on as viewed from the Earth				
How the Hubble constant (H_0) relates galactic radial velocity (v) to distance (D) and it is defined by $v = H_0 D$				

You should be able to demonstrate and show your understanding of:	Progress and understanding:			
	1	2	3	4
Why $1/H_0$ approximates the age of the universe				
How the equation $\rho_c = \frac{3{H_0}^2}{8\pi G}$ for the critical density of a 'flat' universe can be derived very simply using conservation of energy				