KS5 Physics Orbital Mechanics Basics – Worksheet A

Context and Application

What is this an image of?

Figure 1 Photograph by Jud McCranie - CC4.0

What variables would you want to calculate about an orbiting satellite?

Circular Motion

Name each of the variables below. Include the units.

$$F = \frac{mv^2}{r}$$

$$v = \frac{2\pi r}{T}$$

Newton's Law of Gravitation

Name each of the variables below. Include the units.

$$F = \frac{GMm}{r^2}$$

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KS5 Physics Orbital Mechanics Basics – Worksheet B

Orbiting Bodies

Derive an expression which relates orbital velocity to the orbital radius. Make a comment on your expression.

Kepler's Third (Empirical) Law

1. Express Kepler's Third Law as a mathematical relationship
2. Calculate appropriate data to support Kepler's statement
3. Sketch a graph for Kepler's Third Law

Planet	**[r] (AU)**	**[T] (Days)**	
Mercury	0.39	88	
Venus	0.72	225	
Earth	1.00	365	
Mars	1.52	687	
Jupiter	5.20	4333	
Saturn	9.51	10759	

Proving Kepler's Third Law

Prove Kepler's Third Law using your knowledge of orbiting bodies.

KS5 Physics Orbital Mechanics Basics – Worksheet C

Starlink – how high?

A Starlink satellite passes above you every 91 minutes. Calculate how far above you Starlink satellites orbit.

$M_e = 5.97 \times 10^{24}\ \text{kg}$

$r_e = 6\,371\ \text{km}$

$G = 6.67 \times 10^{-11}\text{N m}^2\ \text{kg}^{-2}$

Starlink – why so low?

The low orbit of a Starlink satellite requires additional work to be done to maintain the orbit. This is due to atmospheric drag effects. Why do they not simply increase the height of the orbit to avoid the drag effect?

Additional Practice

Isaac Physics Game Board – F6 Gravity and orbits
https://isaacphysics.org/gameboards#phys19_f6

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