Gravitation Equations Worksheet

Level: A-Level / AP Physics 1 & 2 | Difficulty: Advanced | Topic: Mechanics

Practice gravitation with 10 problems on Newton's universal law, field strength, and orbital motion. Includes full worked solutions.

Equations you will need

F = Gm_1m_2/r^2	Newton's law of universal gravitation
g = GM/r^2	Gravitational field strength
v = ?(GM/r)	Orbital speed for circular orbit
T^2 = (4pi^2/GM)r^3	Kepler's 3rd law
U = -Gm_1m_2/r	Gravitational potential energy

Symbol key

Symbol	Quantity	Unit
F	force	N
G	gravitational constant	6.67 x 10?¹¹ N*m^2/kg^2
m	mass	kg
M	central body mass	kg
r	separation / orbit radius	m
g	field strength	N/kg or m/s^2
v	orbital speed	m/s
T	orbital period	s

Practice problems

1. Find gravitational force between two 100 kg masses 2 m apart.

2. Find g at Earth's surface. (M=5.97x10^24 kg, r=6.37x106 m)

3. Find orbital speed at 7x106 m above Earth's centre.

4. Find period of a satellite orbiting Earth at radius 8x106 m.

5. Find gravitational PE of a 1000 kg satellite at 4x107 m from Earth's centre.

6. Find g at 2x107 m above Earth's centre (about 3 Earth radii).

7. At what height above Earth's surface is g half its surface value?

8. Find the mass of the Sun given Earth's orbital radius ($1.5x10^{11}$ m) and period (3.16x107 s).

9. Find the escape velocity from Earth's surface.

10. A geostationary satellite has T = 86,400 s. Find its orbital radius.