

Gravitational fields · supported focus

Supported focus · HL

## Supported scope

- Supported HL focus. First assessment 2025; full Physics guide acquired (84 PDF pages). Remaining guide, assessment and practical requirements retain their recorded holds.
- State model conditions and distinguish fictional data from measurements.

# Gravitation · 1.1

## Reasoning

An orbiting satellite is continuously falling while moving sideways. Being in orbit does not require gravity to vanish. Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

# Gravitation · 2.1

## Reasoning

Gravitational field strength is force per unit mass. A gravitational force can provide the centripetal force for a circular orbit. Field and potential describe different quantities. gravitational field: A description of gravitational force per unit mass; centripetal force: Net force toward the centre of a curved path.

# Gravitation · 3.1

## Reasoning

For a point mass or outside a spherical mass, field strength follows an inverse-square distance dependence. Use distance from the centre, not height above the surface alone. State the circular-orbit approximation and ignore atmospheric drag only when justified. Draw the force toward the central body and velocity tangential to the orbit. Do not add an outward force merely because the path is circular.

# Gravitation · 4.1

## Reasoning

State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution. Known: field strength is 8 units at distance  $r$  from a spherical source. At  $2r$ ,  $g_2/g_1 = (r/2r)^2 = 1/4$ .  $g_2 = 8/4 = 2$  units. The gravitational force on a fixed test mass decreases in the same ratio.

## Gravitation · 4.2

### Reasoning

Field strength is 18 units at  $r$ . Find it at  $3r$  for an inverse-square field. Use the same sequence: known quantities  $\rightarrow$  model  $\rightarrow$  relation  $\rightarrow$  substitution  $\rightarrow$  unit and interpretation.

# Gravitation · 5.1

## Reasoning

Weightlessness in an orbiting spacecraft means apparent weight is small in free fall, not that there is no gravitational field. Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

## Gravitation · 5.2

### Reasoning

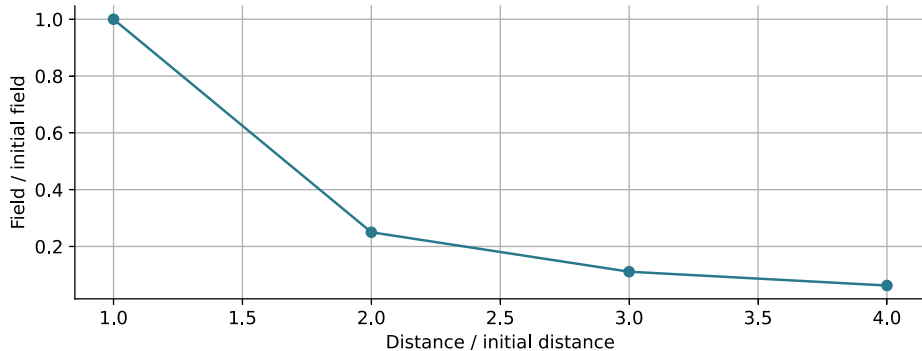
Gravity is zero everywhere a spacecraft experiences apparent weightlessness. This claim is false: Weightlessness in an orbiting spacecraft means apparent weight is small in free fall, not that there is no gravitational field.

## Gravitation · 5.3

### Reasoning

Gravitational fields and orbital motion: For a point mass or outside a spherical mass, field strength follows an inverse-square distance dependence. Use distance from the centre, not height above the surface alone.

# Gravitation · diagram



- Original teaching diagram: Gravitational fields and orbital motion
- Use the labels and the stated model together.

## Gravitation · original transfer

### Your turn

A spherical source produces field 12 units at  $r$ . At  $2r$  the test mass is doubled.  
Compare field and force with the original case.

## Gravitation · transfer reasoning

### Method and interpretation

Field becomes 3 units, one quarter; force becomes one half because test mass doubles. Field is independent of test mass; the inverse-square model applies outside the spherical source.

## Check yourself

- Explain gravitational field using the stated model.
- Explain centripetal force using the stated model.
- Change one value in the original transfer; explain which assumption still matters.