Delta Physics

Select a topic of your Choice

5 minutes – Individual

Gravitation

Why doesn't the Space Station fall down?



Higher Physics

PART 1

Satellites in Free Fall

The Space Station is 400 km up, and gravity there is still strong. Why doesn't it fall down?

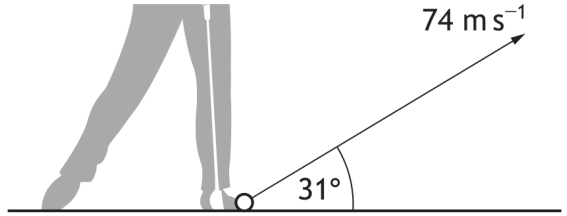
By the end of this part...



1. I can **explain** how a **satellite** stays in **orbit**, using **Newton's cannon**
2. I can **state** that a **satellite** is in **free fall**
3. I can **explain** why **astronauts** feel **weightless**

Projectiles Recap: 2023 Paper 1 Q5

5. A golfer strikes a golf ball as shown.



The ball leaves the club with an initial velocity of 74 m s^{-1} at an angle of 31° to the horizontal.

Which row in the table shows the horizontal and vertical components of the initial velocity of the golf ball?

	Horizontal component of the initial velocity of the golf ball (m s^{-1})	Vertical component of the initial velocity of the golf ball (m s^{-1})
A	38	44
B	38	63
C	44	38
D	63	38
E	63	44

Answer D

horizontal: 74 cos 31° = 63 m s^{-1}

vertical: 74 sin 31° = 38 m s^{-1}

Projectiles Recap: 2026 Paper 2 Q1(a)(i)

1. A shot put competition takes place during an athletics meeting.

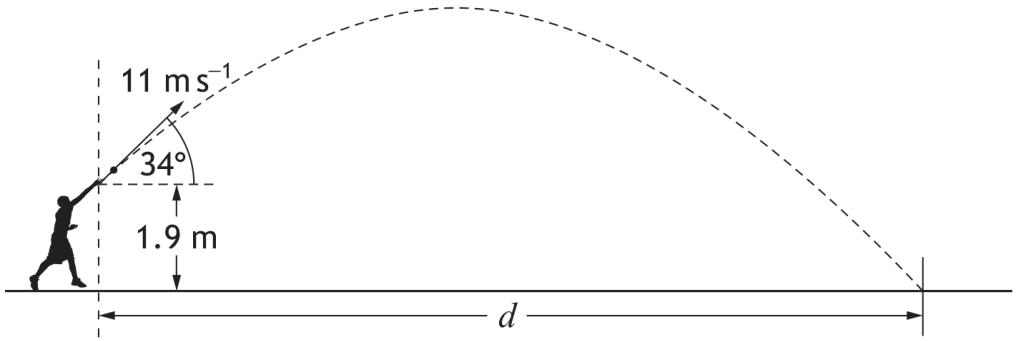
An athlete launches a metal ball, called a shot, with an initial velocity of 11 m s^{-1} at an angle 34° to the horizontal.

The shot is released from a height of 1.9 m.

The horizontal distance travelled by the shot is d.

The effects of air resistance are negligible.

not to scale



(a) (i) Calculate:

(A) the horizontal component of the initial velocity of the shot **1**

Space for working and answer

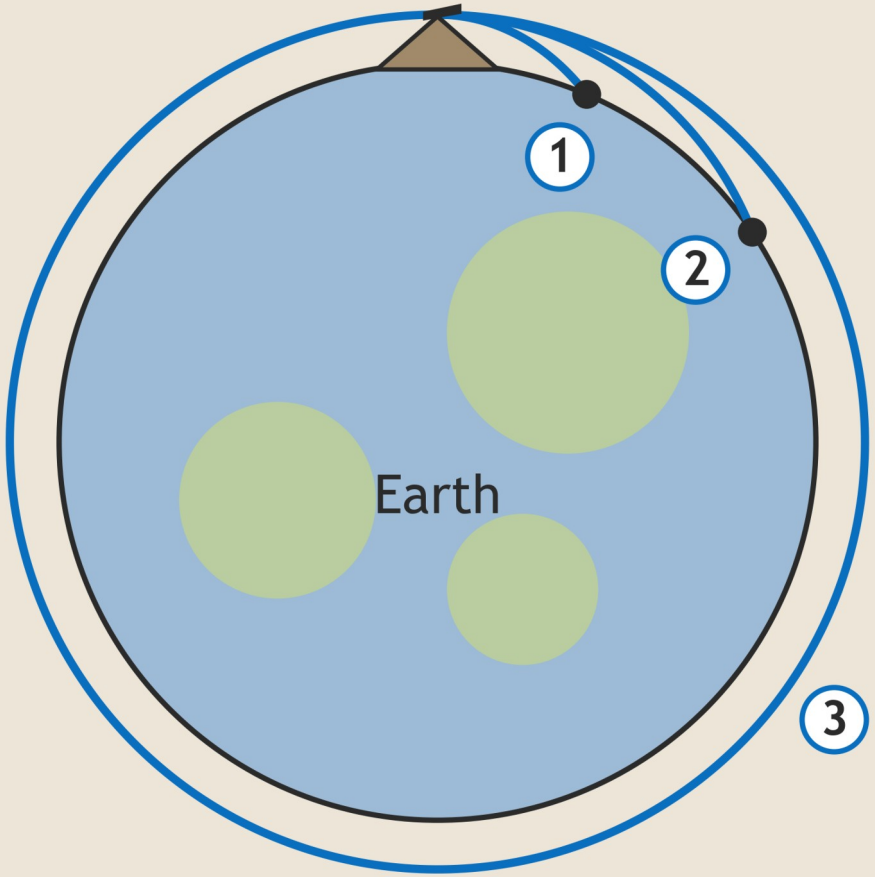
(B) the vertical component of the initial velocity of the shot. **1**

Space for working and answer

(A) horizontal: 11 cos 34 = 9.1 m s^{-1} (1)

(B) vertical: 11 sin 34 = 6.2 m s^{-1} (1)

Newton's Cannon



1 **Slow**: it lands near the mountain.

2 **Faster**: it lands further away.

3 **Fast enough**: the ground curves away as fast as it falls. It never lands: an **orbit**.

Newton's Cannon in 1728

V

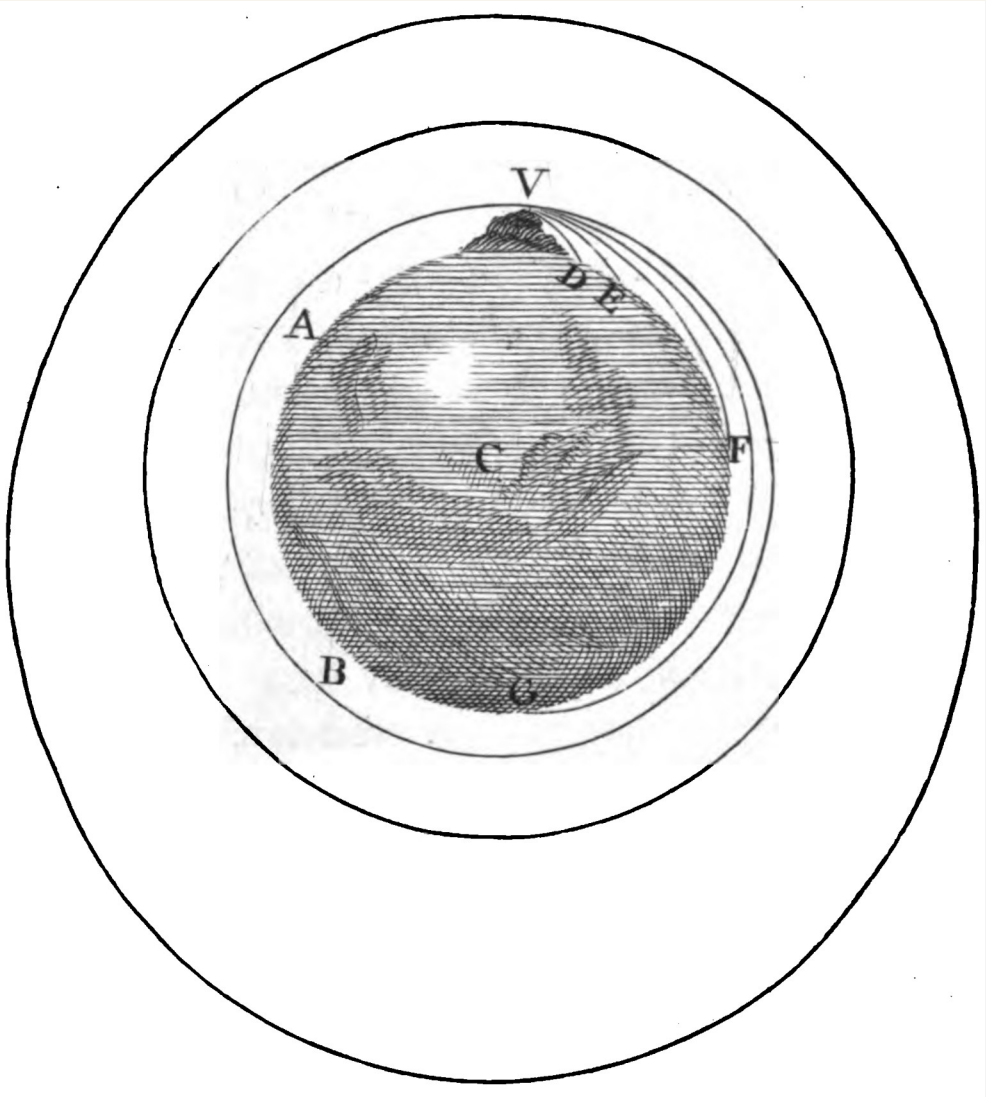
the mountain top

D, E, F, B

landing points, faster each time

Outer circles

orbits: the ball never lands



Satellites Are in Free Fall

Free fall

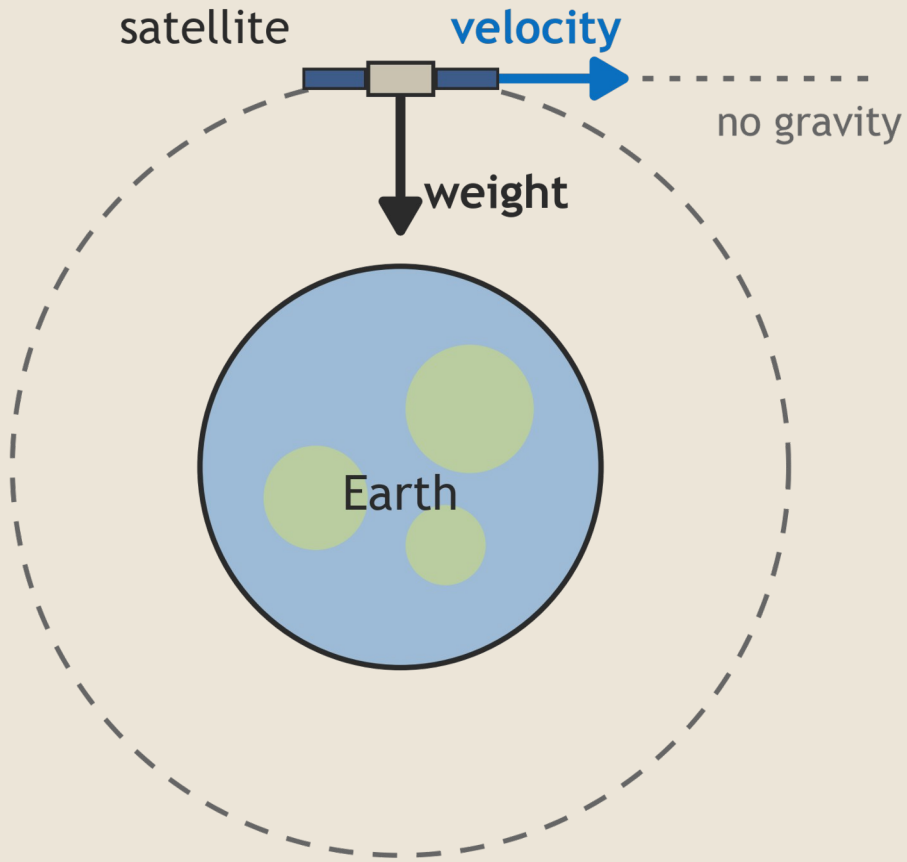
weight is the **only force** acting

A satellite

is in **free fall** around a **planet** or **star**

It stays up

it moves round as it **falls**

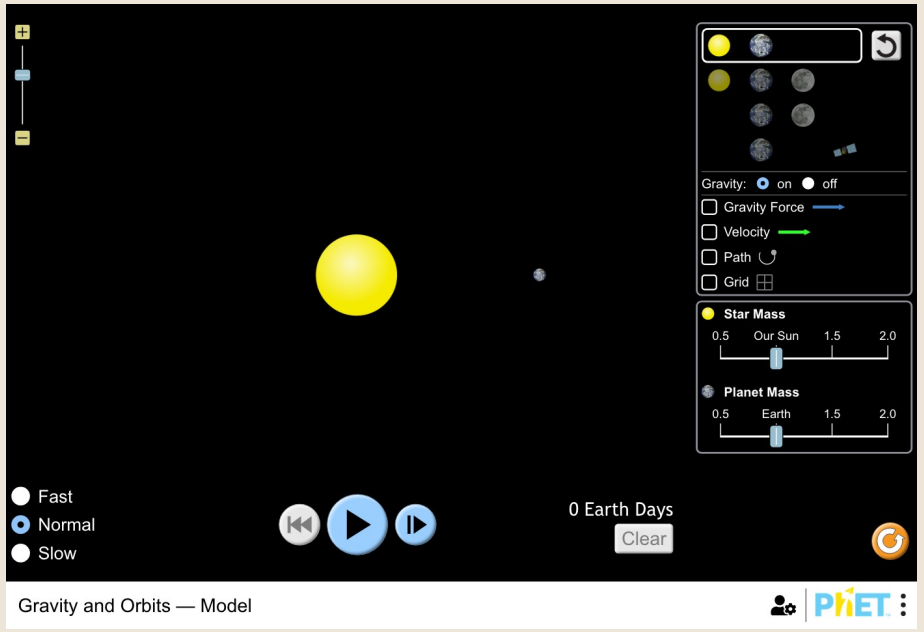


Simulation: Gravity and Orbits

Open the Model screen. Tick **Velocity** and **Path**.

Change one thing. **Describe** the path.

Change	Path
Gravity off	a straight line
Slower	smaller oval, or crashes
Faster	bigger oval, or escapes



Scan to open the sim.

Weightlessness

Not zero gravity

astronauts still have **weight**

They float

astronaut and ISS **fall together**

So

the floor exerts **no force** on them



Your Turn



1. **Explain** why the ISS does not fall to the ground.

It is falling, but the Earth curves away.

2. **State** what is meant by a satellite being in **free fall**.

Weight is the only force on it.

3. **Explain** why an astronaut floats inside the ISS.

Both fall together: the floor exerts no force.

Past Paper: 2026 Paper 1 Q7

7. The International Space Station (ISS) is orbiting the Earth at a height of 420 km above the Earth's surface.

A group of students make the following statements about the ISS in this orbit:

I The ISS is accelerating towards the Earth.

II The magnitude of the vertical velocity of the ISS increases as it is orbiting the Earth.

III The gravitational field strength is zero at a height of 420 km above the Earth's surface.

Which of these statements is/are correct?

A I only

B I and II only

C I and III only

D II and III only

E I, II and III

Answer A: I only.

It always accelerates towards the Earth: free fall.

Scan: page 7.

Answers: 2026 Paper 1 Q7

A Right.

I only: the ISS is in **free fall**, so it accelerates towards the Earth.

B

II is false: in orbit its **speed stays the same**.

C, E

III is false: **g** at 420 km is **not zero**.

D

misses I: it is **always accelerating** towards the Earth.

Gravitation in the Exam

Paper	Question	Marks
2026 P1	7	1
2025 P2	5(c)	6
2024 P2	4(a)(ii)	3
2023 P1	6	1
2022 P2	5(c)(i)	3

Paper	Question	Marks
2019 P2	4	10
2018 S1	5	1
2017 S2	5(a)(ii)	3
2016 S1	5	1
2015 S2	3	6

Scan: the Higher past paper finder.

Look back — by the end of this part...



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Course specification — 1 of 1

- Knowledge that satellites are in free fall around a planet/star.

Scan: the course specification, page 8.

Credits

Title: the ISS: NASA

2023 Paper 1 Q5: © Qualifications Scotland (SQA). 2023 Higher Physics Paper 1, Q5

2026 Paper 2 Q1(a)(i): © Qualifications Scotland (SQA). 2026 Higher Physics Paper 2, Q1

Newton's Cannon in 1728: Isaac Newton, A Treatise of the System of the World (1728), public domain, via Wikimedia Commons

Simulation: Gravity and Orbits: PhET Interactive Simulations, University of Colorado Boulder, https://phet.colorado.edu, CC BY-NC 4.0

Weightlessness: NASA

2026 Paper 1 Q7: © Qualifications Scotland (SQA). 2026 Higher Physics Paper 1, Q7

Course specification — 1 of 1: © Qualifications Scotland (SQA). Higher Physics Course Specification v4.1 (September 2026), p.8

R Stewart - November 2026