

BURNING QUESTIONS

No. 001

Which planet has the most energy?

Asked by **Physics 10 R**, Tuesday 1 September 2026. • Answered Thursday 3 September 2026. • Mr. Rawson

I did not give you an answer in the room, I said I would go and work it out. Here it is. **The answer is Jupiter.** The answer is also boring, because Jupiter wins for the same reason nearly every time, and once you see the reason you can predict the rest of this page yourself.

The reason is mass

Jupiter	318 Earths
Every other planet, added together	129 Earths

Jupiter is 318 times the mass of Earth and 5,750 times the mass of Mercury. Look at the equation for almost any store and you will find mass sitting right at the front of it, so Jupiter starts every round of this contest with that head start.

1. Sometimes Jupiter wins even though it is losing

It is slow. Jupiter orbits the Sun at 13 km/s. Mercury does 47 km/s, nearly four times faster. Jupiter still holds far more kinetic energy, because $E_k = \frac{1}{2}mv^2$ and being 5,750 times heavier beats being 3.6 times slower.

It is cold. Jupiter's cloud tops sit at -108°C . Earth averages $+15^\circ\text{C}$ and Venus bakes at $+464^\circ\text{C}$. Jupiter still holds about 1,400 times more thermal energy than Venus, because *temperature is not energy*. It has 390 times the mass, and hydrogen stores 15.9 times more energy per kilogram per degree than rock does.

2. Sometimes Jupiter really is remarkable

Its spin. A day on Jupiter lasts 9.9 hours, the shortest of any planet. Its equator is moving at 12.3 km/s while Earth's crawls along at 0.46 km/s. Here mass and speed pull the same way, so this one it wins on merit.

Its gravity. Stand on Jupiter and you would weigh about *two and a half* times what you weigh here, which seems feeble for a planet 318 times heavier. It is feeble because you would be standing 11 times further from the centre. The store is about the whole planet rather than its surface, though, and it depends on m^2 , so the mass counts twice over and Jupiter ends up with 9,200 times Earth's.

Its magnetism. **There is no metal on Jupiter.** Earth's magnetic field is made by liquid iron churning around in its core, and Jupiter has almost no iron at all, it is hydrogen and helium nearly the whole way down. It still has the strongest field of any planet, 14 times Earth's. What its mass does is squeeze that hydrogen so hard that the *hydrogen itself* starts behaving like a metal and carrying a current, and that liquid metallic hydrogen, turning right round every 9.9 hours, is what makes the field.

3. And sometimes all that mass buys nothing at all

Chemical. There is nothing on Jupiter left to burn. Hydrogen and helium are what is left over *after* burning. Earth wins this, and it barely matters, since every fossil fuel on the planet comes to one part in two billion of Earth's gravitational store.

Electrostatic. Every planet is electrically neutral. This store needs one thing to hold more electrons than another, and the electric force is 10^{36} times stronger than gravity, so any imbalance cancels itself almost the moment it appears. Size is no help.

Nuclear. Uranium and thorium live in rock, and Jupiter is nearly all hydrogen, so Earth holds 32 times more of this store in every kilogram. And Jupiter would have to be *80 times heavier* before it could fuse anything and become a star. This is the row where mass finally runs out.

The bit worth remembering

That last store answers what you actually asked on Tuesday. The uranium warming Earth's interior was forged inside exploding stars long before the Sun existed, and it is still decaying under your feet. Energy is never created, so every store here was filled by something earlier. Good question, keep them coming.

Why sunlight is not on this page. Jupiter catches more sunlight than any planet, 7.7×10^{17} W, and it is still not a store. Radiation is a **pathway**, so switch the Sun off and nothing is left in it. What it does is fill the thermal store, which is here. **The working:** standard equations, planetary data from NASA's fact sheets. Thermal, chemical and nuclear are estimates.