Flipping Physics Lecture Notes:

g is Positive.
http://www.flippingphysics.com/+g.html

The acceleration due to gravity, g, is ***positive***. Here on Earth, it has a value of roughly 9.81 meters per second squared. And, again, g is positive. However, I understand that many students question that. And I think this is why they typically do. For the first month or so of physics class, every time we use the acceleration due to gravity, it is as a part of the acceleration experienced by an object in free fall. We have shown many examples of that. We have thrown a medicine ball up in the air[1]. We have dropped dictionaries[2]. From a moving car, we have dropped a ball and had it land in a bucket[3]. And we have launched a ball from a nerd-a-pult and landed the ball in a basket[4]. Every time we did that the acceleration of the object in the y-direction was equal to negative 9.81 meters per second squared. So, again, I understand, because the acceleration of the object was always negative 9.81 meters per second squared in each of these problems, students tend to infer that the acceleration due to gravity is also negative 9.81 meters per second squared. It is not. g is ***positive*** 9.81 meters per second squared.

Now that we have learned Newton's Second Law, we can better understand why g = +9.81 m/s^2 near the surface of planet Earth. Let's begin by looking at the simple example of a ball in projectile motion. The free body diagram of the forces acting on any object in projectile motion has only one force in it, the force of gravity acting straight down. When we sum the forces in the y-direction on the ball, we get this:

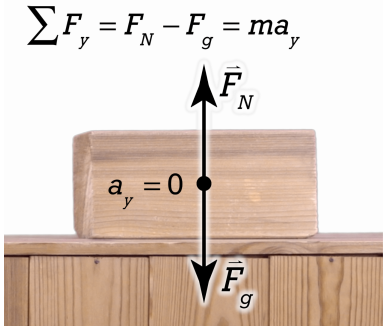
$$\sum F_y = -F_g = ma_y \Rightarrow -mg = ma_y \Rightarrow a_y = -g \;\&\; g_{Earth} = +9.81\frac{m}{s^2} \Rightarrow a_y = -9.81\frac{m}{s^2}$$

In other words, the acceleration of an object in projectile motion near the surface of planet Earth equals negative 9.81 m/s^2. That free fall acceleration is caused by the force of gravity. The reason free fall acceleration is negative, is because the force of gravity is down or toward the center of the planet.

Notice, the acceleration due to gravity, g, is not the acceleration of the object, but rather, it is the value by which you multiply the mass of an object to get the force of gravity the Earth exerts on an object.

The acceleration of an object and acceleration due to gravity, g, are two different things: a ≠ g

An object at rest on a surface will still have the force of gravity acting on it. You still multiply mass times the acceleration due to gravity to get the magnitude of the force of gravity acting on the object, however, in this case, the acceleration of the object is zero. Again, the acceleration of the object and the acceleration due to gravity are two different things. And the acceleration due to gravity, g, near the surface of planet Earth is ***positive*** 9.81 meters per second squared.



[1] https://www.flippingphysics.com/introduction-to-free-fall.html
[2] https://www.flippingphysics.com/dropping-dictionaries.html
[3] https://www.flippingphysics.com/projectile-motion-problem-part-1-of-2.html
[4] https://www.flippingphysics.com/nerd-a-pult.html