The electrical power dissipated by a resistor is given by $P = I^2 R$. It is also given by $P = (\Delta V)^2/R$. So is the power really proportional to R or to 1/R or is neither really true? Discuss thoroughly.

Don't be misled by equations

While these equations make it seem that it can be both, power and resistance are actually proportional. We have:

1. P = I^2R

2. P = V^2/R

We also know that P = QV/t, I = Q/t, and V = IR.

If we substitute V = IR into P = V^2/R, we get P = I^2R. Knowing that this is possible to relate it like this means that they are proportional.

Context is everything

These formulas are used in different contexts, depending on what is constant. The first one is used when the current is constant and the second one is used when the voltage is constant. But to answer the original question, there is not a consistent relationship between P and R.

Equation 1 shows that when the current (I) is constant, the power (P) is proportional to the resistance (R) and these values will increase proportionally when either R or P are raised. In Equation 2 it focuses on the voltage being constant and the power dissipation is inversely proportional to the resistance, so if there is a large resistance the power dissipation is lower. R and 1/R are both proportional reflecting the conditions, as power is proportional to resistance in equation 1 but in equation 2 power is inversely proportional to resistance

We have the two equations we can use to determine whether power is proportional to R or 1/R. The answer can vary. P is proportional to R when the current is constant, and P is inversely proportional when the voltage is constant. Thus, it depends on the situation.

Unlike compact fluorescent bulbs or LED bulbs, an ordinary light bulb is basically a thin wire filament that acts as a simple resistor. Estimate the resistance of such a bulb using some common numbers from ordinary household experience that previously may not have meant much to you. And look at the equations I gave you in the first question.

Straightforward with the proper sense of estimation

Estimating values....a 10 W bulb and the voltage is equal to 100 V, then Resistance = V^2/P --> (100 V)^2/10 W = 1000 ohms

Another good response

Let's say that P = 100W and V = 200V. Using P = V^2/R, we can change this to be R = V^2/P. This would give us:

R = (200W)^2/100V.

This would mean that the resistance is about 400 ohms.

And finally, good except for one detail

The average voltage for a house is 120 volts while an ordinary light bulb is around 50 watts.

1. Use the equation P=(deltaV)^2/R

2. Rearrange to solve for R, so swap the R and P to get R=(deltaV)^2/P

3. Plug in values. R=(120V)^2/50 W which is about 100V^2=10,000V^2/50W=200 V^2/V*A=200 V/A=200 ohms

Charge is for a capacitor as what is for a resistor?

a. energy
b. power
c. current
d. potential