Answer on Question#39068, Physics, Thermodynamics

Question:

A heating coil is immersed in a calorimeter of heat capacity 50 joule per degree Celsius containing 1 kg of a liquid of specific heat capacity 450 joule per kg per degree Celsius. The temperature of the liquid rises by 10 degree Celsius when 2 ampere current is passes through it for 10 minutes. Find

1. the resistance of the coil

2. the potential difference across the coil

Answer:

The power of electricity current equals:

$$P = I^2 R = UI$$

The law conservation of energy:

$$P\varDelta t = \varDelta Q$$

where $\varDelta t$ is time, Q – changing of heat;

$$Q = (cm + C)\varDelta T$$

c is specific heat capacity, C is heat capacity T – temperature;

Therefore:

$$R = \frac{(cm + C)\varDelta T}{\varDelta t \, I^2} = 2.1 \, \varOmega$$

$$U = \frac{(cm + C)\varDelta T}{\varDelta t \, I} = 4.2 \, V$$

Answer: $R = 2.1 \, \varOmega, U = 4.2 \, V$