Coefficient of Performance of a Refrigerator

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I. INTRODUCTION

THE purpose of this experiment is to measure the coefficient of performance of a system as both a heat pump and a refrigerator. Using this data, we will then be able to determine in which mode the system is more efficient.

II. THEORY

1) *Briefly explain how this system works. Be sure to discuss the function of the compressor, condenser, expansion valve, and the evaporator.*
2) *Explain how a heat pump works. Why does your text describe a heat pump and a refrigerator as the same system, each operating in the reverse direction of a heat engine?*
3) *Derive an equation for the coefficient of performance for a refrigerator in terms of the specific heat of water, the flow rate, the temperature change, and the electrical power. Carry out the derivation with the definition of the COP given in the text.*

III. DATA

Table I
TABLE 1 DATA

Resistance of Tap Water	28.7kΩ	Tap Temperature	26.0 C
Resistance of Cold Water	44.4 kΩ	Cold Temperature	16.1 C
Resistance of Hot Water	16.15 kΩ	Hot Temperature	40.0 C
Current	7.0 ± .25 A	Potential	116.4 ± .1 V
Mass of Dry Beaker 1	212.73 g	Mass of Dry Beaker 2	212.69 g
Mass, Beaker + Hot Water	1610.07 g	Mass, Beaker + Cold Water	1808.22
Time to Fill, Hot Water	35.03 s	Time to Fill, Cold Water	46.83 s
Flow Rate, Hot Water	45.96 $\times 10^{-3}$ kg/s	Flow Rate, Cold Water	38.61 $\times 10^{-3}$ kg/s

Power Supplied (IV rms): P =814.8 W
Specific Heat of Water : C_w =4186 J/kg°C

Table II
RESULTS

COP, Refrigerator	2.338
COP, Heat Pump	2.777