Science Virtual Learning

MPI Physics 240

Thermodynamics 23: Refrigerators and Air Conditioners

May 22, 2020

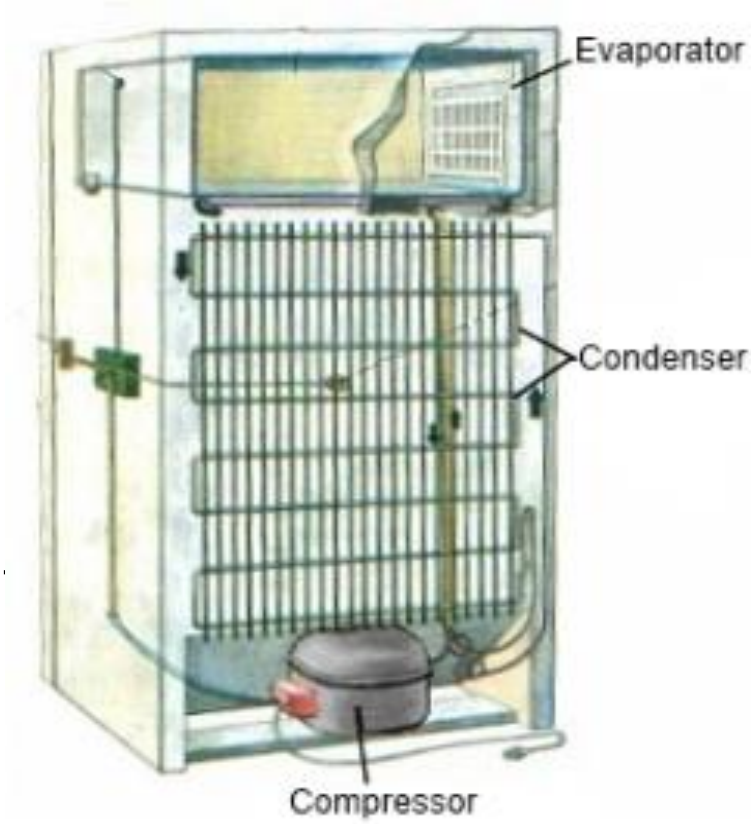
Lesson: MPI Thermodynamics 22
Refrigerators and Air Conditioners
May 22, 2020

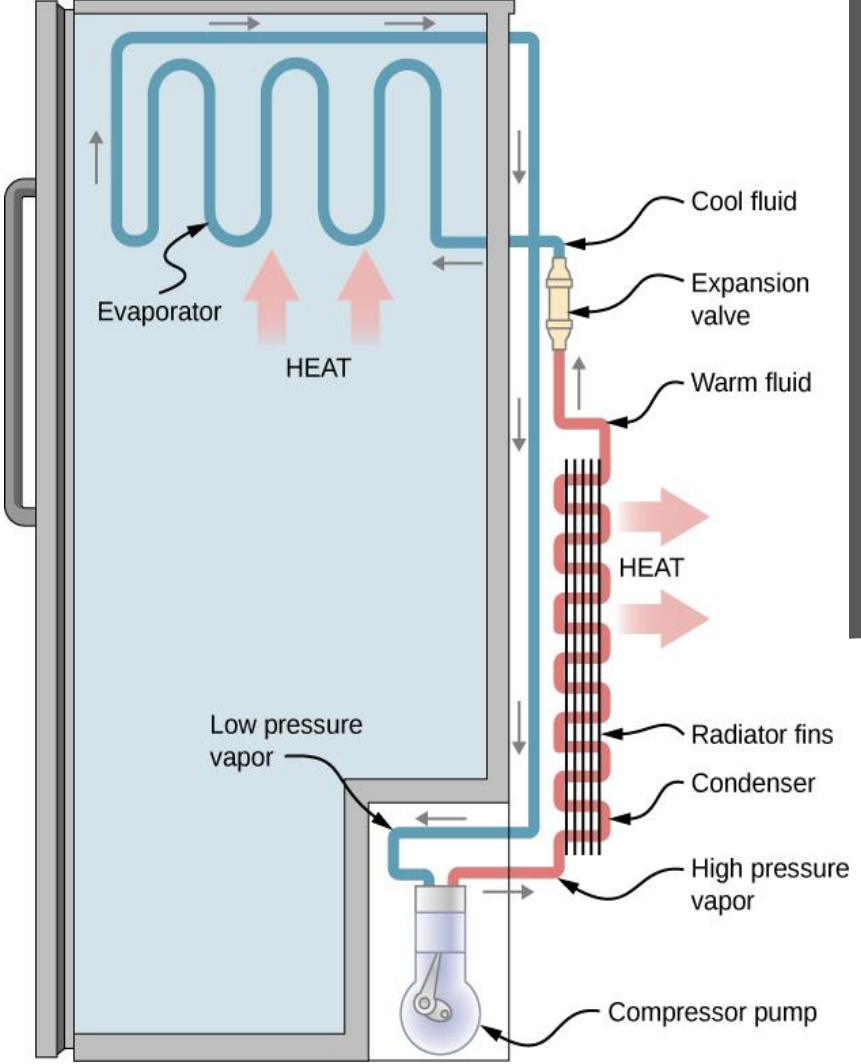
Objective: To apply what we've learned about thermodynamics to understand how refrigerators and air conditioners work

This video discusses the thermodynamics of refrigerators and air conditioners

https://youtu.be/5g_jiHJlAUw

Video: Refrigerators and Air Conditioners


Evaporator
Condenser
Compressor


Evaporator
HEAT
Cool fluid
Expansion valve
Warm fluid
HEAT
Low pressure vapor
Radiator fins
Condenser
High pressure vapor
Compressor pump

Ex 1: How much Work does it take a refrigerator to remove 10000 J of heat from fridge, if its CoP = 1.10? How much heat does it radiate out the back?

Ex 2: A window air conditioner cools a room that is 3.00 m x 4.00 m x 5.00 m from 23.0°C to 18.0°C, at 1.00 atm of pressure. How much heat must it remove from the air? If the CoP of the AC is 1.33, how much Work must it do?

Video: https://youtu.be/UcO2DT3bUfU

Examples Video

Homework

HW 1: An AC takes 50,600 J of Work to cool a house, and dumps 91,900 J of heat into the outside. How much heat did it remove from the house? What is the CoP of the AC?

HW 2: A freezer has a CoP = 1.25. You put 0.200 kg of water at 10.0°C into the freezer, and it turns to ice at -8.0°C.

a) How much heat did the freezer remove from the water?

b) How much work did the compessor do to freeze the water?

- Try to solve the problems yourself, then watch the solution video:
- https://youtu.be/8Jj2KlbydOA

That’s it!