PHYS 2C

Discussion Section – 2/19

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Before we Begin:

- Try and **sit next to a student you don't know**
- Introduce yourselves and find out where the other student is from
- We will attempt to **solve 3 Problems** today

Discussion Problem 1

Adapted from LibreTexts.org

A steel rod and an aluminum rod, each of diameter 1.00 cm and length 25.0 cm, are welded end to end. One end of the steel rod is placed in a large tank of boiling water at $100°C$, while the far end of the aluminum rod is placed in a large tank of water at $20°C$.

The rods are insulated so that no heat escapes from their surfaces.

$k_{Al} = \frac{220W}{m\,°C}, \quad k_{Steel} = \frac{80W}{m\,°C}$

a) What is the temperature at the joint?

b) What is the rate of heat conduction through this composite rod?

Discussion Problem 1 - Solution

A steel rod and an aluminum rod, each of diameter 1.00 cm and length 25.0 cm, are welded end to end. One end of the steel rod is placed in a large tank of boiling water at $100°C$, while the far end of the aluminum rod is placed in a large tank of water at $20°C$.

The rods are insulated so that no heat escapes from their surfaces.

$k_{Al} = \frac{220W}{m\,°C}, \quad k_{Steel} = \frac{80W}{m\,°C}$

a) What is the temperature at the joint?

$$T_{joint} = 41.3°C$$

a) What is the rate of heat conduction through this composite rod?

$$P_{conduction} = 1.47W$$

Discussion Problem 2

Carnot Engine

Adapted from LibreTexts.org

A Carnot engine has an efficiency of 0.60 and the temperature of its cold reservoir is 300 K.

(a) What is the temperature of the hot reservoir?

(b) If the engine does 300 J of work per cycle, how much heat is removed from the high-temperature reservoir per cycle?

(c) How much heat is exhausted to the low-temperature reservoir per cycle?

Discussion Problem 2 - Solution

Carnot Engine

A Carnot engine has an efficiency of 0.60 and the temperature of its cold reservoir is 300 K.

(a) What is the temperature of the hot reservoir?

$$T_h = 750K$$

(a) If the engine does 300 J of work per cycle, how much heat is removed from the high-temperature reservoir per cycle?

$$Q_h = 500J$$

(a) How much heat is exhausted to the low-temperature reservoir per cycle?

$$Q_c = 200J$$

Discussion Problem 3

Isothermal Work

2 moles of an ideal is isothermally expanded to 3 times its original volume at 300K . Calculate:

a) Work done on the gas

b) Heat absorbed by the gas

Discussion Problem 3 - Solution

Isothermal Work

2 moles of an ideal is isothermally expanded to 3 times its original volume at 300K . Calculate:

a) Work done on the gas

$$W = 5.48 \times 10^3 J$$

a) Heat absorbed by the gas

$$Q = 5.48 \times 10^3 J$$