Problem 1
A coal-burning steam power plant produces a net power of 300 MW with an overall thermal efficiency of 32%. The actual gravimetric air–fuel ratio in the furnace is calculated to be 12 kg air/kg fuel. The heating value of the coal is 28,000 kJ/kg.

1. Determine the amount of coal consumed during a 24-hour period
   \[ \text{solution: } m = 2.89 \times 10^6 \text{ kg} \]

2. Determine the rate of air flowing through the furnace \[ \text{solution: } \dot{m} = 402 \text{ kg/s} \]

Problem 2
Consider a building whose annual air-conditioning load is estimated to be 40,000 kWh in an area where the unit cost of electricity is $0.10/kWh.

Two air conditioners are considered for the building:
- Air conditioner A has a seasonal average COP of 2.3 and costs $5500 to purchase and install
- Air conditioner B has a seasonal average COP of 3.6 and costs $7000 to purchase and install

All else being equal, determine which air conditioner is a better buy.

Problem 3
Refrigerant-134a enters the condenser of a residential heat pump at 800 kPa and 35°C at a rate of 0.018 kg/s and leaves at 800 kPa as a saturated liquid. The compressor consumes 1.2 kW of power.

1. Determine the COP of the heat pump

2. Determine the rate of heat absorption from the outside air \[ \text{solution: } \dot{Q}_L = 1.96 \text{ kW} \]