Learning Goal:
To understand the quantitative relationships related to ideal (Carnot) engines and the limitations of such devices imposed by the second law of thermodynamics.

1. In general terms, the efficiency of a system can be thought of as the output per unit input. Which of the expressions is a good mathematical representation of efficiency \( e \) of any heat engine?
   - \( e = \frac{Q_h}{W} \)
   - \( e = \frac{Q_c}{Q_h} \)
   - \( e = \frac{Q_c}{W} \)
   - \( e = \frac{W}{Q_h} \)
   - \( e = \frac{W}{Q_c} \)

2. During the Carnot cycle, the overall entropy (circle one):
   - increases
   - decreases
   - remains constant

3. Which of the following gives the efficiency of the Carnot engine?
   - \( e = \frac{T_h}{T_c} \)
   - \( e = \frac{T_c}{T_h} \)
   - \( e = \frac{T_h-T_c}{T_h} \)
   - \( e = \frac{T_h}{T_c+T_h} \)

4. The Carnot engine does not exist in real life: It is a purely theoretical device, useful for understanding the limitations of heat engines. Real engines never operate on the Carnot cycle; their efficiency is hence lower than that of the Carnot engine. However, no attempts to build a Carnot engine are being made. Why is that?
   - A Carnot engine would generate too much thermal pollution.
   - Building the Carnot engine is possible but is too expensive.
   - The Carnot engine has zero power.
   - The Carnot engine has too low an efficiency.

5. A real heat engine operates between temperatures \( T_c \) and \( T_h \). During a certain time, an amount \( Q_c \) of heat is released to the cold reservoir. During that time, what is the maximum amount of work \( W_{\text{max}} \) that the engine might have performed?