EXERCISE 6.

1. A heat engine takes in 360 J of energy from a hot reservoir and performs 25.0 J of work in each cycle.
Find: a) the efficiency of the engine and
b) the energy expelled to the cold reservoir in each cycle.
2. A heat engine performs 200 J of work in each cycle and has an efficiency of 30.0%. For each cycle, how much energy is (a) taken in and (b) expelled by heat?
3.A particular heat engine has a useful power output of 5.00 kW and an efficiency of 25.0%. The engine expels 8 000 J of exhaust energy in each cycle. Find :
a) the energy taken in during each cycle an
b) the time interval for each cycle.
4. Heat engine *X* takes in four times more energy by heat from the hot reservoir than heat engine *Y*. Engine *X* delivers two times more work, and it rejects seven times more energy by heat to the cold reservoir than heat engine *Y*. Find the efficiency of (a) heat engine *X* and (b) heat engine *Y*.
5. A multicylinder gasoline engine in an airplane, operating at 2 500 rev/min, takes in energy 7.89×10^3 J and exhausts 4.58×10^3J for each revolution of the crankshaft.
(a) How many liters of fuel does it consume in 1h of operation if the heat of combustion is 4.03×10^7 J/L?
(b) What is the mechanical power output of the engine? Ignore friction and express the answer in horsepower.
(c) What is the torque exerted by the crankshaft on the load?
(d) What power must the exhaust and cooling system transfer out of the engine?
6. Suppose a heat engine is connected to two energy reservoirs, one a pool of molten aluminum (660°C) and the other a block of solid mercury (-38.9°C). The engine runs by freezing 1g of aluminum and melting 15 g of mercury during each cycle. The heat of fusion of aluminum is 3.97×10^5 J/kg; the heat of fusion of mercury is 1.18×10^4 J/kg. What is the efficiency of this engine?