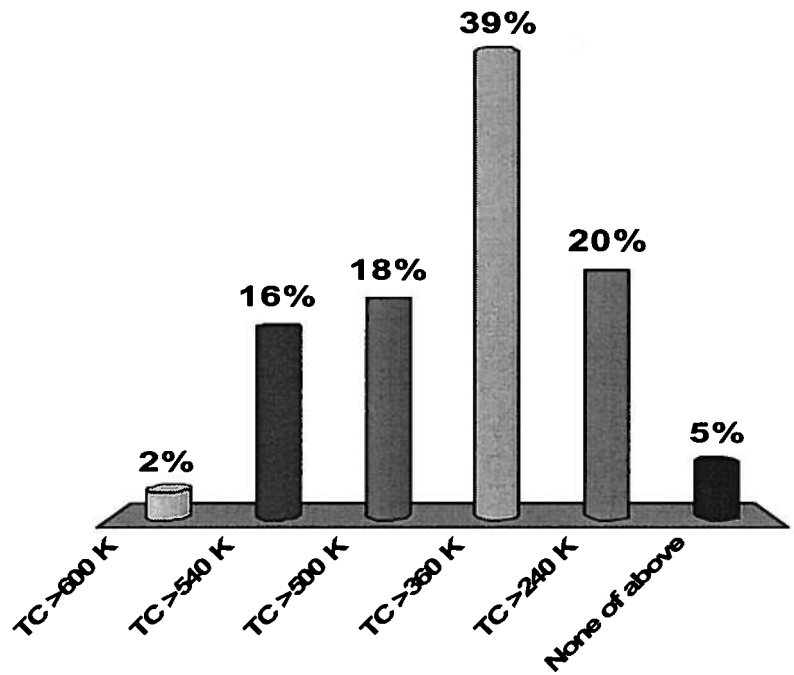
J. Griffin 11/28/079

A heat engine takes in 100 J of heat and performs 60 J of work in each cycle. If its maximum Temperature is T_H = 600 K, what at most can be inferred about its minimum (exhaust) temperature, T_C ?

1. T_C >600 K
2. T_C >540 K
3. T_C >500 K
4. T_C >360 K
5. T_C >240 K
6. None of above



J. GRIFFIN 4/29/07 (b)

One concludes that the exhaust temperature, $\mathbf{T_C < 240\ K}$ (i.e. answer (d)), as follows:

- $\mathbf{\eta_{ACTUAL} < \eta_{CARNOT}}$ **implies**
- (i) $1-(Q^{OUT}/Q^{IN}) < 1-(T_C/T_H)$, so that
- (ii) $(Q^{OUT}/Q^{IN}) > (T_C/T_H)$, or
- (iii) $\mathbf{T_H * (Q^{OUT}/Q^{IN}) > T_C}$.
- Since (1^{st} Law, with $\Delta U = 0$):
- (iv) $Q^{IN} - Q^{OUT} = W^{OUT}$
- Or (v) $Q^{IN} - W^{OUT} = Q^{OUT}$, (iii) becomes
- (vi) $(Q^{IN} - W^{OUT})/Q^{IN})*T_H > T_C$ and **compute**
- $((100 - 60)/100)*600\ K > T_C$
- or $\mathbf{240\ K > T_C}$.