

Practical advice

These are simple practice questions

Answers and worked solutions

1. (a) Maximum efficiency = $(T_{\text{HOT}} - T_{\text{COLD}})/T_{\text{HOT}} = (2000 - 300) / 2000 = 0.85 = 85\%$
- (b) Maximum efficiency = $(T_{\text{HOT}} - T_{\text{COLD}})/T_{\text{HOT}} = (288 - 273) / 288 = 0.052 = 5.2\%$
The temperature difference is maintained by the world climate, and affects large masses of water, so that a substantial amount of renewable energy might be extracted, provided that doing so did not materially affect the temperature gradient. Such a power station is called Ocean Thermal Energy Conversion (OTEC).
2. (a) Maximum efficiency = $(T_{\text{HOT}} - T_{\text{COLD}})/T_{\text{HOT}} = ([98 + 273] - [30 + 273]) / [98 + 273]$
 $= (371 - 303) / 371 = 0.183 = 18.3\%$
- (b) Efficiency = useful power out / total power in
so power in = power out / efficiency = $80 / 6\% = 1333 \text{ kW}$
- (c) The energy keeps on coming, as long as we don't pump too much cold water down and cool the rocks too much.
3. (a) Maximum efficiency = $(T_{\text{HOT}} - T_{\text{COLD}})/T_{\text{HOT}} = ([543 + 273] - [100 + 273]) / [543 + 273]$
 $= (816 - 373) / 816 = 0.54 = 54\%$
- (b) Maximum efficiency = $(T_{\text{HOT}} - T_{\text{COLD}})/T_{\text{HOT}} = ([565 + 273] - [273 + 100]) / [565 + 273]$
 $= (838 - 373) / 838 = 0.67 = 67\%$
So efficiency is improved by $67\% - 54\% = 13\%$

External reference

Question 1 of this activity is from Nuffield Revised Physics unit K question 43(P)