9.7) NEUTRONS FORM A GAS IN NUCLEAR REACTORS. FIND $\bar{v}$ AND v^* FOR NEUTRONS AT a) 300K AND b) 630K (A TYPICAL LIGHT-WATER NUCLEAR REACTOR).

THE SPEEDS ARE $\bar{v} = \frac{4}{\sqrt{2\pi}}\sqrt{\frac{kT}{m}}$ AND $v^* = \sqrt{\frac{2kT}{m}}$

NEUTRONS HAVE A MASS OF 1.675×10^{-27} kg [TZD II FRONT COVER]

a) $\bar{v}_{300K} = \frac{4}{\sqrt{2\pi}}\sqrt{\frac{(1.38\times10^{-23})(300)}{(1.675\times10^{-27})}} = 2509\ \frac{m}{s} = \boxed{2.51\ \frac{km}{s} = \bar{v}_{300K}}$

$v^*_{300K} = \sqrt{\frac{2(1.38\times10^{-23})(300)}{(1.675\times10^{-27})}} = 2223\ \frac{m}{s} = \boxed{2.22\ \frac{km}{s} = v^*_{300K}}$

b) $\bar{v}_{630K} = \frac{4}{\sqrt{2\pi}}\sqrt{\frac{(1.38\times10^{-23})(630)}{(1.675\times10^{-27})}} = 3636\ \frac{m}{s} = \boxed{3.64\ \frac{km}{s} = \bar{v}_{630K}}$

$v^*_{630K} = \sqrt{\frac{2(1.38\times10^{-23})(630)}{(1.675\times10^{-27})}} = 3222\ \frac{m}{s} = \boxed{3.22\ \frac{km}{s} = v^*_{630K}}$

THESE AREN'T VERY DIFFERENT SINCE THE SPEED ONLY GOES UP BY THE SQUARE ROOT OF THE RATIO:

$$\sqrt{\frac{630}{300}} = \sqrt{2.1} = 1.45 \sim \text{GOT!}$$