$\boxed{8}$. (a) $T_C = \frac{5}{9}(T_F - 32) = \frac{5}{9}(500 - 32) = \boxed{260°C}$. (b) $T_C = \frac{5}{9}(0 - 32) = \boxed{-18°C}$.

(c) $T_C = \frac{5}{9}(-20 - 32) = \boxed{-29°C}$. (d) $T_C = \frac{5}{9}(-40 - 32) = \boxed{-40°C}$.

13. $T_C = \frac{5}{9}(T_F - 32) = \frac{5}{9}(134 - 32) = \boxed{56.7°C}$. $T_C = \frac{5}{9}(-80 - 32) = \boxed{-62°C}$.

16. $T_C = \frac{5}{9}(T_F - 32) = \frac{5}{9}(98.2 - 32) = 36.78°C$. So her final temperature is $36.78°C - 8.5C° = \boxed{28.3°C}$.

$T_F = \frac{9}{5}T_C + 32 = \frac{9}{5}(28.3) + 32 = \boxed{82.9°F}$.

18. Since $T_C = \frac{5}{9}(T_F - 32)$. If T_c is much higher than 32°C, $T_C \approx \frac{5}{9}T_F = \boxed{0.555\ T_F}$.

By using $\frac{1}{2} = 0.500$, the percentage difference is about $\frac{0.555 - 0.500}{0.500} = \boxed{11\%}$.

31. (a) $T_C = T_K - 273 = 30\,000 - 273 = \boxed{29\,727°C}$. $T_F = \frac{9}{5}T_C + 32 = \frac{9}{5}(29\,727) + 32 = \boxed{53\,541°F}$.

(b) The percentage error is $\frac{30\,000 - 29\,727}{30\,000} = \boxed{0.910\%}$.

35. $T = (273 + 37)\text{ K} = 310\text{ K}$

$pV = Nk_BT$, ☞ $N = \frac{pV}{k_BT} = \frac{(1.01 \times 10^5\text{ Pa})(7.0 \times 10^{-3}\text{ m}^3)}{(1.38 \times 10^{-23}\text{ J/K})(310\text{ K})} = \boxed{1.7 \times 10^{23}}$.

$\boxed{40}$. $T_1 = 92°F = \frac{5}{9}(92 - 32)\ °C = 33.3°C = 306.3\text{ K}$, $T_2 = 32°F = 0°C = 273\text{ K}$.

$\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$, ☞ $V_2 = \frac{p_1V_1T_2}{T_1p_2} = \frac{(20.0\text{ lb/in.}^2)(0.20\text{ m}^3)(273\text{ K})}{(306.3\text{ K})(14.7\text{ lb/in.}^2)} = \boxed{0.24\text{ m}^3}$.

Here lb/in.^{2} can be used since it is in a ratio.

41. $T_1 = 61°F = \frac{5}{9}(61 - 32)°C = 16.1°C = 289.1\text{ K}$, $T_2 = 100°F = 310.8\text{ K}$,

$p_1 = 30.0\text{ lb/in.}^2 + 14.7\text{ lb/in.}^2 = 44.7\text{ lb/in.}^2$. $\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$.

Since $V_1 = V_2$, $p_2 = \frac{p_1T_2}{T_1} = \frac{(44.7\text{ lb/in.}^2)(310.8\text{ K})}{289.1\text{ K}} = 48.1\text{ lb/in.}^2$.

So the gauge pressure is $48.1\text{ lb/in.}^2 - 14.7\text{ lb/in.}^2 = \boxed{33.4\text{ lb/in.}^2}$.

44. $\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$, ☞ $p_2 = \frac{p_1V_1T_2}{T_1V_2} = \frac{(1\text{ atm})(2.4\text{ m}^3)(303\text{ K})}{(273\text{ K})(1.6\text{ m}^3)} = \boxed{1.7\text{ atm}}$.

47. The pressure 15 m below the surface is
$p_1 = p_a + \rho gh = 1.01 \times 10^5\text{ Pa} + (1000\text{ kg/m}^3)(9.80\text{ m/s}^2)(15\text{ m}) = 2.48 \times 10^5\text{ Pa}$.
$\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$, ☞ $V_2 = \frac{p_1T_2}{p_2T_1} \times V_1 = \frac{(2.48 \times 10^5\text{ Pa})(293\text{ K})}{(1.01 \times 10^5\text{ Pa})(280\text{ K})} \times (2.0\text{ cm}^3) = \boxed{5.1\text{ cm}^3}$.

81. $v_{rms} = \sqrt{\frac{3k_BT}{m}}$, ☞ $\frac{v_{rms}}{(v_{rms})_o} = \sqrt{\frac{T}{T_o}} = \sqrt{\frac{600\text{ K}}{300\text{ K}}} = \sqrt{2}$.

So the rms speed $\boxed{\text{increases by a factor of } \sqrt{2}}$.

83. (a) Since $U = \frac{3}{2}nRT$ and $pV = nRT$,

$U = \frac{3}{2}pV = \frac{3}{2}(1.01 \times 10^5\text{ Pa})(4.00\text{ m})(10.0\text{ m})(3.00\text{ m}) = \boxed{1.82 \times 10^7\text{ J}}$.

(b) $U_g = mgh$, ☞ $h = \frac{U_g}{mg} = \frac{1.82 \times 10^7 \text{ J}}{(1200 \text{ kg})(9.80 \text{ m/s}^2)} = \boxed{1.55 \times 10^3 \text{ m}}$.

$\boxed{84}$. $v_{rms} = \sqrt{\frac{3k_B T}{m_o}}$, ☞ $\frac{(v_{rms})_2}{(v_{rms})_1} = \sqrt{\frac{T_2}{T_1}} = \sqrt{\frac{373 \text{ K}}{298 \text{ K}}} = \boxed{1.12 \text{ times as fast}}$.

88. $pV = Nk_B T$, ☞ $N = \frac{pV}{k_B T} = \frac{(20 \text{ Pa})(0.10 \text{ m}^3)}{(1.38 \times 10^{-23} \text{ J/K})(293 \text{ K})} = \boxed{4.9 \times 10^{20}}$.