

3(a)	(gas that obeys) $pV \propto T$ (at all values of p , V and T)
	where T is thermodynamic temperature
3(b)(i)	$pV = \frac{1}{3} Nm \langle c^2 \rangle$ and $Nm / V = \rho$
	$(p = \frac{1}{3} \rho \langle c^2 \rangle)$
	r.m.s. speed = $\sqrt{\langle c^2 \rangle}$
	$1.6 \times 10^5 = \frac{1}{3} \times 1.9 \times \langle c^2 \rangle$ leading to r.m.s. speed = 500 m s^{-1}
	or r.m.s. speed = $\sqrt{(3 \times 1.6 \times 10^5 / 1.9)} = 500 \text{ m s}^{-1}$
3(b)(ii)	$(pV =) \frac{1}{3} Nm \langle c^2 \rangle = NkT$
	(so) $\frac{1}{2} m \langle c^2 \rangle = (3 / 2) kT$
	$\frac{1}{2} \times 4.7 \times 10^{-26} \times 503^2 = (3 / 2) \times 1.38 \times 10^{-23} \times T$
	$T = 290 \text{ K}$
	or
	$pV = NkT$ and $Nm / V = \rho$
	(so) $T = pm / \rho k$
3(c)	$T = 1.6 \times 10^5 \times 4.7 \times 10^{-26} / (1.9 \times 1.38 \times 10^{-23})$ $= 290 \text{ K}$
	potential energy (of molecules) is zero
	$U = N \times \frac{1}{2} m \langle c^2 \rangle = 6.0 \times 6.02 \times 10^{23} \times \frac{1}{2} \times 4.7 \times 10^{-26} \times 503^2$
	or $U = N \times (3 / 2) kT = 6.0 \times 6.02 \times 10^{23} \times (3 / 2) \times 1.38 \times 10^{-23} \times 287$
	or $U = n \times (3 / 2) RT = 6.0 \times (3 / 2) \times 8.31 \times 287$
	$U = 21000 \text{ J}$