

4(a)(i)	thermodynamic temperature
4(a)(ii)	molar gas constant
4(b)(i)	m : mass of one molecule (of the gas) $\langle c^2 \rangle$: mean-square speed (of molecules)
4(b)(ii)	$NBT/A = \frac{1}{3} Nm\langle c^2 \rangle$ clear use of $E_K = \frac{1}{2} m\langle c^2 \rangle$ leading to $E_K = 3BT/2A$
4(c)	line with positive gradient passing through the origin smooth curve with decreasing positive gradient

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) $T = pm / \rho k$ $T = 1.6 \times 10^5 \times 4.7 \times 10^{-26} / (1.9 \times 1.38 \times 10^{-23})$ $= 290 \text{ K}$
3(c)	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 $U = n \times (3/2) RT = 6.0 \times (3/2) \times 8.31 \times 287$ $U = 21000 \text{ J}$