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

A-Level Physics: **s25 44**

3(a)	(gas that obeys) $pV \propto T$ (at all values of p, V and T)
	where T is thermodynamic temperature
3(b)(i)	$pV = ⅓ Nm\langle c^2 \rangle$ **and** $Nm / V = \rho$ ($p = ⅓ \rho \langle c^2 \rangle$)
	r.m.s. speed = $\sqrt{\langle c^2 \rangle}$
	$1.6 \times 10^5 = ⅓ \times 1.9 \times \langle c^2 \rangle$ 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 m s^{-1}
3(b)(ii)	(pV =) $⅓ Nm\langle c^2 \rangle = NkT$ (so) $½ m\langle c^2 \rangle = (3 / 2) kT$
	$½ \times 4.7 \times 10^{-26} \times 503^2 = (3 / 2) \times 1.38 \times 10^{-23} \times T$ T = 290 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 K
3(c)	potential energy (of molecules) is zero
	$U = N \times ½ m\langle c^2 \rangle = 6.0 \times 6.02 \times 10^{23} \times ½ \times 4.7 \times 10^{-26} \times 503^2$ **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 J