4. States of matter

4.1 The gaseous state- ideal and real gases

Paper 2

Marking Scheme

Q1.

(d)(i)	$pV = nRT \therefore V = 8.31 \times 630 \div 100\,000 =$ **0.0524** (m^3)	1

Q2.

(d)	**M1** *value of n based on re-arranged equation for 'n' and substitution of correct values* $n = \frac{3.23 \times 10^5 \cdot 250 \times 10^{-6}}{8.31 \cdot 500} = 0.0194(34416)$	1
	M2 calculated value of M_r based on M1 $M_r = 3.30 \div n = 170$	1
	M3 period 3 chloride which matches M_r in M2 (formula) $SiCl_4$	1

Q3.

(c)(i)	high temperature AND low pressure	1
(c)(ii)	**M1** CO is polar / has a permanent dipole OR N_2 is non-polar	1
	M2 IMF in CO are (more) significant / larger OR IMF in N_2 are smaller / less significant	1
	Alternative answer **M1** (Size of) N_2 smaller than CO OR volume of N_2 molecules / particles smaller	
	Alternative answer **M2** volume of N_2 molecules / particles is more negligible ORA	

(d)	**M1** correct conversion to consistent units P = 101 000 V = 100 / 1 000 000 = (1×10^{-4}) T = 293	1
	M2 use of all values from M1 in correct relationship, n = PV / RT	1
	M3 calculation = 4.15×10^{-3} mol	1

Q4.

(c)(i)	*Any two assumptions about the behaviour of particles in an ideal gas from* • (particles / molecules have mass but) negligible size / volume (compared to total volume of gas / container) • no / negligible forces / interactions (between particles / molecules) • collisions are elastic	2
(c)(ii)	**M1** IMF become larger / more significant	1
	M2 volume of molecules / particles becomes significant / no longer negligible	1

Q5.

(e)	**M1** pressure increases **M2** (pressure goes up as) number of moles/molecules increases in ratio 3 (gas) reactants to 5 (gas) products **OR** pressure is (directly) proportional to number of moles/molecules	**2**

Q6.

(d)(i)	**M1** *correct conversions of data to SI/consistent units* $p = 404\,000$; $V = 20 \times 10^{-6}$; $T = 298$	**1**
	M2 *calculation of n (= pV/RT) from **M1** values* $n = \frac{404000 \times 20 \times 10^{-6}}{8.31 \times 298} = 3.263 \times 10^{-3}$ mol of Cl_2	**1**
	M3 *finding the mass of Cl_2* $= 3.263 \times 10^{-3} \times 71.0 = 0.23$ (g)	**1**

(d)(ii)	**Method 1** **M1** $= 3.263 \times 10^{-3} \times 2$	**Method 2** **M1** $= \frac{0.23}{71.0} \times 2$ **OR** 6.53×10^{-3}	**1**
	M2 $= 6.02 \times 10^{23} \times$ **M1** $= 3.93 \times 10^{21}$ atoms of Cl	**M2** $= 6.02 \times 10^{23} \times$ **M1** $= 3.90 \times 10^{21}$ atoms of Cl	**1**
(d)(iii)	**M1** size / volume of **molecule / particle** becomes significant / non-negligible **OR** IMFs become significant / non-negligible		**1**
	M2 IMFs becomes significant / non-negligible / collisions are not elastic		**1**