

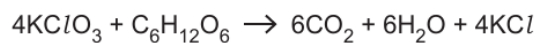
4. States of matter

4.1 The gaseous state- ideal and real gases

Paper 2

Question Paper

- 1 (d) Molten KClO_3 reacts with glucose, $\text{C}_6\text{H}_{12}\text{O}_6$.



KClO_3 melts at 630 K. At this temperature, both CO_2 and H_2O are gases.

- (i) Use the ideal gas equation to calculate the volume, in m^3 , of one mole of gas at 630 K and $1.00 \times 10^5 \text{ Pa}$.

Show your working. Give your answer to 3 significant figures.

volume of 1 mol of gas = m^3
[1]

- 2 (d) A 3.30 g sample of a Period 3 chloride is heated to 500 K in a sealed flask. At this temperature, the chloride is a gas of volume 250 cm^3 and the pressure in the flask is 323 kPa.

Use the ideal gas equation $pV = nRT$ to calculate the M_r of the Period 3 chloride. Deduce its formula.

$M_r = \dots\dots\dots$

formula of Period 3 chloride =
[3]

3 Carbon monoxide gas, CO(g), and nitrogen gas, N₂(g), are both diatomic molecules.

(c) Both carbon monoxide and nitrogen are gases at room temperature and pressure.

They both behave like ideal gases under certain conditions.

(i) State the **two** conditions necessary for these two gases to approach ideal gas behaviour.

.....
..... [1]

(ii) Explain why N₂(g) behaves more like an ideal gas than CO(g) does at 20.0°C and 101 kPa.

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.....
..... [2]

(d) Calculate the amount, in mol, of pure nitrogen gas which occupies 100 cm³ at 101 kPa and 20.0°C.

Use relevant information from the *Data Booklet*. Show your working.

Assume nitrogen behaves as an ideal gas.

..... mol
[3]

4 The strength of interaction between particles determines whether the substance is a solid, liquid or gas at room temperature.

(c) Nitrogen, N_2 , is also a gas at room temperature and pressure. Neither CO nor N_2 is an ideal gas.

(i) State two assumptions that are made about the behaviour of particles in an ideal gas.

1

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2

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[2]

(ii) Explain why N_2 does not behave as an ideal gas at very high pressures.

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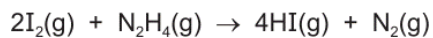
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..... [2]

5 Hydrogen iodide, HI, is a colourless gas at room temperature.

(e) HI(g) can also be formed by the reaction of $I_2(g)$ with hydrazine, $N_2H_4(g)$.



State the change in pressure that would occur when 2 mol $I_2(g)$ fully reacts with 1 mol $N_2H_4(g)$ in a sealed container at constant temperature. Explain your answer.

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..... [2]

- 6 (d) Chlorine exists as a diatomic gas, $Cl_2(g)$. A sample of $Cl_2(g)$ was made during a chemical reaction. When measured at 404 kPa and 25 °C the sample occupied a volume of 20.0 cm³.

- (i) Calculate the mass, in grams, of $Cl_2(g)$ formed.

For this calculation, assume that chlorine behaves as an ideal gas under these conditions.

mass of $Cl_2(g)$ = g [3]

- (ii) Calculate the number of chlorine atoms in this sample of $Cl_2(g)$. You may find it helpful to use your answer to (d)(i).

If you are unable to calculate an answer to (d)(i), use 0.36 g of Cl_2 . This is **not** the correct answer.

number of chlorine atoms = [2]

- (iii) $Cl_2(g)$ does **not** behave as an ideal gas under these conditions.

Explain why $Cl_2(g)$ behaves even **less** ideally at:

- very high pressures

.....

- very low temperatures.

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[2]