

GASEOUS STATE

Learning Objectives

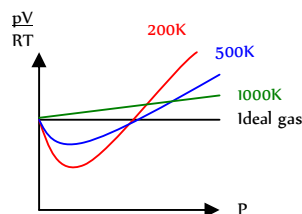
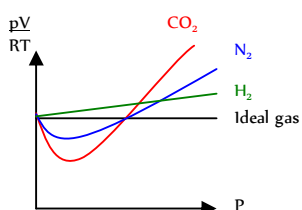
Candidates should be able to:

State the **basic assumptions** of the kinetic theory as applied to an ideal gas.

1. Gas particles are far away with random motions
2. Negligible volume of particles
3. Negligible forces of attraction between particles
4. Particles collide elastically without losing KE after collision
5. Average KE of particles directly proportional to Kelvin temperature

Instead, properties of real gases:

1. Significant volume
2. Significant forces of attraction (usually VDW)
3. Particles collide inelastically



Factors influencing deviation from ideal behaviour:

1. Forces of attraction (e.g. VDW, hydrogen bonding)
2. Particle size

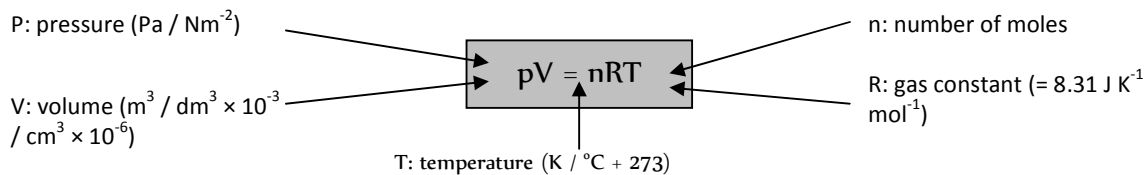
Explain qualitatively in terms of intermolecular forces and molecular size: **Conditions** necessary for a gas to approach **ideal behaviour**.

- ✓ Low pressure
 - Few particles in container, gas particle volume negligible
- ✓ High temperature
 - High KE, can easily overcome intermolecular attraction

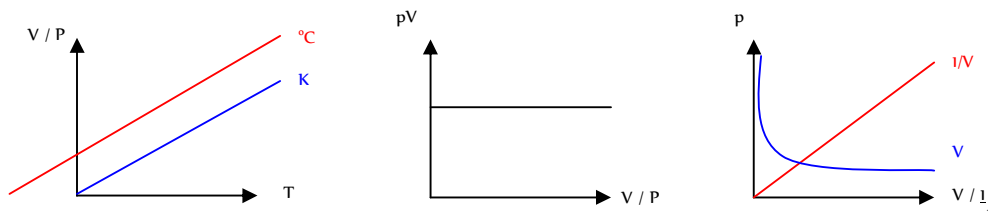
Explain qualitatively in terms of intermolecular forces and molecular size: **Limitations of ideality** at very high pressures & very low temperatures.

- ✓ High pressure
 - Gas particles tightly packed, intermolecular attractions & molecular volume significant
 - Below 360 atm, pV is smaller & pV/RT decreases
 - Above 360 atm, pV is larger & pV/RT increases
- ✓ Low temperature
 - KE decreases, molecular speeds lowered, intermolecular attractions significant
 - Greatest deviation at 200K

State and use general gas equation $pV = nRT$, including determination of M_r .



✓ @ Standard temperature & pressure: 273 K & 1 atm / 1.01 × 10⁵ Pa



- ✓ Since $n = M / M_r$
 - $pV = \frac{mRT}{M_r}$
 - $M_r = \frac{mRT}{pV}$
- ✓ Density of gas directly proportional to M_r & inversely proportional to temperature
- ✓ Law of partial pressure of gases
 - Each gas in mixture behaves as if it were only gas present
 - Gases mix homogeneously in any proportion
 - Partial pressure of gas = $(N_{\text{gas}} \div N_{\text{total}}) \times P_{\text{total}}$