Module 5.2: Ideal gases

This section explores the Ideal Gas laws and theories in terms of the kinetic model, linking the macroscopic bulk gas to the microscopic molecule world. It provides an opportunity to discuss how Newton’s laws can be used to model the behaviour of gases (HSW1) and significant opportunities for the analysis and interpretation of data (HSW5).

| Specification reference | Checklist questions |
| --- | --- |
| 5.1.4 a | Can you understand an amount of substance, measured in moles? |  |
| 5.1.4 a | Can you explain the Avogadro constant, *N*A? |  |
| 5.1.4 b | Can you describe the model of the kinetic theory of gases and its assumptions? |  |
| 5.1.4 c | Can you describe pressure in terms of the model of the kinetic theory of gases? |  |
| 5.1.4 d i | Can you calculate the equation of state of an ideal gas *pV* = *nRT*, where *n* is the number of moles? |  |
| 5.1.4 d ii | Can you understand techniques and procedures used to investigate *pV* = constant (Boyle’s law) and  = constant? |  |
| 5.1.4 d iii | Can you calculate an estimation of absolute zero using variation of gas temperature with pressure? |  |
| 5.1.4 e | Can you explain the equationrelating the number of particles and the mean square speed? |  |
| 5.1.4 f | Can you understand root mean square speed and mean square speed? |  |
| 5.1.4 g | Can you understand the Boltzmann constant, ? |  |
| 5.1.4 h | Can you calculate? |  |
| 5.1.4 i | Can you describe the internal energy of an ideal gas? |  |

**Homework and Independent Study**

HW: Assessed past-paper questions.

 Kerboodle online task(s)

Revision: As part of first half-term test (Module 5.1 and 5.2)

IS: Textbook summary questions on each sub-topic, to self-assess.

Zig-zag booklets for revision and IS. *Answers distributed at end of topic.*

Use of online resources including physicandmathstutor.com, Seneca Learning and Kerboodle textbook (Chapter 15).

Practise past-paper questions at the end of topic (textbook pages 300-1)

**Key Terms (Modules 5.1 and 5.2)**

**Absolute Temperature:** A temperature value relative to absolute zero.

**Absolute Zero:** The lowest possible temperature of a system, where no heat

remains and the particles in the system have no kinetic energy.

**Avogadro Constant:** The number of particles that make up one mole of any gas.

**Boltzmann Constant:** A constant relating the average kinetic energy of the

particles in a gas, to the gas’ temperature.

**Boyle’s Law:** The pressure of an ideal gas is inversely proportional to its volume

when held at constant temperature.

**Brownian Motion:** The random motion of particles.

**Change of Phase:** The transitions between solids, liquids and gases. During a

change of phase, there is a change of internal energy but not temperature.

**Equation of State of an Ideal Gas:** An equation linking pressure, volume, number

of moles, temperature and the ideal gas constant.

**Gas:** A phase of matter in which the particles are high energy and free to move.

Gases will fill the space they are placed in.

**Internal Energy:** The sum of the randomly distributed kinetic and potential

energies of the particles in a given system.

**Kelvin:** The unit of absolute temperature.

**Key Terms (continued)**

**Liquid:** A phase of matter in which the particles can slide over each other, but still

have forces of attraction between each other.

**Solid:** A phase of matter in which the particles can only vibrate about fixed

positions, due to strong intermolecular forces.

**Specific Heat Capacity:** The amount of energy required to increase the

temperature of 1kg of a substance by 1 Kelvin.

**Specific Latent Heat:** The amount of energy required to change the state of 1kg

of a substance without a change of temperature.

**Thermal Equilibrium:** A stable state in which there is no thermal heat transfer

between two regions.

Refer to the “H556 Physics OCR A Formula Booklet” you have been given, for Module 5 equations.