GCSE Geology – 1.1 Minerals

Mineral definition – a naturally occurring, inorganic substance, with a characteristic chemical composition and atomic structure.

Mineral physical properties used to identify and distinguish between the ten minerals on the data sheet.

Colour – many minerals are white, grey, or colourless. This property is only useful to identify minerals with a distinct colour (augite, olivine, garnet, galena, haematite).

Lustre – the way a mineral reflects light.
Glassy – reflecting light such as glass (quartz, calcite, halite).
Pearly – reflecting light such as pearls (mica).
Metallic – reflecting light such as polished metal (galena, haematite).
Dull – where the light is not reflected (haematite, weathered galena).

Streak – the colour of a mineral's powder obtained by scraping a specimen across an unglazed porcelain tile. Metallic minerals produce characteristic streaks and are important for identification; galena produces a lead-grey streak, while haematite produces a red-brown streak.

Cleavage – when minerals break up into regular flat-sided pieces. This happens due to planes of weakness running through the mineral's atomic structure. Minerals may have no cleavage (quartz), one plane (mica), two planes (feldspar) or three planes (calcite).

Hardness – measured using Mohs Scale and requires the use of a fingernail, copper coin and a steel nail or pin to determine relative hardness.

Fingernail scratches mineral – hardness is 2.5 or below.
Copper coin scratches mineral – hardness is 3.5 or below.
Steel pin/nail scratches mineral – hardness is 5.5 or below.

Calcite is not scratched by a fingernail but instead by a copper coin; therefore, the mineral has a hardness of 2.5 to 3.5.

A mineral that is not scratched by a steel pin/nail has a hardness over 5.5 (quartz, olivine).

Acid reaction – 0.5 mol dm^{-3} hydrochloric acid is used to identify calcite. It fizzes and gives off carbon dioxide.

Below are the key properties of the ten minerals on the data sheet.

- **Quartz** – not scratched by steel, glassy lustre, no cleavage
- **Feldspar** – not scratched by steel, pearly to glassy lustre, two cleavages
- **Mica** – brown or silvery colour, pearly to glassy lustre, one cleavage
- **Augite** – black, not scratched by steel, two cleavages
- **Olivine** – olive green, not scratched by steel, no cleavage
- **Halite** – just scratched by fingernail, three cleavages, tastes salty
- **Calcite** – scratched by copper coin, three cleavages, reacts with acid
- **Haematite** – red-brown streak, metallic or dull lustre, no cleavage
- **Galena** – grey streak, metallic lustre, three cleavages, high density (feels heavy)
- **Garnet** – red, not scratched by steel, no cleavage.

Mineral Forming Processes (SHREC)

Solidification/ crystallisation from a melt (lava/ magma) [quartz, feldspar, mica, augite, olivine].
Hydrothermal activity when hot fluids dissolve minerals and re-deposit them in a more concentrated form in veins and faults [haematite, galena (valuable ore minerals), quartz, calcite (worthless gangue minerals)].
Recrystallisation during metamorphism [calcite, garnet, quartz, mica].
Evaporation of seawater causing precipitation/crystallisation [halite and calcite].
Cementation is the precipitation and crystallisation of quartz and calcite from flowing pore waters in loose sediments to convert them into solid sedimentary rocks.

Laboratory analysis of minerals on a small scale is used to determine their detailed chemistry and microscopic physical details.

Scanning Electron Microscope (SEM) is a microscope in which the surface of a specimen is scanned by a beam of electrons that are reflected to form an image. Produces images up to a magnification of X1,000,000.

Electron Microprobes bombard mineral samples with an electron beam, emitting x-rays at wavelengths characteristic to the elements being analysed. This enables the abundances of elements present within small sample volumes to be determined.