Diagnostic properties

Rock and mineral ***D and P***

The teacher demonstrates the difference between a rock and a mineral using a large piece of pegmatite containing clearly distinct minerals. Students then look at a piece of granite and describe the colour of each mineral present.

Diagnostic mineral properties (except cleavage and form)

A P F 1hour for 12 trays

12 trays of minerals each one illustrating one of the diagnostic properties listed below. Students must answer questions or make statements about the contents of each tray or about individual samples. Suggested trays:

Minerals with distinctive colours	***All black minerals***
All white minerals	***Varieties of quartz***
Varieties of fluorite	***Streak***
Lustre	***Transparency***
Hardness	***Density***
Acid reaction	***Magnetism***

Cleavage 1 ***D***

Use a large sheet of mica and large calcite rhomb to show cleavage faces and lines of incipient cleavage

Cleavage 2 ***D***

Use a model (or photo) of the molecular structure of mica and of graphite to show the relationship of cleavage to bond length

Cleavage 3 ***A I 5 min***

Students use a hammer to break up small pieces of calcite or galena and examine the shape of the fragments. Do this on a board in a tray. Bags of small bits of calcite and galena can be obtained from mineral dealers

Cleavage 4 ***A I 2 min***

Students are given pieces of mica to peel thin sheets off.

Cleavage 5 *A I 15 min*

Students examine labelled samples of mica, calcite, feldspar, galena, pyroxene, amphibole to find the cleavage planes. They are then tested on unlabelled samples.

Conchoidal fracture *A I 2 min*

Students break flint nodules to obtain a curved fracture but this needs to be done with care outside and with goggles.

Form *A I 5 min per mineral*

Students are provided with a series of trays each one with several minerals illustrating a given form. The students must examine and draw one sample from each tray. They then must identify the form of unlabelled samples.

Diagnostic properties of minerals *A P or I 10 min per mineral*

Students are provided with a series of trays, each tray has several samples of the same minerals and a card which tells them about the mineral and gives the most useful diagnostics properties (thus for malachite it gives colour and form, and for quartz hardness, acid reaction and form). Students examine the minerals in each tray and work out the precise properties e.g. bright green and mammilated.

Mineral testing kit *F*

Students are provided with a tray containing the following:

1) A copper coin, metal nail, glass slide and small flat piece of steel to test for hardness,
2) A piece of quartz to use as a comparison for density
3) Acid bottle filled with 2M hydrochloric acid and tissue paper
4) A streak plate. The back of any white porcelain tile will do
5) Magnetism: a small compass such as a plotting compass
6) A sheet of instructions

Identifying minerals *A P 3min per mineral*

Students are given unlabelled samples which they must describe and then identify using a key or computer program.

Themed identification *A P 3 min per mineral*
Students are given all white, or all black minerals to identify, or only minerals containing iron or only calcium, or with 3 cleavages etc.

Identifying minerals in rocks *A P 20 min*
Students are given a tray with a coarse grained rock and samples of the minerals it contains. They must match the minerals to those in the rock and note which of the minerals properties are visible or testable on the grain in the rock.

Distinguishing between quartz and calcite *A P F 20 min*
Students have labelled samples (not crystals) of quartz and calcite which they test for hardness, acid reaction, presence of cleavage or conchoidal fracture. They put this information in a table. They then have to identify the mineral present in unlabelled samples of quartz and calcite and of marble, limestone, metaquartzite and orthoquartzite.

Effect of molecular structure on a mineral's properties *D*
You will need samples and molecular models of diamond and graphite (a small clear quartz crystal or better a Heinnecker diamond (doubly terminated quartz crystal) will substitute for a real diamond). Compare the transparency, hardness, density, flexibility and explain these properties in terms of the arrangement of the atoms.

Effect on the density of changing the cation *A P F 15 min*
Students are given the following samples: gypsum, barite, aragonite, cerussite and a list of their chemical formulas and the atomic weight of their cations. They must identify each using only acid reaction and feeling how dense they are.

Which mineral is which? *A P F 30 min*
As above but with the edition of anglesite, witherite, strontianite. In this case the minerals all have nylon loops attached to them with araldite. Students weigh the minerals in air and then in water to work out their density.

Atomic mass and density *E P F 1 hour*
Students are provided with named samples belonging to an isomorphous series.

They work out the density of each and plot atomic weight of the cation against the density.

Mineral use display **D**

Make a display like a spider's with a mineral in the centre and all its uses around the outside. Mineral Use Guide or Robertson's Spider webs by RHS Robertson is a very good source of information.