GCE A LEVEL

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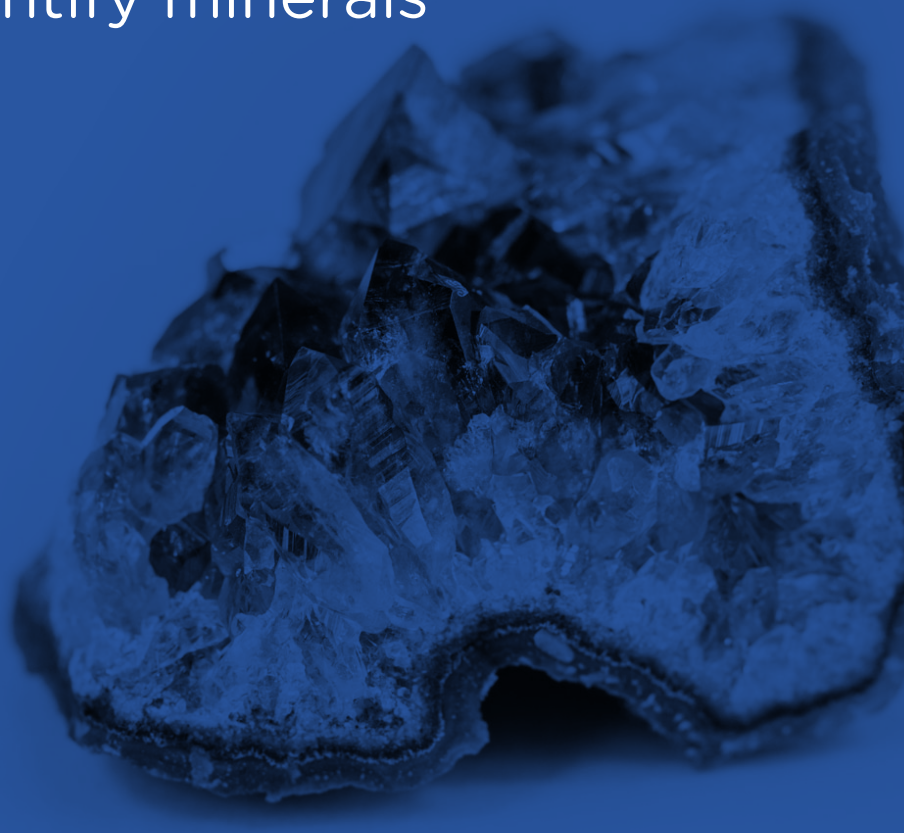
WJEC Eduqas GCE A LEVEL in

GEOLOGY

SP1 Investigation of diagnostic properties of minerals: colour, crystal shape, cleavage, fracture, hardness, relative density, streak, lustre, reaction with cold dilute (0.5 mol dm^{-3}) hydrochloric acid in order to identify minerals



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Title: SP1 Investigation of diagnostic properties of minerals: colour, crystal shape, cleavage, fracture, hardness, relative density, streak, lustre, reaction with cold dilute (0.5 mol dm^{-3}) hydrochloric acid in order to identify minerals

Specification reference: F1.1e

Aim: To use physical and chemical testing to identify minerals.

Apparatus:

Mineral testing equipment:
Streak plate/unglazed tile to test the colour of powdered minerals.

Dilute hydrochloric acid ("bench strength" 0.5 mol dm^{-3}) in a dropper bottle to test if a mineral is a carbonate.

Copper coin (pre 1992 coins are 97% copper, post 1992 they are copper plated steel), hardness ~3.5 on Mohs' scale.

Steel pin/needle (dissecting pin from Biology department or steel nail), hardness ~5.5 on Mohs' scale.

Learners to also use own fingernail, hardness ~2.5 on Mohs' scale.

Method:
Carry out the appropriate tests and record results.
Complete a table (similar to below) to logically record the results of observations.

Description and identification of mineral specimen X		
Colour		
Crystal shape		
Cleavage		
Fracture		
Hardness	mineral is scratched by	mineral is softer than
	mineral is not scratched by	mineral is harder than
	hardness of mineral is between and on Mohs hardness scale	
Density		
Streak		
Lustre		
Reaction with cold dilute HCl		
Conclusion: identification of mineral X		

Analysis:
1. Identify the mineral by appraising the results of the tests.
2. Compare the mineral identification reached with published results eg. Eduqas mineral data sheet or other sources.

Description and identification of mineral specimen X		
Colour	grey	
Crystal shape	some crystals show a definite cubic shape	
Cleavage	mineral cleaves along planes parallel to the edges of its cubic crystals	
Fracture	none, mineral has cleavage	
Hardness	mineral is scratched by copper coin	mineral is softer than
	mineral is not scratched by fingernail	mineral is harder than
	hardness of mineral is between ~2.5 and ~3.5 on Mohs hardness scale	
Density	no accurate measurement made, but specimen seemed heavy and dense when hefted	
Streak	light grey	
Lustre	metallic	
Reaction with cold dilute HCl	teacher advised me not to carry out this test	
Conclusion: identification of mineral X GALENA		

Teacher/Technician notes

Practical techniques which may be assessed:
K. Use of physical and chemical testing to identify minerals:
- density test
- Mohs hardness test

Appropriate tests listed in the specification at F1.1e:

Colour: to be observed in natural light.

Crystal shape: common appearance of the mineral to be observed and use descriptive terms, learners might see individual well shaped crystals (form) or the shape of a mass of crystals when individual crystals cannot be seen when it is massive (habit). Commonly used terms to describe shape include rhombic, cubic, fibrous, kidney shaped.

Cleavage: to be observed and described in terms of number of cleavage planes and if multiple planes to look at how they intersect (e.g. one perfect, two planes at 90° or at 120°).

Fracture: to be observed and use descriptive terms, (e.g. conchoidal, uneven).

Hardness: tested by scratching the specimen with fingernail/copper coin/steel pin, observations can be checked using a hand lens. To be described in relative terms (harder than/softer than and link to figures, e.g. if a mineral is not scratched by a fingernail, but is scratched by a copper coin then it will have a hardness of ~2.5 - ~3.5).
If a mineral cannot be scratched by steel it has a hardness > 5.5.

Density: (**Hefting**) With practice learners may be able to judge which minerals feel heavy or light for their size when they pick up the specimen in their hand. Care must be taken to allow for the size of the specimen. It would be good to have similar sized specimens of quartz, barites, galena etc to compare.
Density: (**Calculation**) See SP2.

Streak: the colour of a mineral's powder, to be obtained by rubbing a mineral specimen on an unglazed white porcelain tile/streak plate. To be described using the colour of the powdered mineral (e.g. white, black, greenish black, lead grey, cherry red), or a negative result if the mineral is harder than the tile and scratches it (e.g. scratches streak plate).

Lustre: the way the mineral reflects light, to be observed and recorded using descriptive terms (e.g. vitreous, pearly, silky, resinous, metallic, dull).

Reaction with cold dilute (0.5 mol dm^{-3}) hydrochloric acid: this is to test the mineral for carbonates. Observations to be described in terms of positive reactions (effervesces/fizzes) to identify carbonates, or no reaction to identify non-carbonate.

Minerals not listed on the specification (specified on the mineral data sheet) could also be tested and results observed. The photograph shows the positive reaction to application of cold dilute (0.5 mol dm^{-3}) hydrochloric acid and identification as a carbonate.

Health and Safety

1. If acid has been applied, then the specimen should be washed afterwards to remove any remaining acid.
2. Sulphide minerals should not be tested with acid.
3. Learners should wash their hands after handing mineral specimens.

Rock forming minerals listed (as specified on the mineral data sheet) in specification section F1.1e:
quartz, calcite, feldspars (orthoclase, plagioclase), augite, hornblende, olivine, micas (biotite, muscovite), haematite, galena, pyrite, chalcopyrite, fluorite, barite, halite, gypsum, garnet, chiastolite/andalusite.