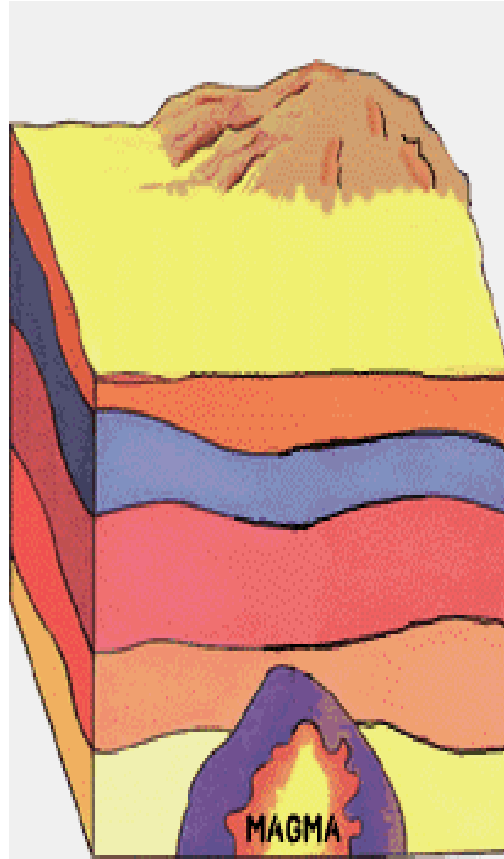




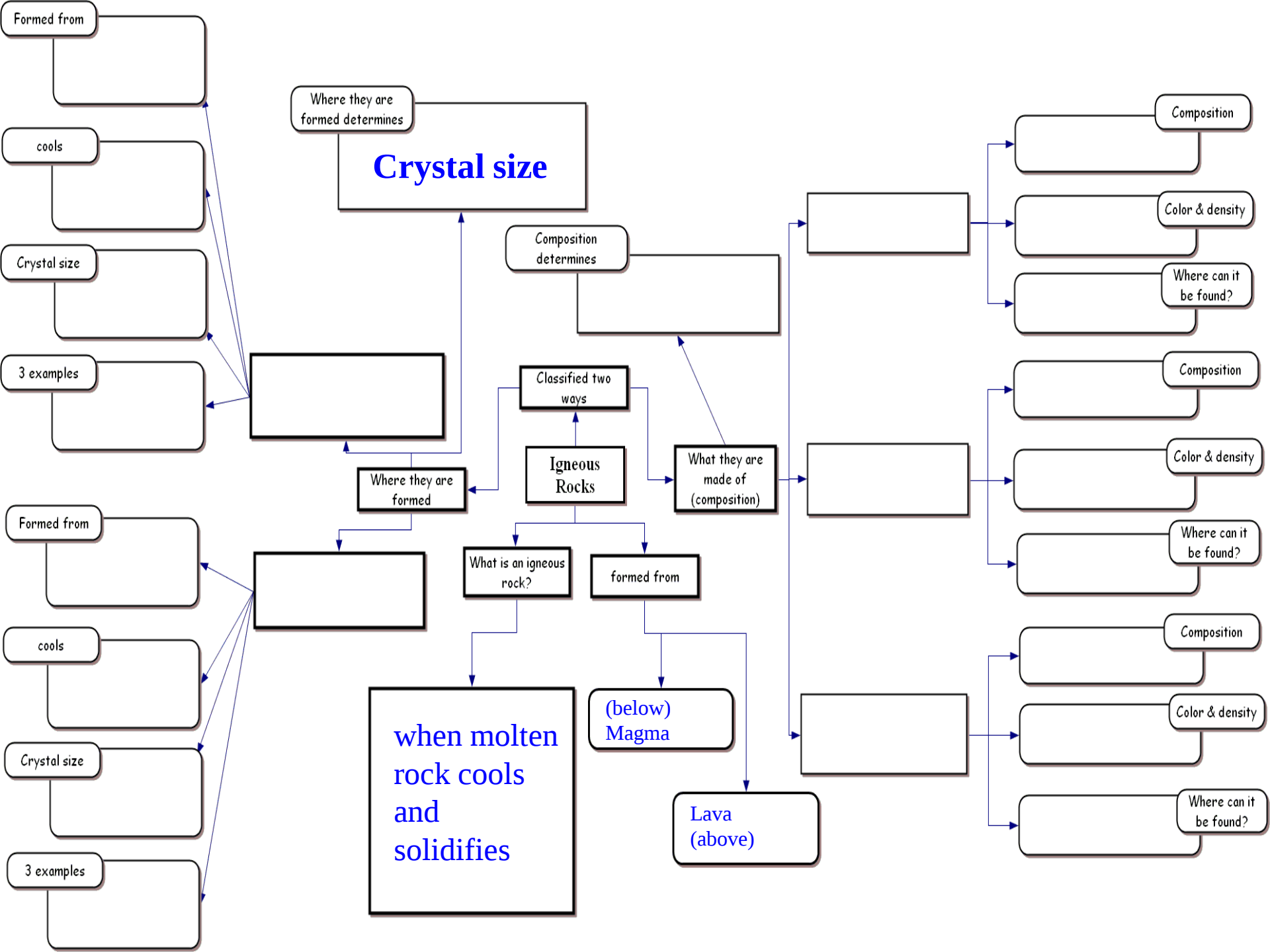
Igneous Rocks

Hot rocks/Fire Rocks

Igneous Rock



- Igneous rocks form when molten rock cools and solidifies. Molten rock is called magma when it is below the Earth's surface and lava when it is above.



Igneous Rock classification

- Igneous rocks are classified two different ways:
 - Where they were formed
 - What they are made from (mineral composition)

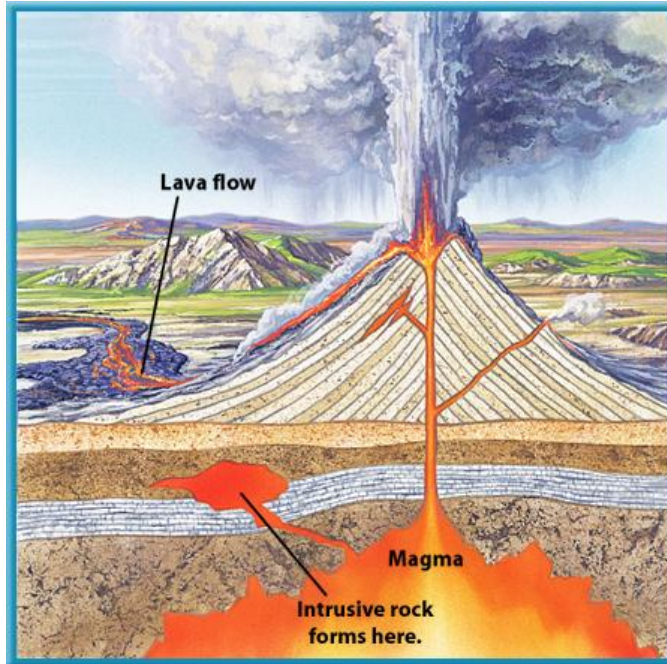




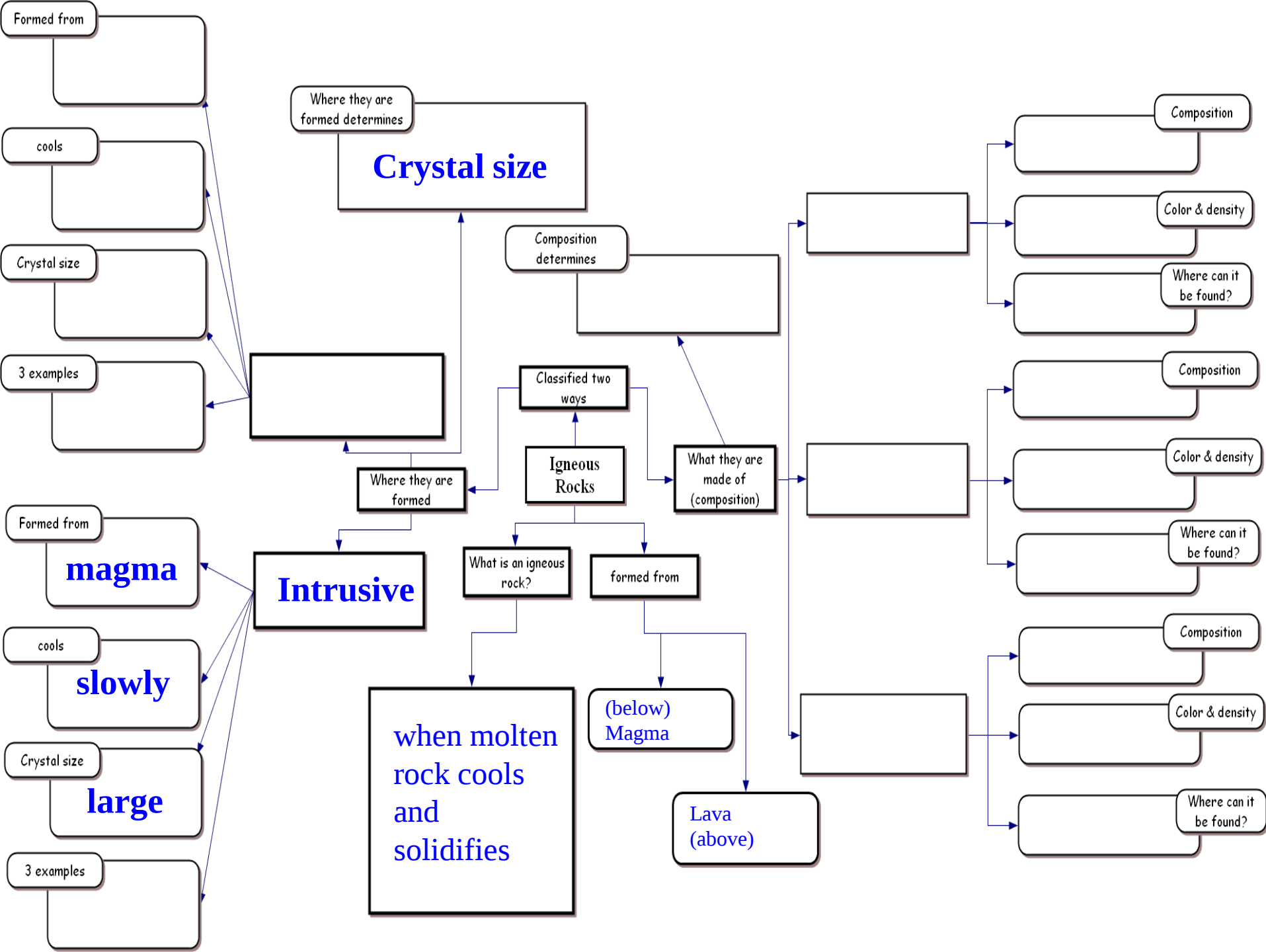
Part 1

Classifying igneous rocks by where they are formed.

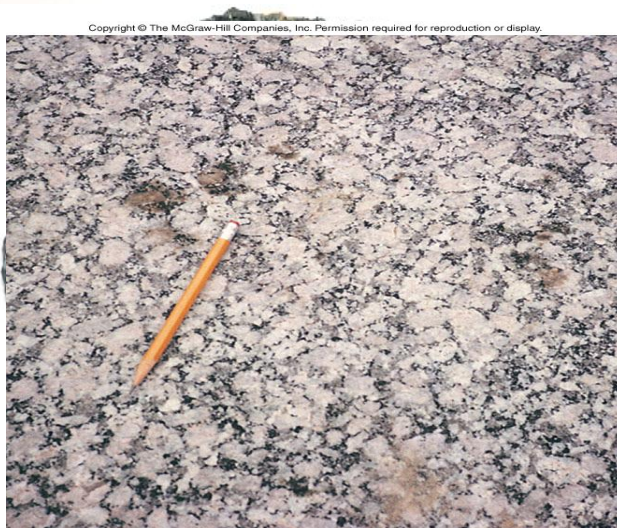
Intrusive Igneous Rocks



- Igneous rocks that form below the Earth's surface are called intrusive igneous rocks (or plutonic).
- The word "plutonic" comes from Pluto, the name for the Roman god of the underworld.
- They form when magma enters a pocket or chamber underground that is relatively cool and solidifies into crystals as it cools very slowly.

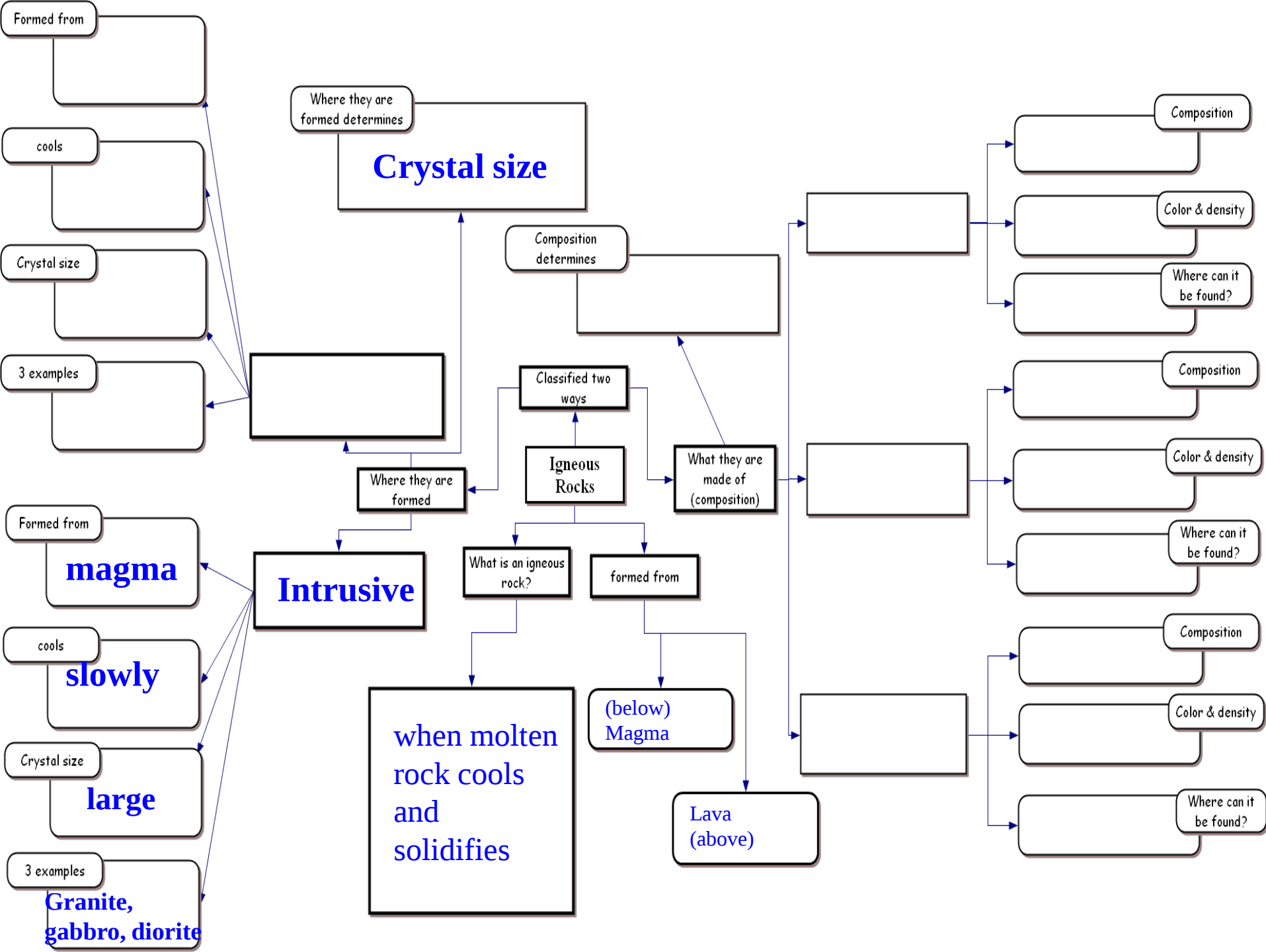


Intrusive Igneous Rock



~~Granite~~
Diorite

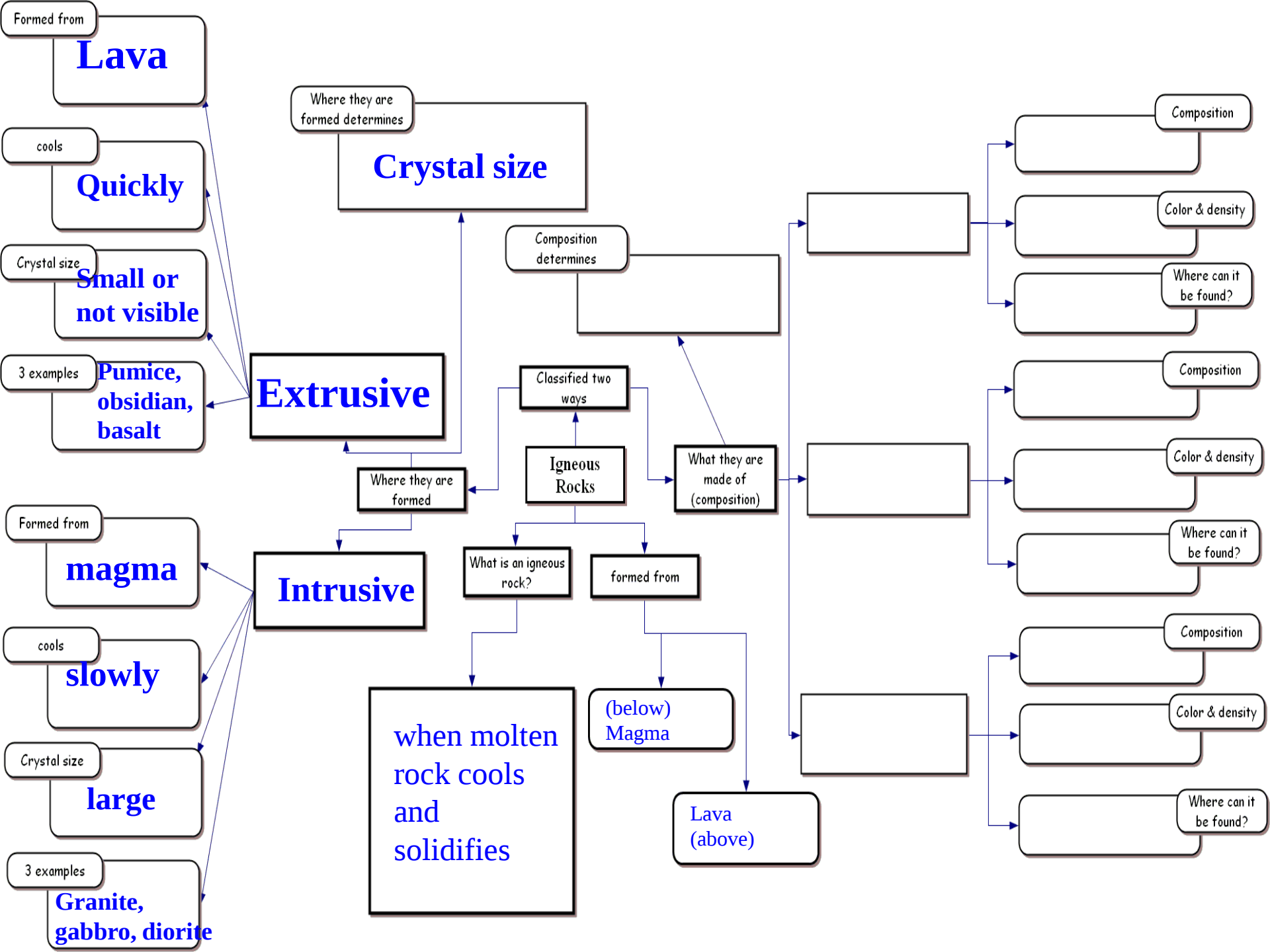
- Most intrusive rocks have large, well formed crystals. The mineral crystals within them are large enough to see without a microscope.
- The more slowly molten rock cools within the Earth, the larger the igneous rock crystals will be.
- Examples of intrusive igneous rocks are granite, gabbro, and diorite



Extrusive Igneous Rocks



- Extrusive igneous rocks form when magma makes its way to Earth's surface. The molten rock erupts or flows above the surface as lava, and then cools forming rock.
- Most extrusive (volcanic) rocks have small crystals. Examples include pumice, obsidian, and basalt.





Volcanic Glass

- Pumice, obsidian, and scoria are examples of volcanic glass.
- These rocks cooled so quickly that few or no mineral grains formed.
- Most of the atoms in these rocks are not arranged in orderly patterns, and few crystals are present.

Glassy Igneous Rocks

Glassy Igneous Rocks cool so rapidly, that atoms don't have enough time to get together, bond and form crystals. To cool this quickly the rocks **MUST** be extrusive.

- Pumice (left)
- Scoria (bottom left)
- Obsidian (bottom)
- Note gasses in the lava can cause fine holes called vesicles as seen in the pumice and scoria.





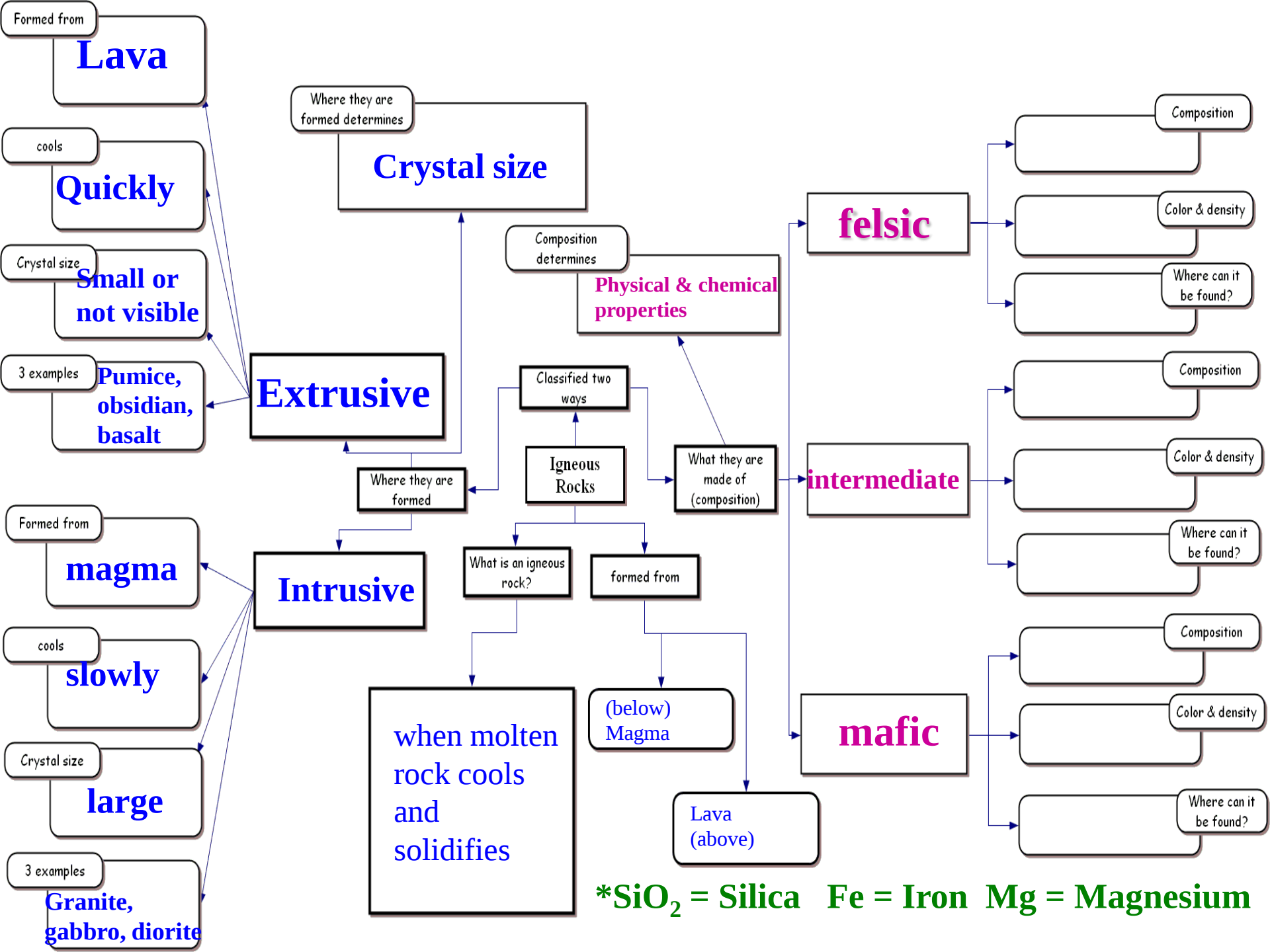
Part 2

Classifying by mineral composition

Magma types



- A way to further classify these rocks is by the magma from which they form. An igneous rock can form from felsic, intermediate, or mafic magma.
- Magma composition determines the physical & chemical properties of an igneous rock

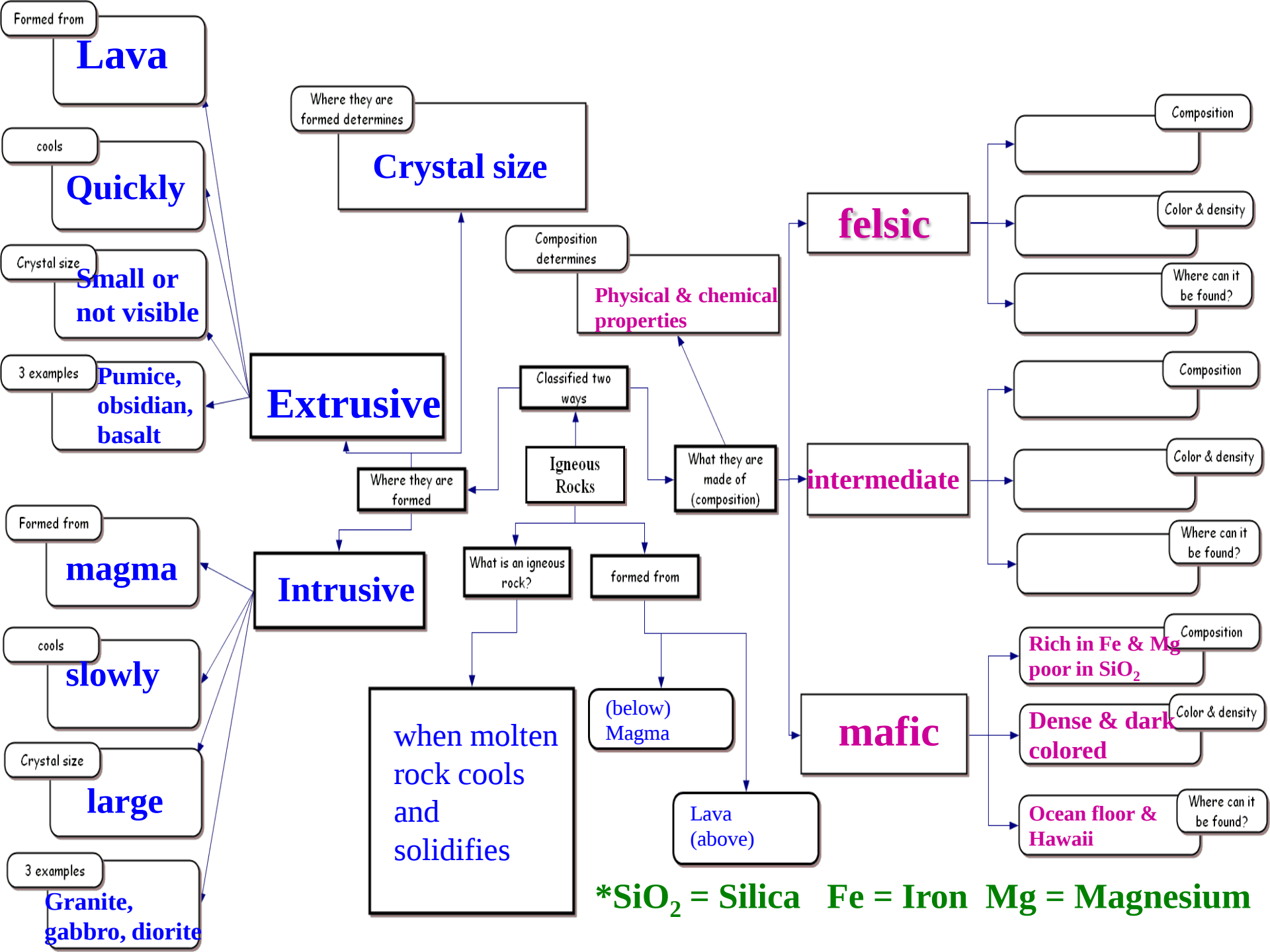




Mafic Igneous Rocks



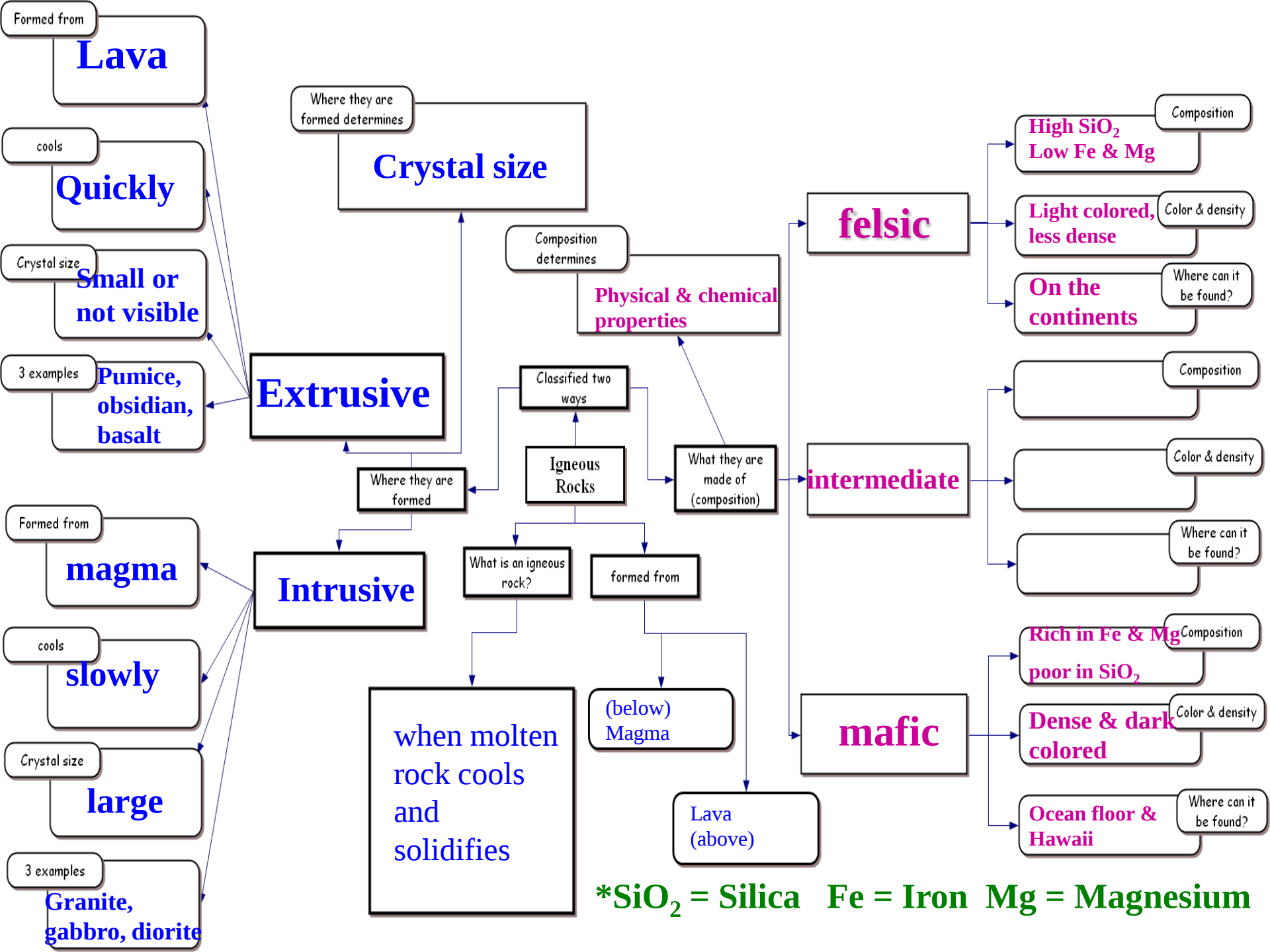
- **Mafic** igneous rocks are dense, dark-colored rocks.
- They form from magma that is rich in iron and magnesium and poor in silica, which is the compound SiO_2 .
- The presence of iron and magnesium in minerals in basalt gives basalt its dark color.
- Mafic lava is fluid and flows freely from volcanoes in Hawaii.
- Basalt is the most common rock type in the Earth's crust (the outer 10 to 50 km). Most of the ocean floor is made of basalt



Felsic Rocks



- **Felsic** igneous rocks are light-colored rocks of lower density than mafic rocks.
- Felsic rocks are coarse-grained
- Felsic magma is thick and stiff and contains lots of silica but lesser amounts of iron and magnesium.
- It is the most common rock type on the continental land masses. Yosemite Valley in the Sierra Nevada and Mt. Rushmore are two notable examples of felsic rocks

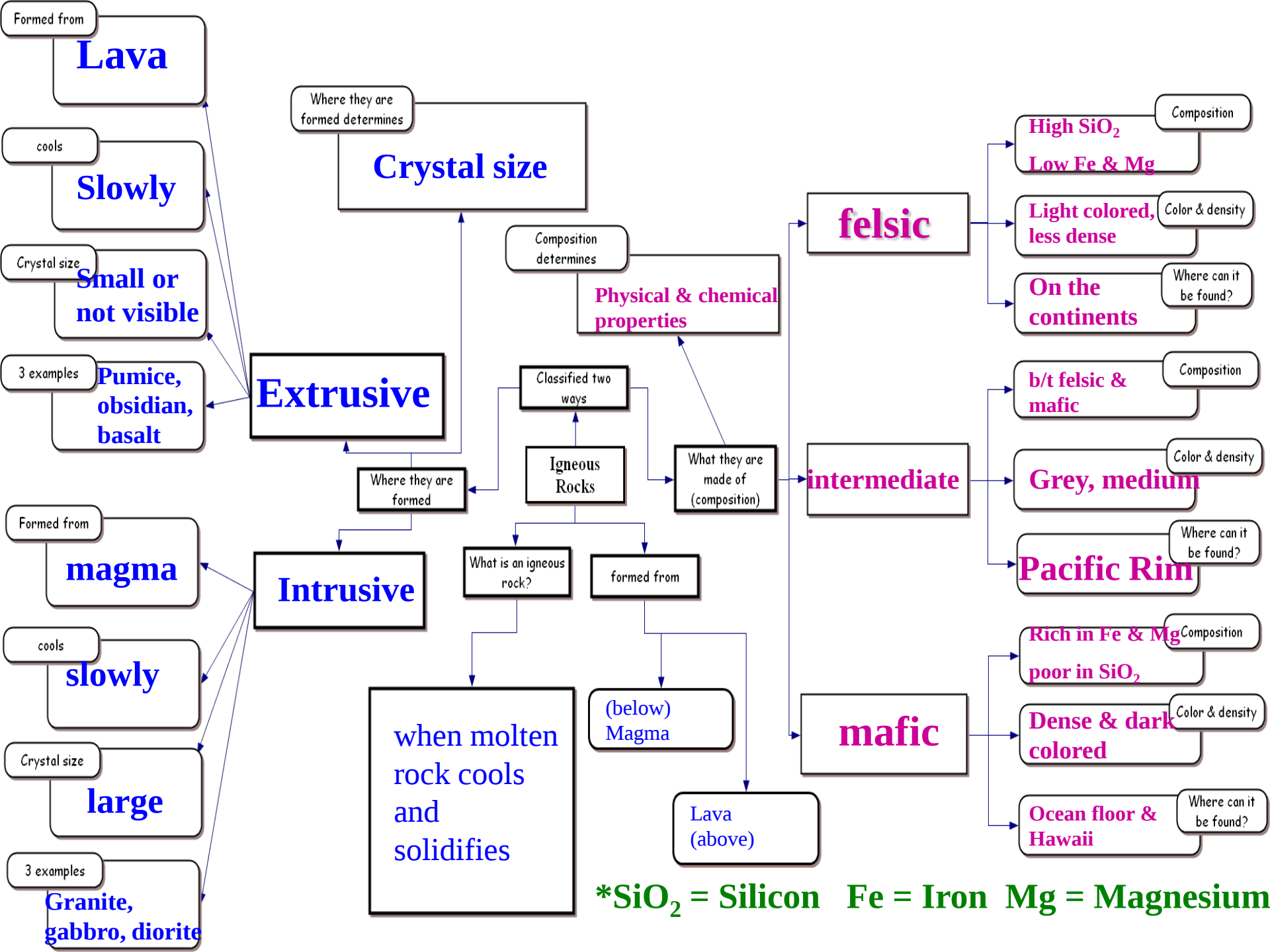




Intermediate Rocks

- Intermediate igneous rocks have mineral compositions between those of mafic and felsic rocks.
- Many volcanoes around the rim of the Pacific Ocean formed from intermediate magmas.
- Like volcanoes that erupt felsic magma, these volcanoes also can erupt violently.
- Rocks made from intermediate tend to be fine-grained.





Intrusive or Extrusive?



Andesite is a fine-grained, **extrusive** igneous rock.

Intrusive or Extrusive?



Diorite is a coarse-grained, **intrusive** igneous rock.

Intrusive or Extrusive?



Gabbro is a coarse-grained, dark colored, **intrusive** igneous rock.

Intrusive or Extrusive?



Basalt is a fine-grained, dark-colored **extrusive** igneous rock.

Intrusive or Extrusive?



Granite is a coarse-grained, light colored, **intrusive** igneous rock.

Intrusive or Extrusive?



Obsidian is a dark-colored volcanic glass that forms from the very rapid cooling of molten rock material. It cools so rapidly that crystals do not form.

Intrusive or Extrusive?



Pegmatite is a light-colored, extremely coarse-grained **intrusive** igneous rock.

Intrusive or Extrusive?



Pumice is a light-colored vesicular igneous rock. It forms through very rapid solidification of a melt. The vesicular texture is a result of gas trapped in the melt at the time of solidification.

Intrusive or Extrusive?



Rhyolite is a light-colored, fine-grained, **extrusive** igneous rock

Intrusive or Extrusive?



Scoria is a dark-colored, vesicular, extrusive igneous rock. The vesicles are a result of trapped gas within the melt at the time of solidification. It often forms as a frothy crust on the top of a lava flow or as material ejected from a volcanic vent and solidifying while airborne.