Estimate the Percentage of Mafic Minerals

Activity **5.5**

Name: _____ Course/Selection: _____ Date: _____

Learning GOAL This activity gives you opportunities to visually estimate the percentage of mafic minerals in an igneous rock. Being able to estimate the percentage of mafic minerals allows you to classify an unknown igneous rock as felsic, intermediate, mafic or ultramafic, and so helps you to identify the rock type.

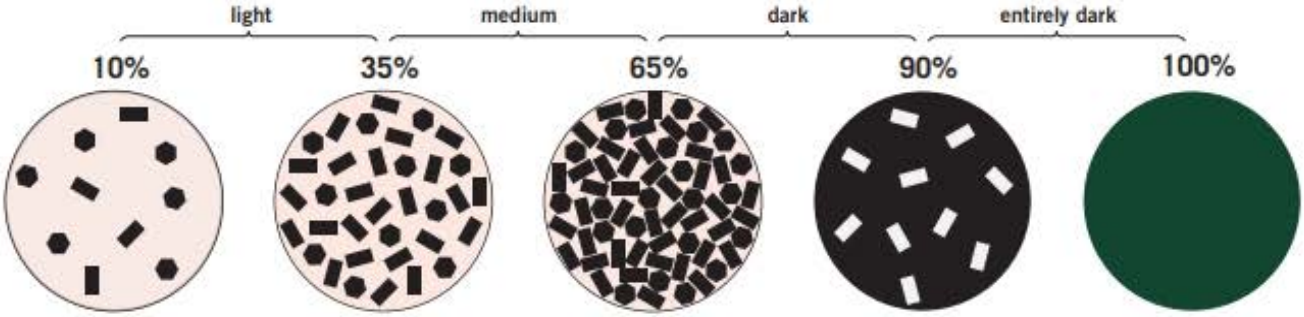
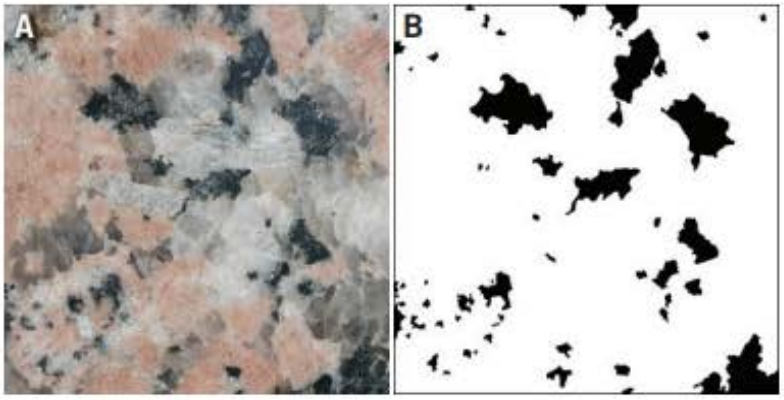


Figure A5.5.1 ▲



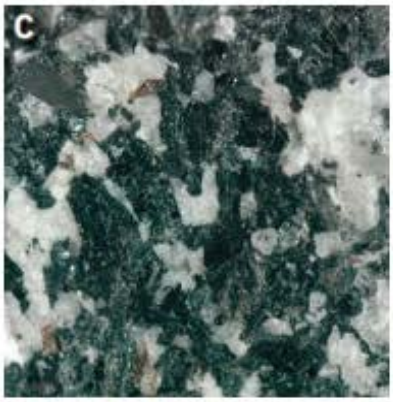
The mafic minerals in photo A are shown as black areas in map B. Use **Fig. A5.5.1.** to estimate the percentage of mafic minerals in this rock.

mafic %: _____

Based on your estimate, describe this rock as felsic, intermediate, mafic, or ultramafic. Refer to **Fig. 5.15**.

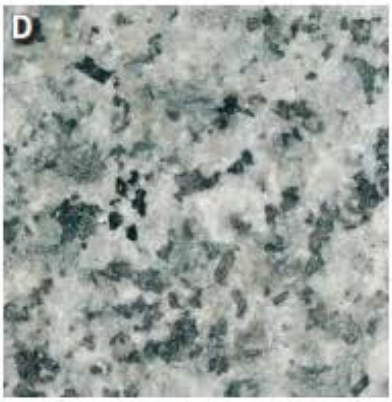
_____

Now do the same analysis for the three rocks shown below.



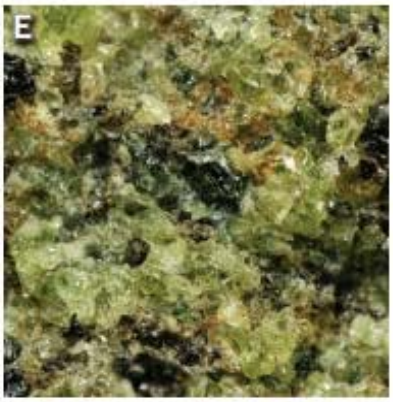
mafic %: _____
rock description:

_____



mafic %: _____
rock description:

_____



mafic %: _____
rock description:

_____

Figure A5.5.2 ▲

Activity 5.6 Estimate Mineral Composition of a Phaneritic Rock by Point Counting

Name: _____ Course/Selection: _____ Date: _____

Learning GOAL You will learn how to use a form of point counting to identify the rock by its composition. This activity also gives you experience with simple counting statistics: the average (mean) and standard deviation.

Geologists sometimes classify rocks using a technique called *point counting* to estimate the relative abundance of different minerals in a rock. We will use a similar method adapted for this lab so that you can experience the basic idea of point counting without having to learn optical mineralogy or how to use a petrographic microscope.

A phaneritic igneous rock is shown in Fig. A5.6.1A. The four major minerals in the rock are identified and mapped as different-colored areas in **Fig. A5.6.1B**.

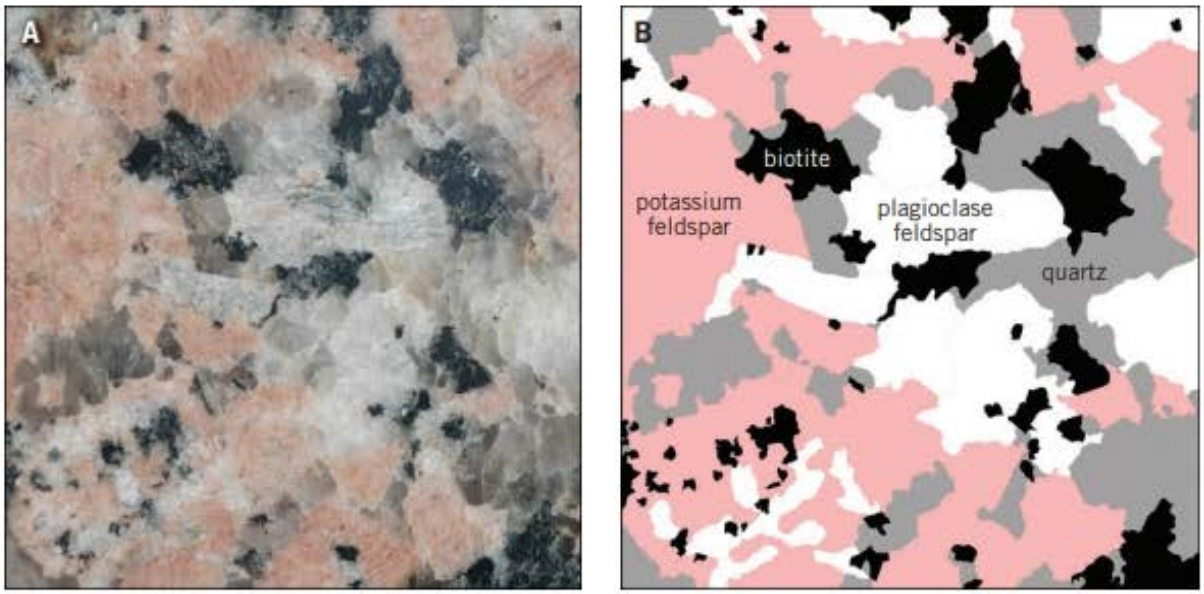


Figure A5.6.1 ▲

The task is to identify the mineral(s) found at each of several points on the rock. We make 25 small holes in a square grid on an opaque sheet, with each hole just large enough so that you can look through it to see what's on the other side. Then we put the grid sheet on top of the mineral map of the igneous rock (Fig. A5.6.2A) and repeat this process three times with the grid shifted slightly each time (**Fig. A5.6.2B–D**).

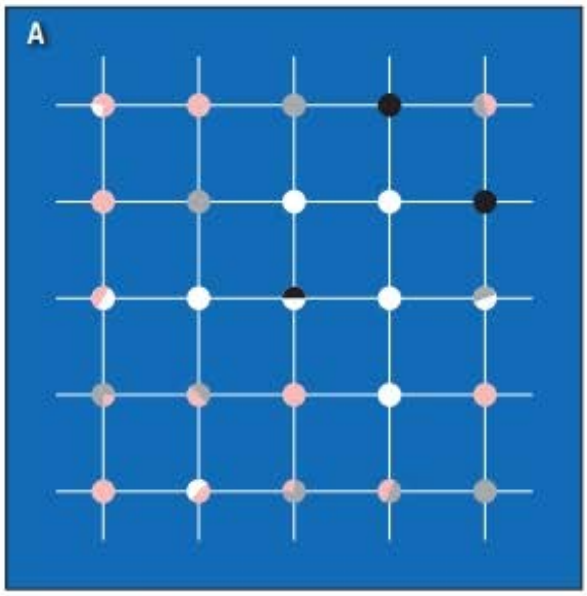


Figure A5.6.2 ▲

Count the number of node points that are filled with each of the four major minerals (that is, with each of the four colors on the map) and use that number to estimate the total volume of each major mineral in the rock. You can see more than one mineral through the hole at some node points, so estimate how much of each mineral fills each hole: 0.25 if a mineral fills a quarter of the hole, 0.5 if a mineral fills half of the hole, and 1.0 if a mineral fills the entire hole. For example, 7.25 circles are filled with white (plagioclase feldspar) in **Fig. A5.6.2A**, so estimate that about (7.25 × 4)% or ~29% of the rock is composed of plagioclase feldspar.

Point Count, Grid A

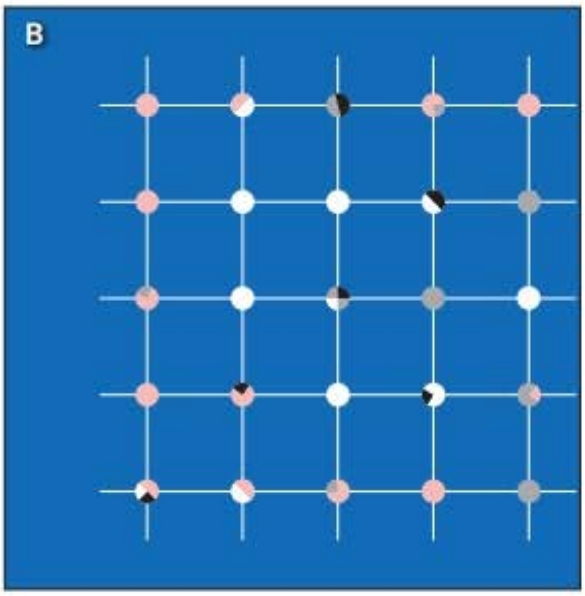
Number of nodes filled with the mineral

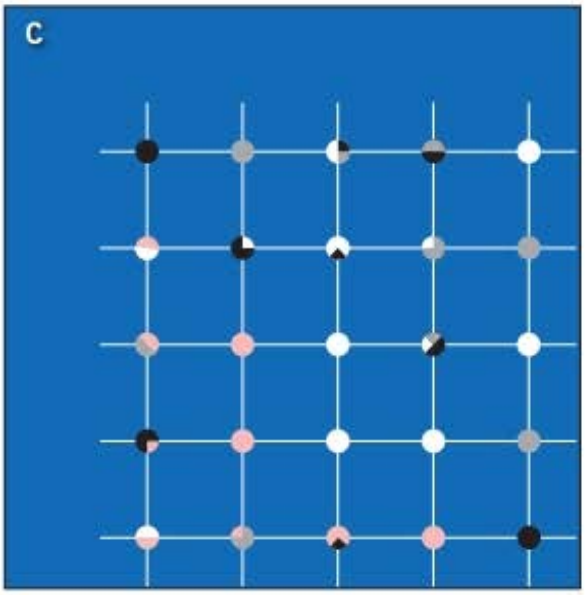
(_____ × 4)% = _____ % potassium feldspar (pink)

(__ 7.25 __ × 4)% = ~29% plagioclase feldspar (white)

(_____ × 4)% = _____ % quartz (gray)

(_____ × 4)% = _____ % biotite (black)





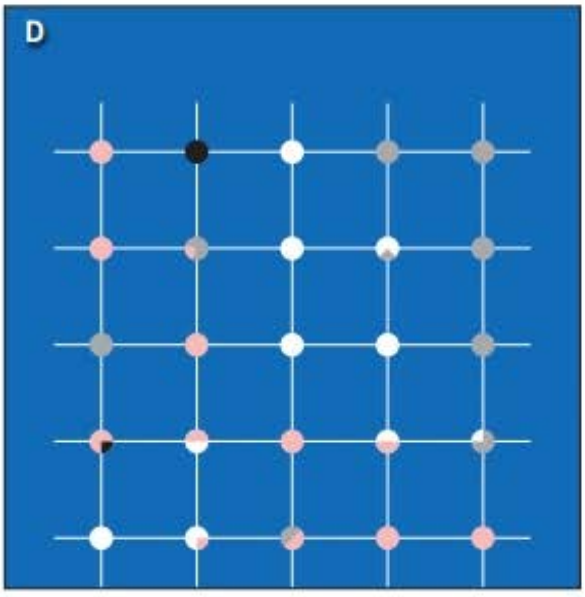


Figure A5.6.2 ▲ (*continued*)

How reliable was that sample of 25 points as a way to estimate the modal composition of the rock? Let's see.

The grid has been shifted in three different ways, so we can sample three different sets of points. Repeat the point count for each of these three grids.

Point Count, Grid B

(_____ × 4)% = _____% potassium feldspar (pink)

(_____ × 4)% = _____% plagioclase feldspar (white)

(_____ × 4)% = _____% quartz (gray)

(_____ × 4)% = _____% biotite (black)

Point Count, Grid C

(_____ × 4)% = _____% potassium feldspar (pink)

(_____ × 4)% = _____% plagioclase feldspar (white)

(_____ × 4)% = _____% quartz (gray)

(_____ × 4)% = _____% biotite (black)

Point Count, Grid D

(_____ × 4) = _____% potassium feldspar (pink)

(_____ × 4) = _____% plagioclase feldspar (white)

(_____ × 4) = _____% quartz (gray)

(_____ × 4) = _____% biotite (black)

Use the data from the point counts of grids B, C, and D to complete the following table.

	average	standard deviation
potassium feldspar		
plagioclase feldspar		
quartz		
biotite		

Do the results of your point count of grid A on the previous page fall within one standard deviation of the average of grids B, C, and D for each of the major minerals? Explain.

What type of phaneritic igneous rock is shown in **Fig. A5.6.1A**?

Figure A5.7.1 ▲

IGNEOUS ROCKS WORKSHEET					
Sample number or letter	Texture(s) present (Figure 5.21).	Minerals present and their percentage of abundance (Figures 5.13–14, 5.21).	Estimate the percentage of mafic minerals.	Rock names (Figures 5.16, 5.22).	Describe a geological environment where this rock might have formed (intrusive vs. extrusive, tectonic setting, etc).

Name: _____ Course/Selection: _____ Date: _____

Name: _____ Course/Selection: _____ Date: _____

Figure A5.7.1 ▲ *(continued)*

IGNEOUS ROCKS WORKSHEET					
Sample number or letter	Texture(s) present (Figure 5.21).	Minerals present and their percentage of abundance (Figures 5.13–14, 5.21).	Estimate the percentage of mafic minerals.	Rock names (Figures 5.16, 5.22).	Describe a geological environment where this rock might have formed (intrusive vs. extrusive, tectonic setting, etc).