The Oldest Lunar Rocks

Apollo astronauts recovered over 840 pounds of lunar rocks, and during the last 30 years, these have been carefully studied to find out which features came first, and the ancient history of the lunar surface including its formation. The table below shows the ages (in millions of years: Myr) of some of the mineral specimens determined by geologist using various radioisotope methods applied to the different rock samples.

Location	Mission	Rock Type	Age (Myr)
Mare Tranquillitatis	Apollo-11	Basalt	3,500
Oceanus Procellarum	Apollo-12	Basalt	3,200
Fra Mauro Formation	Apollo-14	Basalt	4,150
	Apollo-14	Impact melts	3,850
	Apollo-14	KREEP	4,420
Mare Imbrium	Apollo-15	Basalt	3,250
	Apollo-15	Anorthosite	4,090
Descartes Mountains	Apollo-16	Breccia	3,980
	Apollo-16	Basalt	3,790
	Apollo-16	Anorthosite	4,470
	Apollo-16	Plagioclase-old	4,560
	Apollo-16	Plagioclase-young	4,290
Taurus-Littrow Mountains	Apollo-17	Zircon -old	4,418
	Apollo-17	Zircon -Young	4,331
	Apollo-17	Basalt	3,750
	Apollo-17	Impact melts	3,900

Problem 1 - What is the average age of all of the samples in the table in millions of years?

Problem 2 - What is the average age of all of the samples in the table to the nearest 0.1 billion years?

Problem 3 - Order the samples from oldest to youngest age. About how many different groups can you identify in terms of their similar ages, and what is the average age of each group of samples in billions of years?

Problem 4 - To the nearest 100 million years, about how old are the lunar mare (dark regions on moon - basalts) compared to the mountainous highland regions (KREEP, anorthosites, zircons and plagioclase) in billions of years?

Problem 1 - Answer: Add the 16 numbers in the last column together and divide by 16 to get 63,949 million years/16 = 3,997 million years.

Problem 2 -Answer: Add the 16 numbers in the last column together and divide by 16 to get 63,949/16 = 3,997 million years, which equals 3.997 billion years which needs to be rounded to 4.0 billion years.

Problem 3 - The samples ordered from oldest to youngest age:

Descartes Mountains	Apollo-16	Plagioclase-old	4,560
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Oceanus Procellarum	Apollo-12	Basalt	3,200

About how many different groups can you identify in terms of their similar ages, and what is the average age of each group of samples in billions of years? (One possibility is shaded)
Oldest Group: (4.56+4.47+4.42+4.418+4.331)/5 = 4.4 billion years.
Middle Group: (4.29+4.15+4.09+3.98+3.9+3.85)/6 = 4.0 billion years
Young Group: (3.79+3.75+3.5+3.25+3.2)/5 = 3.5 billion years.

Problem 4 - To the nearest 100 million years, about how old are the lunar mare (dark regions on moon - basalts) compared to the mountainous highland regions (KREEP, anorthosites, zircons and plagioclase) in billions of years?

Answer: The lunar basalts are mostly in the younger group with an age of 3.5 billion years. The highland samples have ages (4.56 + 4.47 + 4.42 + 4.418 + 4.331 + 4.290 + 4.090)/7 = 4.37 billion years, or rounded to the nearest 0.1 you get 4.4 billion years.

Note: The highland materials sampled by the Apollo astronauts are older than the mare samples by nearly 1 billion years, and represent the ancient, and very old, original crust of the moon before volcanism filled the mare with lava during the first billion years after lunar formation.