Passage II

Soils are classified by *texture* (nature of the soil based on the proportions of sand, silt, and clay particles) and *porosity* (percent of a soil's volume occupied by open space). Typical soil particle categories and their particle diameters are shown in Table 1. A soil with particles that have a small range of different diameters is described as *well sorted*, whereas a soil with particles that have a wide range of different diameters is described as *poorly sorted*.

Table 1

Particle category	Particle diameter (mm)
Gravel	> 2.0
Very coarse sand	1.1–2.0
Coarse sand	0.6–1.0
Medium sand	0.26–0.5
Fine sand	0.14–0.25
Very fine sand	0.07–0.13
Silt	0.004–0.06
Clay	< 0.004

Study 1

A dry, 500 g sample of a soil (Soil 1) was washed through a screen with 0.06 mm holes to remove all of the silt and clay particles. The soil remaining on the screen was dried and weighed, then sifted through a series of screens, each successive screen having smaller holes than the one before, to separate the particles in different categories. The particles of each category were then weighed, and the procedure was repeated for samples of 4 other soils (Soils 2–5). The results are shown in Table 2.

Table 2

	Weight (g) of particles				
Particle category	Soil 1	Soil 2	Soil 3	Soil 4	Soil 5
Gravel	0	0	0	0	36
Very coarse sand	0	132	0	0	54
Coarse sand	0	241	0	0	197
Medium sand	0	127	35	134	76
Fine sand	14	0	136	245	36
Very fine sand	11	0	79	96	33

Study 2

Another sample of each soil was dried by heating at 101°C for 24 hours, and was then weighed. The porosity and the *void ratio* (ratio of the volume of open space to the volume of solid material) of each soil sample were calculated (see Table 3).

Table 3

Soil	Porosity (%)	Void ratio
1	45	0.82
2	34	0.52
3	43	0.75
4	42	0.72
5	10	0.11

6. It is known that soils with a higher porosity can hold more water when saturated than can soils with a lower porosity. Based on this information, which of the following soils in Study 2 would hold the most water when saturated?

F. Soil 1
G. Soil 2
H. Soil 4
J. Soil 5

7. Based on the results of Study 2, another soil sample that had a porosity of 25% would have had a corresponding void ratio of:

A. less than 0.11.
B. between 0.11 and 0.52.
C. between 0.52 and 0.72.
D. greater than 0.72.

8. In Study 2, if a soil sample had shown virtually no decrease in weight during the heating process, the scientist conducting the study would most likely have concluded which of the following?

F. The particles in the soil sample were all larger than 2 mm in diameter.
G. The particles in the soil sample were all smaller than 0.06 mm in diameter.
H. The heating process removed significant amounts of water.
J. The heating process removed little or no water.

9. In Study 1, after removing the silt and clay particles, it was necessary to dry the soil samples before passing them through a series of screens to ensure that the particles:

A. larger than 2 mm in diameter would pass through all of the screens.
B. smaller than 0.06 mm in diameter would stick to each other.
C. would more easily stick to the screens and to each other.
D. would not stick to the screens or to each other.

10. The sample of which soil in Study 1 would most likely be considered the most poorly sorted?

F. Soil 1
G. Soil 2
H. Soil 3
J. Soil 5

11. Assume that *permeability* (a measure of how fast water moves through a soil) increases as the proportion, by weight, of a soil's particles that are coarse sand size or larger increases. Based on the results of Study 1, the sample of which of the following soils most likely has the highest permeability?

A. Soil 2
B. Soil 3
C. Soil 4
D. Soil 5