

2008-2009 ACT Passage V

Passage V

Density is defined as the mass of a substance divided by its volume:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

Table 1 lists the phases and the densities, in grams per cubic centimeter (g/cm^3), of various pure substances at 25°C and 1 atmosphere (atm) of pressure.

Table 1		
Substance	Phase	Density (g/cm^3)
Arsenic	solid	5.73
Glucose	solid	1.56
Iron	solid	7.86
Lead	solid	11.34
Zinc	solid	7.14
Ethanol	liquid	0.79
Ethyl ether	liquid	0.71
Glycerol	liquid	1.26
Mercury	liquid	13.59
Freon-12	gas	0.00495
Krypton	gas	0.00343
Methane	gas	0.00065

Figure 1 shows how the density of liquid water changes with temperature.

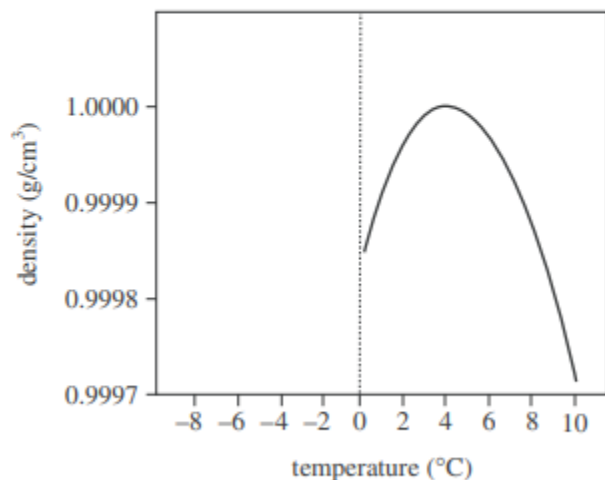


Figure 1

Figure 2 shows how the density of solid water changes with temperature.

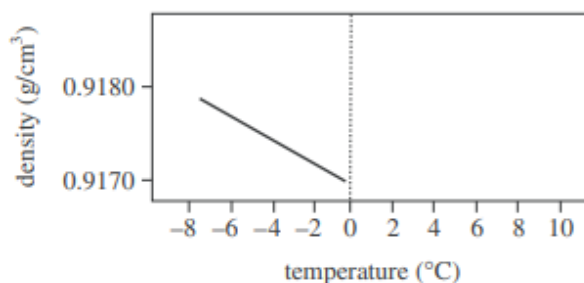
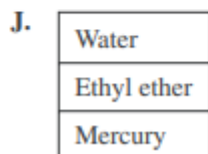
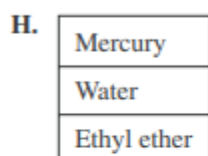
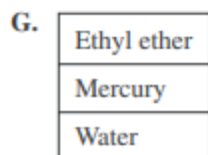
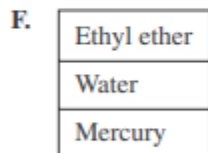


Figure 2

Figures adapted from John C. Kotz and Keith F. Purcell, *Chemistry & Chemical Reactivity*. ©1987 by CBS College Publishing.

- According to Figure 1, as the temperature of liquid water decreases from 10°C to 0°C , the density:
 - increases only.
 - decreases only.
 - decreases, then increases.
 - increases, then decreases.
- A student claimed that "If the masses of 1 cm^3 of any solid and 1 cm^3 of any liquid are compared, the mass of the solid will be greater." Do the data in Table 1 support his claim?
 - No; lead has a higher density than any of the liquids listed.
 - No; mercury has a higher density than any of the solids listed.
 - Yes; lead has a higher density than any of the liquids listed.
 - Yes; mercury has a higher density than any of the solids listed.
- Which of the following hypotheses about the relationship between the temperature and the density of a solid is best supported by the data in Figure 2? As the temperature of a solid increases, the density of the solid:
 - increases only.
 - decreases only.
 - increases, then decreases.
 - decreases, then increases.

28. Equal amounts of ethyl ether, mercury, and water (density = 0.9971 g/cm^3) at 25°C are poured into a single beaker. Three distinct layers of liquid form in the beaker. Based on the data in Table 1, which of the following diagrams represents the order, from top to bottom, of the liquids in the beaker?



29. According to Figure 1, 100 g of water at 4°C would exactly fill a container having which of the following volumes?

- A. 1 cm^3
- B. 10 cm^3
- C. 100 cm^3
- D. $1,000 \text{ cm}^3$

Test 4: Science—Scoring Key

	<u>Key</u>	
1.	B	_____
2.	J	_____
3.	C	_____
4.	F	_____
5.	A	_____
6.	J	_____
7.	D	_____
8.	G	_____
9.	C	_____
10.	H	_____
11.	D	_____
12.	H	_____
13.	B	_____
14.	F	_____

	<u>Key</u>	
15.	C	_____
16.	J	_____
17.	A	_____
18.	F	_____
19.	B	_____
20.	F	_____
21.	B	_____
22.	G	_____
23.	A	_____
24.	H	_____
25.	D	_____
26.	G	_____
27.	B	_____
28.	F	_____

	<u>Key</u>	
29.	C	_____
30.	F	_____
31.	D	_____
32.	G	_____
33.	C	_____
34.	J	_____
35.	C	_____
36.	H	_____
37.	D	_____
38.	G	_____
39.	C	_____
40.	J	_____