Passage V

Students performed the following experiments to determine the density of common plastics.

Experiment 1

A dry 100 mL graduated cylinder was placed on an electronic balance and *tared* (the balance was reset to 0.000 g). H_2O was added to the graduated cylinder until a certain mass was obtained. Ethanol was added to the graduated cylinder until the volume of liquid was 50.0 mL. The density of the liquid was then calculated. The procedure was repeated with different amounts of ethanol and H_2O (see Table 1).

	Table 1			
Liquid	Mass of H_2O (g)	Mass of ethanol (g)	Total mass (g)	Density (g/mL)
1	0	39.67	39.67	0.793
2	10.24	32.43	42.67	0.853
3	19.79	25.23	45.02	0.900
4	35.42	12.47	47.89	0.958
5	49.96	0	49.96	0.999

Experiment 2

A known mass of potassium iodide (KI) was dissolved in a known mass of H_2O. A dry 100 mL graduated cylinder was placed on the balance and tared. The solution was added to the graduated cylinder until the volume was 50.0 mL. The density of the liquid was then calculated. The procedure was repeated with different amounts of KI and H_2O (see Table 2).

	Table 2			
Liquid	Mass of H_2O in solution (g)	Mass of KI in solution (g)	Mass of solution in graduated cylinder (g)	Density (g/mL)
6	97.66	7.36	52.51	1.05
7	95.41	15.52	55.70	1.11
8	94.38	20.68	57.53	1.15
9	92.18	29.08	60.63	1.21
10	87.77	41.31	64.64	1.29

Experiment 3

A solid plastic bead was placed at the bottom of a sample of each of Liquids 1–10 from Experiments 1 and 2. If the bead stayed at the bottom, "S" was recorded in Table 3. If the bead rose, "R" was recorded in Table 3. The procedure was repeated for various plastics.

Table 3										
	Liquid									
Plastic	1	2	3	4	5	6	7	8	9	10
Polybutylene	R	R	R	R	R	R	R	R	R	R
VLDPE	S	R	R	R	R	R	R	R	R	R
LDPE	S	S	S	R	R	R	R	R	R	R
HDPE	S	S	S	S	R	R	R	R	R	R
PA-11	S	S	S	S	S	R	R	R	R	R
PA-6	S	S	S	S	S	S	S	R	R	R
Polycarbonate	S	S	S	S	S	S	S	S	R	R
PVC	S	S	S	S	S	S	S	S	S	S

22. In Experiment 1, the density of ethanol was found to be:

F. less than 0.793 g/mL.
G. 0.793 g/mL.
H. 0.999 g/mL.
J. greater than 0.999 g/mL.

23. Based on the results of Experiments 1–3, the density of PA-11 is most likely:

A. less than 0.793 g/mL.
B. between 0.853 g/mL and 0.958 g/mL.
C. between 0.999 g/mL and 1.05 g/mL.
D. greater than 1.11 g/mL.

24. Suppose that a sixth KI/H_2O solution had been measured in Experiment 2 and the mass of the solution in the graduated cylinder was 67.54 g. The density of this solution would most likely have been closest to which of the following?

F. 1.25 g/mL
G. 1.30 g/mL
H. 1.35 g/mL
J. 1.40 g/mL

25. A plastic bead was tested as in Experiment 3 using Liquids 1–4. Which of the following is NOT a plausible set of results for the plastic?

	Liquid		
1	2	3	4
A. R	R	R	R
B. R	R	S	S
C. S	S	R	R
D. S	S	S	S

26. In Experiments 1 and 2, the students tared the graduated cylinder in each trial so they could more easily determine:

F. the mass of the substances added to the graduated cylinder.
G. the density of the graduated cylinder.
H. when the total volume of the added substances was equal to 50.0 mL.
J. when all of the KI was dissolved in the H_2O.

27. A student claimed that polycarbonate is more dense than PA-6. Do the results of Experiments 1–3 support his claim?

A. No, because in Liquid 8, polycarbonate stayed at the bottom and PA-6 rose.
B. Yes, because in Liquid 8, polycarbonate stayed at the bottom and PA-6 rose.
C. No, because in Liquid 8, polycarbonate rose and PA-6 stayed at the bottom.
D. Yes, because in Liquid 8, polycarbonate rose and PA-6 stayed at the bottom.

Test 4: Science—Scoring Key

	Key			Key			Key	
1.	D	_____	15.	A	_____	29.	C	_____
2.	G	_____	16.	H	_____	30.	G	_____
3.	D	_____	17.	A	_____	31.	D	_____
4.	F	_____	18.	F	_____	32.	G	_____
5.	A	_____	19.	B	_____	33.	D	_____
6.	F	_____	20.	G	_____	34.	H	_____
7.	C	_____	21.	C	_____	35.	D	_____
8.	J	_____	22.	G	_____	36.	J	_____
9.	C	_____	23.	C	_____	37.	A	_____
10.	J	_____	24.	H	_____	38.	F	_____
11.	B	_____	25.	B	_____	39.	B	_____
12.	J	_____	26.	F	_____	40.	J	_____
13.	D	_____	27.	B	_____			
14.	H	_____	28.	H	_____			