



## Procedure Measuring Rates of Diffusion

Diffusion is a process that occurs all around us and therefore is easy to witness in action (Figure 4.7).

In this experiment you will examine the effects of temperature, concentration, and particle size on the rate of diffusion by placing dyes in water and in agar. When you have completed the activities, answer Check Your Understanding question 4 (p. 83).

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### Safety Note

Safety glasses, gloves, and lab coats are required. Use caution with the following dyes, as they will stain clothes and irritate and stain skin.

### Part 1

- 1 Obtain two 100 ml glass beakers. Label one beaker "cold" and the other "hot." Fill the "cold" beaker with ice water (take care not to get ice in the beaker, though), and fill the "hot" beaker with water that has been heated.
- 2 Add two drops of food coloring to each beaker.
- 3 Observe the beakers from the side, and measure with a ruler the distance that the dye spreads every minute for 5 minutes. Record your results in Table 4.3.

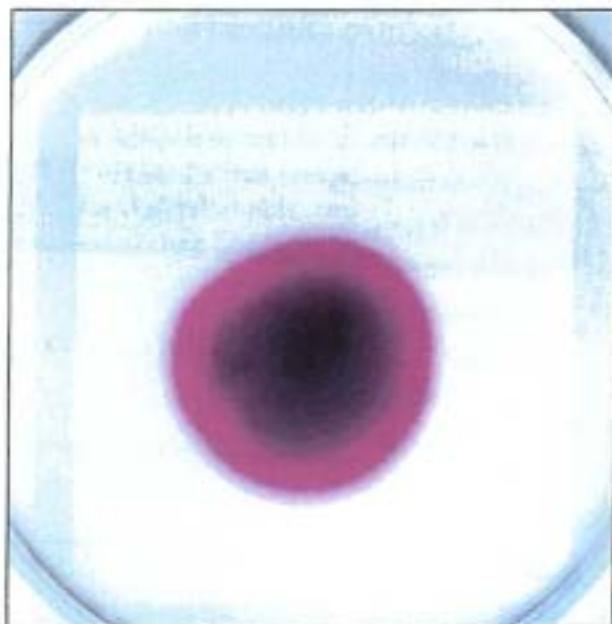


FIGURE 4.7 An example of diffusion is seen with potassium permanganate dye in agar. The dye diffuses outward over time from a high concentration to a low concentration.

TABLE 4.3 Diffusion Results for Food Coloring in Water

Time	Distance of Dye Diffusion: Cold Water	Distance of Dye Diffusion: Hot Water
1 minute		
2 minutes		
3 minutes		
4 minutes		
5 minutes		

- 4 Interpret your results. What effect does temperature have on the rate of diffusion?

### Part 2

- 1 Obtain 4 agar plates with 1 cm wells scooped out of the middle. Label the plates 1, 2, 3, and 4.
- 2 Fill the well of plate 1 with 0.1M potassium permanganate (molecular weight = 158 g/mol).
- 3 Fill the well of plate 2 with 0.1M methylene blue (molecular weight = 374 g/mol).
- 4 Fill the well of plate 3 with 1.0M methylene blue (molecular weight = 374 g/mol).

5 Fill the well of plate 4 with 0.1M Congo red (molecular weight = 697 g/mol).

6 Measure with a ruler the distance that each dye has diffused in 10-minute intervals for 50 minutes. Record your results in **Table 4.4**.

TABLE 4.4 Diffusion Results for Dyes in Agar

Time	Distance of Diffusion: Plate 1, 0.1M Potassium Permanganate	Distance of Diffusion: Plate 2, 0.1M Methylene Blue	Distance of Diffusion: Plate 3, 1.0M Methylene Blue	Distance of Diffusion: Plate 4, 0.1M Congo Red
10 minutes				
20 minutes				
30 minutes				
40 minutes				
50 minutes				

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7 Interpret your results:

a Which dye diffused the fastest?

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b Which dye diffused the slowest?

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c What effect does particle size have on the rate of diffusion?

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d What effect does concentration have on the rate of diffusion?

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