B1 L8 Challenge worksheet: Diffusion

Name: _____ Class: _____

A. Distance and diffusion

Help: online screens 9 and 10 [8]

A student puts a layer of clear jelly into four dishes. Each layer is a different thickness. The student adds the same dye on top of each layer and times how long the colour takes to reach the bottom.

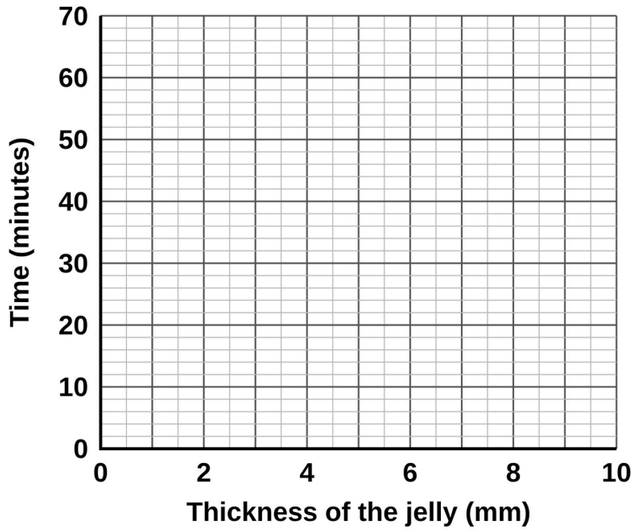


Table 1

Thickness of the jelly (mm)	Time for the dye to reach the bottom (minutes)
2	4
4	16
6	36
8	64

(a) Plot the results on the grid. Draw a smooth curve through the points. [3]

(b) Calculate the mean rate of diffusion through the 6 mm layer. Give your answer in mm per hour. [3]

_____ mm per hour

(c) A student says: 'If the jelly is twice as thick, the dye takes twice as long to reach the bottom.' Use Table 1 to show that the student is wrong. [2]

_____

_____

B. When the kidneys stop working

Help: online screens 6 and 7 [4]

The kidneys remove urea from the blood. In some people the kidneys stop working properly. Then urea builds up in the blood plasma. Figure 1 shows urea (◆) in a liver cell and in the plasma next to it.

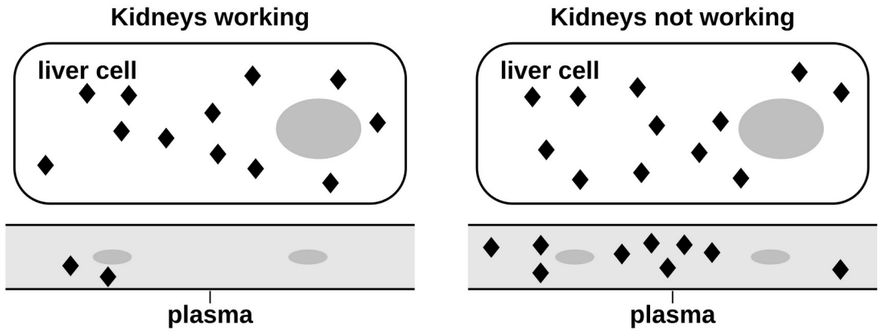


Figure 1 **♦ = urea particle**

(a) Explain why urea diffuses out of the liver cells more slowly when the kidneys are not working. Use Figure 1. [3]

_____

_____

_____

_____

(b) In dialysis, a person's blood flows past a special liquid. The liquid has no urea in it. Urea diffuses out of the blood into the liquid. Suggest why the liquid has no urea in it. [1]

_____

_____

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C. Reading a graph

Help: online screens 9 and 11 [5]

A scientist changed the difference in oxygen concentration between the blood and some cells. She measured the rate of diffusion of oxygen into the cells each time. Figure 2 shows the results.

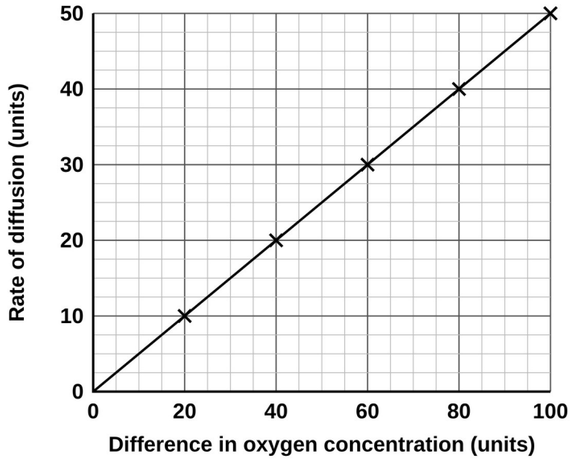


Figure 2

(a) Use Figure 2 to find the rate of diffusion when the difference in concentration is 60 units. [1]

_____ units

(b) Describe the relationship between the difference in concentration and the rate of diffusion. [2]

_____

_____

(c) During exercise, the oxygen concentration in a muscle cell falls from 40 units to 10 units. The oxygen concentration in the blood stays at 100 units. Use Figure 2 to calculate how many times faster oxygen diffuses into the cell during exercise. [2]

_____ times

D. Extended response

Help: online screens 7, 9 and 10 [6]

Most body cells are within about 0.1 mm of a capillary. Your toes are more than 1 metre from your lungs. Use your answers to Task A to explain why the body needs blood to carry oxygen to the toes, and why capillaries must pass very close to every cell. [6]

In your answer, think about how the time for diffusion changes when the distance gets bigger.