DIAGRAMS FOR SOLVING PHYSICS PROBLEMS.

BY JOHN W. SCOVILLE,
Central High School, Syracuse.

By means of diagrams it is possible to solve hard problems in specific heat and heat of fusion in about thirty seconds. These diagrams are useful in checking up the measurements of students in calorimetry experiments; in a few seconds the teacher can tell the student whether the observations are accurate enough to warrant him in going through with the calculations or whether he should repeat the experiment in order to get a new set of data.

To make a diagram for solving problems in specific heat, draw a horizontal line, about forty-five centimeters long, and divide it into one hundred units. This is the temperature line which is shown in Figure 1. Above this line and parallel to it, draw lines

to represent the weight of metal taken and similarly below the temperature line draw lines to represent the weight of water into which the metal is dropped. The spaces between the upper parallel lines will be less than the spaces between the lower parallel lines; the ratio of the width of the upper and lower spaces being the same as the ratio of the specific heat of the metal used to the specific heat of the liquid into which it is dropped.

Suppose the diagram is constructed and we wish to solve this problem: 1,500 grams of iron at a temperature of 90°C. is dropped into 350 gms. of water at a temperature of 20°C.; what will be the temperature of the mixture? Insert a pin in the diagram at A to show the weight of the water and the temperature

of the iron. Insert another pin at B to indicate the weight of the iron and the temperature of the water. Place a straight edge against these pins and where this crosses the temperature line, read off the temperature of the mixture.

Figure 2 shows a diagram for solving problems which deal with the mixing of ice and water. The temperature line is 180 units long and the spaces above and below it are of equal width. Suppose we are to solve this problem: 200 gms. of ice at temperature of zero is dropped into 400 gms. of water at temperature of 80°C .; what will be the temperature of the mixture when the ice is melted? Insert a pin A on the vertical line at the ex-

treme left of the diagram to represent the weight of warm water. Insert a pin B to represent the weight of the ice and the temperature of the hot water. Place a straight edge against these pins and where this cuts the temperature line, read off the temperature of the mixture.

Suppose we were to find out how much ice would be required to cool 400 gms. of water from 100°C . to 0°C . Insert pin A as shown in Figure 1; put the second pin on the temperature line at 0° , connect the two with a straight edge, and where this cuts the vertical line at the right of the diagram, read off the weight of ice required.

A diagram like Figure 2 can be constructed to solve problems in the condensation of steam. The distance marked 80 units in Figure 2 will now be made 536 units long, the whole temperature line being 636 units long and the zero reading being at the extreme right.

Figure 3 shows a diagram for solving problems on lenses or joint resistance. Draw BD perpendicular to EC and draw AD to bisect angle BDE. On BD, DC, and ED mark off equal spaces. At these points on ED erect perpendiculars to cut AD. The spaces on AD will be longer than the spaces on DC or DB. Suppose we wish to find the image distance when the object distance is 4 and the focal length of the lens is 1.5. Insert a pin at A to indicate the object distance, insert a pin at B to indicate the focal length of the lens. Place a straight edge against these pins and where this cuts the line DC, read off the distance of the image from the lens. It can be seen that if the object

FIG 3 J.W.S.

distance is infinite, the image distance is the same as the focal length. If the object distance taken is less than the focal length, the straight edge will intersect the horizontal line at the left of D, indicating that the image is now virtual.

To use this diagram to get joint resistance, insert a pin on DC to indicate one resistance, insert a pin on AD to represent the other resistance, and where the straight edge connecting these pins cuts the vertical line, read off the joint resistance of the two wires in parallel. Transferring this resistance to the line AD, it could be combined with the resistance of a third wire, and so on.

Describe construction of Leclanche cell.

A.: Packed around the carbon is magneise of dioxide and emersed in sulphuratic acid.

Q.: Why is a balloon not completely filled before releasing?

A.: It would rise too quick and the outside air gets in as it goes up and the higher up it gets it condenses because the air is hot high up.

State how the freezing point is marked on a thermometer.

A.: Place it in melting ice and mark how high the rercery goes.