ducted. But too often the problems found in texts are foreign to the student's life and are therefore thought to be "catchy," whereas they are senseless. There can be no question but that problems which can be taken from the student's experiences, and especially in the early part of the work those which can be solved graphically, should be given freely. At no time in the teaching of dynamics should an exercise be accepted as having educational value which consists in the student's selecting the proper formula, substituting the values named in the problem, and "solving," as he says. To know the principles of dynamics is simply to be able clearly to picture the motion of a given mass when acted upon for a given time by a given force.

PLANTS AS PETS.

BY EDWARD F. BIGELOW,

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In many schools space and earth are not always available for growing plants. But, fortunately for the purposes of study, observation and caring for the plants as pets, earth is not needed and the space required by artificially fed plants is very small.

Plants naturally grown in soil, even in the richest, require large root surface to explore every tiny "nook and cranny" of the underground part of the home of the plant. Not a particle of food within the area must be missed. But it is the food percolating through the soil that the plant requires. Plants may be fed with the required chemicals, and not greatly inconvenienced by the lack of soil.

One of the best of artificial foods is that known as the Sachs nutrient solution, commonly used for experimental purposes in every botanical laboratory.

The writer has extensively supplied this food in tablets convenient for use in any school room as follows:

	Metric weight [nearly]
Common table salt (sodium chloride, NaCl)	
2½ grains.	.162 grams.
Plaster of Paris—Gypsum (calcium sulphate, CaSO ₄)	
2½ grains.	.162 grams.

Epsom salts (Magnesium sulphate, MgSO_4)	$2\frac{1}{2}$ grains.	.162 grams.
Phosphate of lime, nearly the same as burned bones (Calcium phosphate, $\text{Ca}_3(\text{PO}_4)_2$)	$2\frac{1}{2}$ grains.	.162 grams.
East India saltpetre—Nitre (potassium nitrate, KNO_3)	5 grains.	.325 grams.
Compound of iron and chlorine (ferric chloride, FeCl_3)	nearly 1-10 grain.	

DIRECTIONS—To make the food solution, two of these tablets are required for each pint (500 ccm. nearly) of water. Crush the tablets to be used and put the powder in the water. Shake or stir thoroughly before using. Keep the plants thoroughly moistened with this solution, which is both drink and food for them.

By using a nutrient solution made from these tablets all that is needed is some material, such as sawdust, pebbles, shot, beads,

WHITE LUPINES, MILLET, OATS AND VETCH IN SAWDUST IN EGGSHELLS.

The plants may thus be grown at least two feet tall. In a similar manner a garden may be grown in clam shells, small tin cups, etc. The roots of artificially fed plants require but little room.

broken bits of brick—anything in pieces that will not decay—through which the roots may pass to seek the food applied to the artificial soil.

These chemicals can be obtained in bulk from almost any chemist or at most drug stores, or a box containing thirty compressed tablets will be supplied by the writer, with full directions, upon receipt of ten cents. (Two cents of this is for postage.)

A solution made from these tablets is the food required by most plants. This solution does not germinate the seeds, it feeds the plant from the first appearance of the tiny roots.

Let the seeds germinate in moist warm air supplied in any manner, perhaps the most convenient material is cotton batting. Then the plant may be placed on mosquito netting stretched across the top of a tumbler or other receptacle, full of the solution or in sawdust, pebbles or in almost any material kept wet with the

A "HILL" OF BEANS GROWING IN SAWDUST IN AN OLD DRIPPING PAN.

solution. A fine crop may be grown in brick dust or pieces of brick in an old tomato can or in a bowl filled with sand or with pulverized stone from a macadamized road. All that is needed is a receptacle through which the roots may penetrate in darkness. You supply the food and nature does the rest. If the growth is on a net stretched across a transparent vessel containing only

the liquid with no opaque objects among which the roots may naturally shun the light, heavy paper or black cloth should be wrapped around the glass, the wrapper to be removed whenever it is desired to examine the roots of the plant.

By this process there is no limit to the novelty of methods, and novelty always pleases and attracts children. There is also the added advantage in bringing the plants under close observation—as pets, the children call them. A plant grown on a tumbler in a desk by the child is more apt to become an object of real love than the plant down in the garden. The progress of the plant is eagerly watched from day to day. A few new root hairs is an event of great interest.

Plants may be grown on a shelf or from open mouthed bottles hanging on chandeliers or by the window. A large plant may be grown in a small receptacle for plants artificially fed, seem not to require as many roots as when they must search over a great extent of soil for the food. The accompanying illustrations show three methods of novelty and suggest many others.

DO GRASSHOPPERS DRINK?

BY CHARLES D. SNYDER,

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Who has ever seen a grasshopper drink? We are all familiar with “where the bee sucks,” and the mosquito, too, but where and when does the grasshopper, the locust, suck? We are familiar enough with the sight of these sphinx-faced creatures eating—eating with a seriousness and solemnity as though all heaven and earth depended upon the operation. Vegetarians that they are, seeking out the tenderest dew-laden morsels the fields afford, they certainly have very little occasion actually to leave off eating and go to drinking. And when this does happen it is most probable that few people indeed observe the process.

It was the good fortune of the writer during the past fall to see several specimens of *Melanoplus* drink great draughts of water. He had never before seen any kind of a grasshopper