A COURSE

OF

SIMPLE OBJECT LESSONS

FOR INFANTS

SECOND SERIES

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PREFACE.

THE following Lessons are more specialised than those of the First Series. The selected objects, however, are all such as are familiar to children six or seven years old—for whom the Lessons are specially intended—and possess characters that are easily recognised and understood by such children. As stated in the Introduction to the First Series, the aim of the Lessons is not so much to impart information as to put the children in the way of acquiring information for themselves, by cultivating and developing those natural faculties of the mind which are chiefly concerned in the acquisition of knowledge about external objects.

The Lessons are arranged to follow each other systematically, and should, as far as possible, be given in the order of the Course. In many cases, however, in the notes at the end of some of the Lessons, a suggestion is made as to additional lessons on cognate subjects, which might be inserted if it were thought desirable to extend the Course.

CONTENTS.

SIMPLE OBJECT LESSONS.

(*SECOND SERIES.*)

LESSON 1.

A BRICK.

Objects required—A common red brick ; ten or twelve small wooden bricks ; colour card ; a rule divided into inches ; paper and scissors.

[This introductory lesson is not intended to treat fully of the principal object used for illustration—a brick—but that object is made use of as a convenient means of commencing a series of lessons on the use of the senses. After a brief reference, therefore, to the nature of the object and its use, the remainder of the lesson is devoted to an examination of the form of the brick and the various parts—faces, edges, &c.—which determine that form.]

What is this on the table? What is it used for? How are the bricks laid to make a wall? Here are some little toy bricks which children have to build with; what are they made of? Who could build a little wall with these?

Let some one build, and then show how easily the wall is knocked down or the bricks taken off, and let the children tell of the mortar used in building, and point out the bricks and mortar in the walls of the room. Then proceed to the special examination of the brick on the table.

What colour is this brick? What else is of nearly the same colour? (Let them point out the colour on the card.) Are all bricks of this colour? What other colour then have some bricks? Show me the colour on this card.

What name is given to these sharp points of the brick? (Corners.) How do I know they are sharp? If you fell and knocked your hand or head against these corners, what might be the consequence? How many corners can you see?

Hold up the brick that the children may count the corners; then let them observe that they cannot see all from one position, and let some one say how many he can see. Point out the four corners at each end of the brick. Let the children name other objects in the room having corners, and some objects which have no corners.

How many sides are there? Are they sharp like the corners? What should we say of the sides? (They are flat.) What else in the room has flat sides?

Distinguish the different faces of the brick as it lies on the table, as *top*, *bottom*, *front*, *back*, *right hand*, and *left hand*, letting the children name them as you point them out; and then let some one point them out as you name them.

Are the sides all of the same size? Which are the largest? Which the smallest? If I wanted to draw on the board a figure like this side of the brick, how many lines should I draw? All of the same size? How many long ones? How many short ones?

Draw on the board outlines of the three different-sized faces of the brick, making the lines of the right length by the aid of a rule, and proving the accuracy of your drawing by laying each face of the brick in succession on the outline drawn. Cut out of paper also pieces of the same size as the faces, let the children pick out the piece corresponding to any side pointed out by you, and prove that it does so correspond by laying the paper on that

side; let them also help you in placing the three pieces together to represent part of a brick. Draw a perspective view of a brick on the board, and let them try to copy it on their slates.

Promise to tell them next lesson something about the stuff of which bricks are made.

LESSON 2.

CLAY.

Objects required—Piece of soft moist clay; brick; knife to cut the clay; two small pieces of board (or slate) for shaping the clay.

Commence with a few questions about bricks and their use, and then introduce the specimen of soft clay as the material of which bricks are made. Direct the attention, in the first instance, to the great differences between the clay and the substance of the brick; and explain that we have different names for the two substances because they are so unlike in their characters. Let the children point out, as far as they can, the following points of difference, which they might also be asked to illustrate when possible, or which the teacher might illustrate :—

(1) The difference in colour.

(2) The difference to the sense of touch—the dry, hard, rough nature of the brick, as compared with the moist, soft, and smooth character of the clay. Show the children how they can put their finger into the mass of clay, but not into the brick.

(3) The plastic character of clay, which enables it to be moulded and formed into any shape, whereas the shape of the brick is permanent, and can be altered only by removing portions of it. Cut two pieces of the clay, make one into a rectangular block somewhat like a brick, and roll the other (between two pieces of board) so as to make it like a ball. Press on a piece of clay and point out how it is flattened; drop a piece and show the same effect, and contrast it in this respect with a brick. Show also how easy it is to cut a piece of clay, and let them suggest how the brick might be broken. (Perhaps they will be able to describe how it is broken and shaped by the bricklayer.)

(4) Let the children note the characteristic smell of the clay, and compare it with the brick in this respect.

Then ask the children if they feel sure they could recognise a piece of clay when shown to them, and let them tell you what characters they would expect it to have. After that you might briefly describe how the clay is obtained, shaped, dried, and burnt, until it is converted into bricks like the one they have been examining; and if there should be a brickfield in the neighbourhood, tell them of it, and encourage them to go and see for themselves some of the things that you have been describing.

N.B.—Put aside the two shaped pieces of clay in a place where they will be come thoroughly dry before the next lesson is given

LESSON 3.

DRIED CLAY.

Objects required—The brick and ball of clay shaped in the course of the last lesson, but now dried; another piece of dry clay to powder with hammer or stone; plate, knife, and water to moisten powdered clay and make it plastic.

See first whether the children recognise the brick and ball of clay again; let them carefully examine them and note in what respects the clay has changed since it was set aside. Show them also how the ball of dried clay breaks when it falls, (let it fall on paper so as to catch the pieces), and let them contrast this with the effect produced when the soft clay was dropped in the preceding lesson. Let them try and alter the shape of the clay brick, or flatten it; and let some one try to cut it with a knife. Having drawn their attention to the altered characters of the substance, ask them if it really is clay now, and try and get them to mention some character which is but slightly altered—e.g. colour or smell.

Tell them then that you know it is clay, because you can easily make it into a soft wet mass like it was before; and let them, if they can, tell you how you may do this. Crush up the broken pieces as fine as possible, put them on the plate, and say a few words about the substance—speak of it as a *powder*, show that it adheres to the finger, is readily blown about (blow a little off your hand), and let the children say what it would be called if blown about by the wind in the streets.

Then add a little water (no more than is really necessary) and mix up the whole well, working it with a knife until you have a fairly uniform piece of plastic clay. Let

the children examine this and describe how it differs from the dry clay (both lump and powder). Ask them then if they can tell what it is which makes all the difference, and lead them to understand that the drying of the clay when set aside was due to the escape of some of the water into the air. Connect this idea with the drying of the bricks in the air when first made, and tell them of the very hard sun-dried bricks made in countries where the sun's heat is much more powerful than in our own country. Tell them also that when the clay has been burnt (as in brick-making) it changes very much, so that if they powdered a brick and wetted the powder, they would not get clay.

Let them tell you of some other articles made out of clay (e.g. plate, cup, &c., mentioned in the lessons of the first series), but explain to them that in these cases very fine clay is used, and other substances are put along with the clay to make the glaze and produce the various colours. Let some child fashion a little cup, another a plate, and a third a saucer out of the clay, and let them, together with a brick-like block and a ball of clay, be set aside for some days to dry, and then let attention be once more directed to the changes produced by the drying.

LESSON 4.

FORM.

Objects required—Brick and ball of clay made in the last lesson; slate; ball of soft clay; penny (or other coin); cylinder (a lead pencil if nothing larger can be obtained); two small wooden bricks; two glass marbles.

Set the clay brick and ball on the table, and let the

children briefly describe the difference in the manner of making the two objects—e.g. the flattening of the one against the table, &c., and the rolling of the other in the hands, or between two flat surfaces. Let them also describe how they could make the brick into the shape of a ball, and *vice versâ*. Ask them what could be done with the ball (e.g. rolled), and whether the same could be done with the brick; and then try and lead them to see that since the material is the same in each case, this difference must be due to the difference in shape. Proceed to examine the shape more closely.

Let some one move the ball on the table and then the brick, and point out how the former rolls along while the latter simply slides along. Show the same fact by laying each on a slightly inclined surface, say a slate; and show also that the brick may be rolled over in a manner from face to face, but not so easily as a ball. Explain that this is because the ball is round while the brick has flat faces, and illustrate your explanation with a ball of moderately soft clay, using it first rounded and then with one part flattened. Show them a cylindrical body, and let them point out the rounded and flattened portions, and then show how readily it rolls on the former, but not on the latter parts. Use a penny in the same way, and then let the children suggest other things which are made round for the purpose of rolling and moving easily (e.g. a wheel, hoop, marble, &c.)

Having shown the advantage of rounded surfaces when freedom of movement is required, proceed next to make the children understand that flat surfaces have their advantages—e.g. as regards steadiness. Let a child try to make one marble rest on the top of another, and let the children explain why this cannot be done. Then let them suggest what objects might be built up in this way, and let some one set up one little wooden brick on

another. Show them how steadily the penny lies on either of its flat faces, and how the cylinder will stand on its flattened ends; and remind them how we can stand more steadily and comfortably on a flat than on a rounded surface.

Then briefly go over the parts of the brick (as was done in the first lesson), noting the various faces, edges, and corners, and point out that there are none of these represented on the ball, that a ball looks the same when seen from any position, whereas the appearance of the brick varies when looked at from different positions. This might also be illustrated by simple sketches on the black-board.

LESSON 5.

A BALL.

Objects required—A small (solid and uncoloured) india-rubber ball; a large glass marble; a ball of soft clay.

Show the children the india-rubber ball and let them say what it is, and what they could do with it. Ask them if you have shown them a ball before, and what it was made of; then let them say whether the one you have is made of clay, and give some reason for their answer. See if they remember what happened to a ball of wet and dry clay respectively when dropped, and let them see whether the same happens to the india-rubber ball. Drop it and the soft clay ball together, and let them notice what differences they can—e.g. the flattening of the one and the bouncing of the other.

You might tell them that the india-rubber ball be-

comes flattened a little when dropped, but does not remain so; and show them in this connection how you can press it flat with your finger, or against a slate, but that it becomes rounded again as soon as the pressure is removed. Then do the same with the clay, and let them tell you what difference they observe. Let several of them repeat these experiments, and also that of dropping the two balls together, until they clearly understand that the reason why one substance is said to be india-rubber and the other substance (not india-rubber but) clay, is because they have different characters.

Then introduce the glass marble, and after letting them tell you some ways in which they could play with it, let them experiment with it in the same manner as with the other balls—viz. try to flatten it by pressure, and drop it to see whether it bounces. Then they should be able to give you some reasons for saying that it is made of a different substance from either of the others; and by noting that it is smooth and hard and clear, like the glass in the window, they would have some reasons for saying that it was glass. They would then probably be able to infer what might happen if the marble were dropped on to a hard stone.

The children would thus have learnt that a ball may be made of a variety of different substances, and might be asked to suggest still other substances of which balls could be made (e.g. wood, wool, leather, &c.) They could next consider briefly some of the different ways in which they use the balls in their play– e.g. *rolling* them (letting them explain what they learnt in the last lesson about the shape of the ball being peculiarly adapted for rolling, and about the kind of surface on which the ball rolls best); *throwing* them (speaking of the different directions in which they may be thrown, the care necessary so that neither themselves nor others may be hit), *catching*, and

dropping them. Let several of the children say which of the three balls on the table they would rather play with, and give a reason for their preference.

LESSON 6.

THE SENSES.

Objects required—The india-rubber, glass, and clay balls, used in Lesson 5.

Let the children name the three balls and the materials of which they are composed; and, after examining them, say which is the largest, smallest, softest, hardest; which would bounce best, &c.

Then try to make them understand something about the means by which they are able to examine and to distinguish bodies. Let them, for example, tell you how they know that the balls are on the table; how they would know if you moved one; and how it is they can tell at a distance which is the clay, &c.—viz. by their power of seeing, or, in other words, by their *sight*. Let them tell you with what part of the body they see, and under what circumstances they cannot see—e.g. when it is dark, or when their eyes are shut. Let them also state how they would describe persons who unfortunately never have this power of seeing.

Ask them if a blind person, or if they themselves with their eyes closed, could distinguish the clay from the glass, and that again from the india-rubber. Let some one close his eyes, then put in his hand one of the balls, and let him say which he thinks it is, and why? Repeat the same experiment with others. Then lay all the balls on the table, and let some one come, and name them all with

his eyes closed. They would then probably be able to say that they learned something about each of the balls in this case by *feeling* or *touch*.

In a somewhat similar manner show them that they might distinguish between the balls by means of *smell*, and tell them that it would be possible to do so even by means of *taste*.

Then drop the balls one at a time on the floor, and let them understand that they might know when it was done by *hearing*. Tell them to note carefully the sound made by each ball as it falls; then drop one where they cannot see it, and let them tell you which ball it was that was dropped.

You would thus have shown them that we have five different means of learning about things—five *senses*, as they are termed. Let them repeat the names of the senses. Tell them that we must learn to use all these senses if we would grow up to be useful and clever Let them tell you the parts of the body where each sense is situated; and in the case of touch you might readily show them that, although the power of feeling is present in most parts of our body, the finger-tips are the parts most generally useful to us in connection with this sense.

LESSON 7.

AN ORANGE.

[*Note.*—If there should be any difficulty in obtaining an orange for illustration, an apple might be used, and the details of the lesson somewhat modified, the general principles remaining the same. And it would be well in any case to follow this lesson on the orange, with a lesson on one or two other fruits (e.g. an apple, a cherry, &c.), pointing out that in many respects they resemble an orange, while they differ from it in structure.]

Objects required—An orange ; knife ; colour card ; a small plate (or clean slate) to lay the orange on when cut.

We have talked a great deal about balls lately ; I have another kind of ball in my hand to-day. Do you call it a ball? What do you call it? What is it for? What are balls for? Why do you think I call it a ball? Why do you not call it a ball? Well, then, I will call it an orange.

What colour is it? Have we had anything of nearly the same colour to talk about before? What was it? Was it exactly the same colour? (Let them point out on the colour card brick-red and orange.) You said I called it a ball because it is round ; show me where it is round. What can I do with it if it is round? (Roll it on its side.) But is it round in all parts? At those parts (which we will call the top and the bottom) it is flattened ; like a ball of clay which has been——? You know that flattened things will not easily——? (roll) ; but they will stand more steadily. (Let some one set up the orange on one of its flattened ends, and then show them that it is not quite so easily set rolling as when lying on its rounded side.)

Clay is dug out of the ground. Can anyone tell me how oranges are obtained? (They grow on trees.) What else grows on trees? Apples and gooseberries grow on trees in our gardens and fields, but orange-trees grow in countries far away, and are brought to us in ships. Do you remember what we call the little piece, almost like a stick, which fastens a leaf on to a tree? And oranges are fastened to the trees by stalks : some one try to find out where the stalk was fastened to the orange. (Make a little sketch on the board to illustrate how the orange is attached to the branch by a stalk.)

Here is a knife : what can I do to the orange with it? I want to cut it down the middle ; who can show me where that is? I have cut it there ; how many pieces have I now? Both nearly the same size ; what do we call each of them? (Half.) If I cut each of those pieces into two, how many pieces shall I have? And what shall we call those pieces?

Now look at the knife and you see it is——? (Wet.) What made it wet? Where is the juice? How can I get some out? Could I squeeze juice out of a glass ball? Could I do so if I broke or cut the glass ball? Why not? What do you do with orange juice? Is it nice? What kind of taste has it? What else is sweet? What makes things

sweet? What would you guess was in orange juice to make it sweet? There is sugar in it.

Is the orange the same all the way through? What do you call this outside part? Which part do you eat? Has a ball of clay (or glass) a skin? What else do you know which is covered with skin besides an orange? (They should remember from their earlier lessons that their hand is covered with skin.) In which part of the orange is the juice—in the skin or in the inside part? What keeps in the juice of the orange before it is cut?

There are some little hard pieces in the orange: what do you call them? Does anyone know what they are?

Explain that if they were set, and left for a long time in the ground, they would begin to grow, and grow into orange-trees. Try to get the children to ask their parents, or their elder brothers and sisters, to set an orange pip for them; and let them see you set one.

Note.—Put some common mustard seeds on a saucer of soil, or on damp flannel, and set them on one side in a warm place, so as to grow up fairly well in time for the succeeding lesson.

LESSON 8.

GROWING SEEDS.

Objects required—Some seeds (e.g. common mustard seed) growing on soil or damp flannel; some dry seeds of the same kind.

In the first place remind the children of the seeds found in the orange or apple used in the last lesson, and see if they remember what you said might be done with them, and what they would grow into. Ask them if they

have ever seen any other seeds, if they have seen them set, where they were set, and what they grew into.

Show them some of the dry (mustard) seed, and see if they can recognise it ; break one open and show them the soft inside, and ask them if those seeds are growing. Then show them the growing seeds, and explain to them the circumstances under which they have been placed, in order that they might grow. Let them compare those conditions with the ordinary conditions under which seeds grow when placed in the ground —viz. the manner in which they are kept warm, and the source whence they obtain the moisture that they require.

Then point out how the seeds have swollen and burst and how certain parts have made their way out. (This will best be done by pointing to seeds in various stages of growth.) Let them observe how the roots make their way downwards into the flannel or soil, whilst the stems stand more or less erect and bear green leaves. (In the specimen it may be that the stems are all white, but the children will probably have noticed that the stems of small plants are frequently green.) Let the children point out the leaves, also to what they are attached, and in what manner ; and compare the colour of the leaves with that of the stem and the roots. Let them also note how the leaves are at first folded up, but soon spread themselves out, so as to get as much light and air as possible. If the specimen shows it plainly, it might be pointed out how all the stems stretch in one direction—viz. towards the light in the place where they grew.

Then let them try to explain how the water can get to the leaves and other parts (viz. through the roots and stems), and let them, if they can, describe what would happen if no water were supplied, or if some of the plants were pulled up and laid on the dry plate for a time. (Some of the plants might be pulled up and laid aside in this way and shown to them in the course of a day or two.)

Tell them that we call such things as these which have roots and stems and leaves, and that grow in the soil or in other damp places, *plants*; and let them mention the names of some plants which they have seen growing. Tell them that we eat the leaves of some plants, and the stems or the roots of others, and let them give examples. Let them also understand that what we call *trees* are really plants, which often grow from seeds and which have roots, stems, and leaves, only of a larger size. They might be asked for the names of other parts of plants, such as the branches, flowers, fruits, and seeds.

Note.—If the children were interested in this subject it would be well for the teacher to take further opportunities of growing seeds in the school, in small boxes of soil, and letting the plants flower and seed. Some ears of corn with very short stalks, set in a glass tumbler containing a little water, would sprout and form a very pretty and instructive object. Some grains of wheat placed on damp soil, or even on damp cotton wool, and kept in a warm place, sprout up nicely in the course of a few days.

LESSON 9.

A TREE.

Object required—A geranium or other tree growing in a pot, with buds and flowers if possible.

Let the children understand in the first place the connection between the present and the preceding lesson —viz. that both are about growing plants. Let them suggest reasons for thinking that the tree before them is growing—e.g. the greenness and firmness of the leaves, and the way in which the leaves stand out from the stem;

and let them also tell you how they may know when a tree is dead.

Then let them point out the various parts of the tree which they can recognise and name—stem, branches, leaves, stalks, flowers. Let them note the soil that the tree is planted in, and say what part of the tree is hidden in the soil, and the use of the roots (viz. to hold the tree firmly and to take up water).

Let them go on to speak of the leaves—their colour and form (a simple outline sketch of one of the leaves might be made on the board), the leaf stalk, the falling off of the old leaves and the growth of new ones. Let them distinguish between the older and newer leaves on the tree, and understand that the smaller leaves will grow larger if the tree continues to live. Point out some of the leaf-buds, and show that they are simply bunches of young leaves.

If there are flowers on the tree, examine them next, note the flower-stalk, the series of leaves of which the outer parts of the flower are composed, and their beautiful colours. Note also the scent of the flower, if it is at all distinct. If there are flower-buds, point out that they consist of flowers, the parts of which are small and folded closely together, but which in time will expand and display themselves. Tell the children of the visits of bees, flies, butterflies, &c., to flowers for the purpose of gathering the honey, which is often to be found in them.

In conclusion, speak of the growth of the tree, the necessity for sunlight and water, and the manner in which these are supplied, both when the plant grows out of doors and in our houses.

LESSON 10.

A FLOWER-POT.

Objects required—An empty flower-pot; the tree growing in a pot as used in the last lesson.

Draw the attention of the children to the soil in which the tree is planted, its loose character, and the manner in which it 'soils' the hands or anything that it touches. This will lead to the consideration of the pot which contains the soil.

Let them compare the pot with a brick as to its colour, roughness, &c.; and explain that it is made of burnt clay in the same manner as a brick. Then explain that, unlike a brick, it is hollow—i.e. encloses a space into which the hand, soil, &c., may be put.

Show them the hole at the bottom of the pot, and let them see that loose pieces (e.g. small pieces of chalk) will fall through; and explain that, before soil is put in, the hole must be partly covered over with a small stone or something of the kind. (This may probably be felt in the pot containing the tree, by putting the finger up through the hole). Explain also that it would injure the tree if the soil in which it grew were kept very wet; and that the hole allows some of the water to run out.

Then refer to the shape of the pot—the flat bottom, and the reason for its being flat—and the circular outline of the bottom and of the top. Point out the sloping sides of the pot, and let a child hold a pencil or pointer first in an upright position, and then in a slanting direction corresponding to the direction of the two sides as they appear to him. Let the children understand that the

slope is due to the fact that the top of the pot is larger than the bottom. Draw a simple outline of the pot on the blackboard, and let the children copy it on their slates. Let them also suggest other objects having very similar shapes.

LESSON 11.

A GLASS TUMBLER.

Objects required—A plain tumbler; the empty flower-pot used in the last lesson.

Let the children say what the object is, what it is used for, and what it is made of. Let them point out the top, the bottom (explaining why it is flat), the edge, and the side; and let them further describe and illustrate what is meant by saying things are inside or outside the tumbler.

Proceed next to compare the tumbler with the flower-pot used in the last lesson, drawing the outline of each on the board to illustrate the resemblance in shape. Then compare them as to size, setting them side by side, measuring with a piece of string across and round the top of each, setting one inside the other, &c.

Then let the children point out some obvious differences between the two objects. The pot is red, like a brick: the glass colourless, like water. A pencil or piece of chalk put into the pot cannot be seen without looking into the pot through the opening at the top or bottom; whereas objects in the glass may be seen through the sides. They might be taught to use the word 'transparent'; to give instances of other things that are transparent, and of things that are not transparent; and to mention some purpose for which glass is used on account

of its being transparent (e.g. for windows, as described in an early lesson).

Show them next that it is possible to distinguish between the flower-pot and the tumbler by the sense of touch; and let several children do so with their eyes closed. Let them try and explain how they know one from the other in this way—viz. by the one being smoother than the other; and let them give instances of other rough and smooth bodies about the room. Let them also state what other facts they could learn about the two vessels by merely feeling them—e.g. the relative size, shape, weight, &c.

They would probably suggest as a difference the fact that there is no hole in the bottom of the tumbler, like there is in the pot; and the use of the hole in the one might then be again referred to, and a reason assigned for its being absent in the case of the other. They would also probably know from experience of another point of similarity,—viz. the brittleness of the two substances, as shown by their breaking so readily when dropped or knocked.

LESSON 12.

WATER.

Objects required—A glass tumbler nearly full of water; slate and slate-pencil.

Let the children first say whether there is anything in the tumbler, and how they know there is something there—e.g. by seeing it. (Some one might also be asked to put his finger in the tumbler and so feel the water.) They might then be asked to say what they think the substance

is, and try to explain what makes them think that it is water. This would naturally lead to something being said about the water having no distinct colour, and about its transparency. (Illustrate this latter fact, as on a previous occasion, by putting a pencil in the water, and letting the children see the pencil through the water and the glass. If the sun is shining into the room you might let them see that light will pass through both water and glass, and thus illustrate, in a simple manner, the essential character of transparent bodies—viz. that they allow light to pass through them.)

Then dip the pencil or the finger into the water, and let the children understand that these objects are wetted on account of some water adhering to them—as they may see in the case of the drop at the end, and also by rubbing the wet body against a slate or board. Let some drops fall from the end of the pencil on to a slate, and let the children note how they splash about when they strike the slate. Let them compare these with drops of rain

Then, in the next place, give them a general idea of the other main characters of liquids, by showing them how easily the water moves about when the table is shaken or the tumbler lifted, how easily the water is spilled, and how it can be poured from one vessel into another. Ask the children to name other substances that have these characters, and then tell them that they are all called *liquids*.

Then it might be well to say a little about some of the most important uses of water, explaining that we could not live long without water to drink, that the plants in our gardens and fields would die if they could not get water from the rain or elsewhere; that in some countries, where little or no rain falls, nothing will grow and people cannot live,—and it might be stated that such

places are called 'deserts.' Tell them that children cannot grow up healthy and strong if they do not frequently wash themselves and keep themselves clean, and try also to keep their clothes and their houses clean, and that for these purposes we must again make use of water.

LESSON 13.

ICE.

Objects required—Piece of ice on a plate; piece of glass (e.g. a glass marble); slate; glass tumbler.

[It is desirable that this lesson should, if possible, be taken next to the lesson on water, so that the children may be led to realise that the same substance may exist in different physical states or conditions—the condition of the substance at any given time depending on the circumstances under which it is placed. It would generally be possible, at almost any season, to obtain from a fishmonger a small piece of ice, with which to illustrate this lesson. If, however, ice could not be obtained when required, it would be better to postpone the lesson rather than to attempt to give it without that substance being present before the children.]

After the children have looked at the ice let them say what they think it is, and why they think so. Let them also give their reasons for thinking it is not a piece of glass. Let someone take the ice (or a piece of it) in one hand and a piece of glass (a marble) in the other, and describe the differences he finds between the two substances—e.g. how the ice is colder than the glass, how it also wets his hand, &c.

Then with a duster dry a small piece of ice, and place it on a dry slate, directing the children's attention to the size of the piece, and to the fact of there being at first no water on the slate. Leave the slate for a time on the table, and take another small piece of ice in your hand, and point out how it wets your hand, and how drops of something fall from your hand. Catch these drops in a dry tumbler; let the children give their reasons for not calling the substance in the tumbler ice, and show them that it is a liquid and has the common properties of water (viz. in being transparent, without colour and smell, capable of wetting a slate, duster, &c.). Show them that the piece of ice in the hand has become smaller as the quantity of water has increased, and thus let them understand the reason for saying that ice turns into water. The same facts might be pointed out in connection with the piece of ice placed on the slate.

They could next be led to explain the conditions under which water turns into ice, and ice into water; and also explain why ice is so frequently formed during the night and melted during the day.

They learnt in the preceding lesson to call water and similar substances liquids; let them say whether ice is a liquid, and give their reasons for their answer. Point out that you do not have lumps or pieces of liquids, that such pieces as those of ice or glass will lie on a flat slate, and retain their shape, whereas water spreads itself over the slate. Speak of ice as a *solid* body.

Some little time might be spent in speaking of the clearness and transparency of the ice, its brittleness (which might be illustrated by letting a piece fall on the floor and noting how readily it is broken into fragments), and its smoothness to the touch. Tell them that it is because ice is so smooth that they can slide on it so well, and that they find it so difficult to walk or run on

it ; and caution them about venturing on ice formed over deep water without being sure that it is quite strong enough to bear them safely.

Note.—If circumstances should be favourable, a lesson on snow and hail (or two separate lessons) might follow this one on ice.

LESSON 14.

SALT.

Objects required—Some table salt ; spoon or knife ; tumbler of water ; slate (or piece of glass) to evaporate salt water on. (Either a piece of ordinary rock salt, or, if possible, a colourless specimen of the same.)

[If a piece of clear colourless rock salt can be obtained, it will be an excellent exercise for the children to compare it with the ice treated of in the last lesson, pointing out the points of resemblance and the points of difference (melting, taste, &c.). A little of it might be crushed to powder, to show that it is the same substance as the common salt. If no specimen of colourless rock salt is obtainable, a piece of the ordinary brown rock salt might be used as above described.

It might also be contrasted with glass as regards its taste, its less smoothness, the moist feeling when it is rubbed, and also its relative softness (being readily cut and scratched with a knife.)

The following notes refer only to a specimen of ordinary table salt, and are intended partly to illustrate another property of water—its solvent power—and partly to exercise the children in noting the characteristic and

distinguishing properties of substances that come under their observation.]

Show the children the specimen of table salt, and suggest to them that a white substance of the kind might possibly be snow, or chalk, or sugar, and let them give their reasons for believing that it is not any one of those things. Let them then say what they think it is, and let them suggest some means of proving that it is salt. Speak of it as a powder, and illustrate the relation between a powder and a lump by crushing a piece of rock salt or chalk to powder. Show them that you cannot take up much of a powder with the fingers, as you can take up a large lump of a substance, but must take it up with a knife, or spoon, or on a piece of paper, &c.

Put a few grains of salt in the mouth, and let the children tell you what you could find out about salt by that means. Let one or two children repeat the same experiment. Then remind them of the use of salt along with our food, and how we can tell when the food contains too little or too much salt.

Then put a spoonful of salt into a tumbler of water—note that part of it will probably sink to the bottom, and remind them that we speak of the water and glass as being transparent because we can see the salt through those substances. Then stir the water until the salt has all dissolved, and ask the children where the salt is. Let them prove by taste that the salt still exists, and has the same characteristic taste as before; but explain to them that it is now intimately mixed up with the water, so that each drop of water contains part of the salt, and that it is broken up into such small pieces as to be invisible. When the children have fully comprehended the fact, introduce the term *dissolved*, and let them mention examples of other substances which will dissolve Lead them to see

that when we place salt in our mouths it dissolves in the saliva. Ask those of the class who have seen the sea whether they have ever tasted a drop of the water, and if they have not done so, tell them that there is much salt in sea water.

Then explain to them that we know that the salt is still there when dissolved, though we cannot see it, not only by the taste, but because it is easy to get it back again. Put a little of the salt water on a slate or piece of glass (which might be previously warmed), and let the children describe the manner in which the water will evaporate, when heated by the fire or sun. Evaporate the water (e.g. in front of the fire), and point out the residue on the slate or glass; taste a portion of it yourself first, and then let one or more of the children taste it, so as to satisfy themselves that it is really salt. (It might be mentioned that small pools of sea water are often dried up by the sun, leaving a layer of salt behind in the hollow; and that in this manner salt is frequently obtained, but not the common table salt, which is much purer than sea salt.)

LESSON 15.

SUGAR.

Objects required—Powdered white sugar; tumbler of water; knife (or spoon); brown sugar; slate (or piece of glass) to evaporate water on.

[It is intended by this lesson to again enforce the principle that we recognise bodies by reason of their possessing certain definite characters, and that we distinguish between substances, which may in some respects resemble each other, by certain differences in the characters which

they possess, and which we ascertain by means of our senses. In order to carry out this purpose the teacher should obtain for the illustration of the lesson some powdered white sugar, which at first sight might well be mistaken for salt.]

Let the children state what they think the white powder is, and give some reason for their belief. If, as is possible, some of them think it to be salt, ask them what was done with salt in the last lesson, and repeat the experiment of dissolving a spoonful of the substance in the water; at the same time question them to see if they remember how it is possible to prove that the salt is present in the water, though it is not visible. Having thus shown them that, as far as whiteness and solubility go, the substance resembles salt, ask them if they are satisfied that it is salt, or whether there is not some other test to apply. Let several then taste the powder, and say whether it is salt, and also try to describe the taste. (It would be well to caution the children against being too ready to taste substances about which there is any doubt, telling them that some substances, looking perhaps just like salt or sugar, might make them ill or kill them, even though they tasted very little of the substance. Tell them also that of course you know what the substances are that you show them, and that you would not ask them to taste if the substance would do them any harm.) Let them next taste the water in which the sugar has been dissolved, and ascertain for themselves that its taste is similar to that of the sugar, and different from the taste of the salt water.

Evaporate some of the water containing the sugar on a slate or piece of glass, as in the case of the salt water, letting the children state what substance they would expect to find left on the slate. Let them taste the

residue left after the evaporation, and thus verify their inference.

Ask them next if all sugar is like that you have been using, and let some one point to the other kind of sugar on the table. Point out how the two substances differ in colour and perhaps in smell, and let the children explain, if possible, why both these apparently different substances are called sugar. Let them note that the brown sugar has the same characteristic sweet taste, and that it will dissolve in water and impart a sweet taste to the water.

Then refer to the dissolving of sugar in tea, coffee, &c., and let the children say for what purpose it is put into those liquids. Let them mention other things that are sweet, such as foods to which sugar is intentionally added, sweets (toffee, &c.) which are made principally of sugar, and fruits which, when ripe, contain sugar. Tell them that in many flowers there is a kind of sugar, which some little insects collect, and let them, if they can, give you the name of the substance (honey), and of the well-known insect which collects and stores it. Ask which of them have tasted honey, and let them tell you in what respect it resembles ordinary sugar.

LESSON 16.

SAND.

Objects required—Specimen of sand (white, if possible; but, at all events, sand that has been washed clean so as to settle down quickly after stirring in water and leave the water clear); tumbler of water; knife (or spoon); specimen of sandstone.

[A lesson on sand may very appropriately follow those

on salt and sugar, as affording the children another exercise in the comparison of substances resembling one another in general appearance, but which are found on closer examination to possess very different properties.]

Compare your sand as a powder with the powdered salt and sugar, pointing out to the children that it is composed of a number of very small loose pieces, which may be made into a little heap, but are easily shaken about so as to spread out into a flat mass very much as a liquid would do. Point out also that it may be poured from one piece of paper on to another, or from one vessel into another ; but explain that it is not a liquid, because we can see the separate small pieces of which it is composed, and also because it will stand up in a heap when still, which a liquid would not do.

Let several of the children come and each dip a finger into the sand (first moistening the finger slightly if necessary), and observe the small pieces of sand adhering to the finger. Speak of each piece as a *grain* of sand, and let them count the number so far as to appreciate what a very large number of grains there must be in the small heap on the table. Tell the children that each grain is really a very little stone, and let them rub the grains between their fingers, and press them between the finger and the desk (or a slate), so as to feel how hard they are.

Show them a piece of sandstone, and let them examine it to see if they can recognise it as being composed of a number of grains of sand fastened together ; and it might be well also to crush a small piece of the stone so as to convert it into loose sand. They would then understand the term 'sandstone.'

Then put some of the sand into the tumbler of water, and stir it up to show that it will not dissolve, as the salt

and sugar did under similar circumstances. Let the children say how they know that it has not dissolved. Remind them that when the salt or sugar was put in the mouth it dissolved there, and then there was a characteristic taste ; but that sand would not dissolve in the mouth, and there would be no distinct taste. (If the sand were clean enough, a few grains might be placed on the tongue in order to verify this statement.)

The fact that the sand always sinks to the bottom of the water might be pointed out ; stirring the water well to let them see how it is mixed up with the water so long as that is in motion, but that the sand settles to the bottom as soon as the water becomes still.

Then speak of sand often being found at the bottom of rivers and of the sea, and also of the sand forming the sea-shore. Let them understand that all substances do not sink to the bottom when placed in water, putting one or two small bits of cork or wood (e.g. chips from a lead-pencil) on the water, and pointing out how they float, and how, after having been submerged, they again rise to the top.

Tell them that both sand and clay (which they learnt about in the early lessons) are often dug out of the ground, and let them describe how they would be able to distinguish one of these substances from the other.

LESSON 17.

SLATE.

Objects required—Piece of roofing slate ; writing-slate (framed) ; tumbler of water.

Remind the children that in the last lesson you

showed them a kind of stone which is dug out of the ground in some places, and let them tell you the name of it. Then tell them that you wish to talk, in the present lesson, about another kind of stone, which is also dug out of the ground. Show them the roofing-slate and let them tell you the name of it. Let them then compare it with the sandstone, pointing out the difference of colour, and that the slate is not composed of visibly distinct pieces or grains.

Then speak of the use of slates in connection with our houses, pointing out that, as a rule, sandstone is used only for the walls, while slate is used only for the roof. Ask them some questions to ascertain if they still remember what they learnt in the lesson on the roof in the first series—e.g. the necessity for a roof, and for its being composed of something which would not let rain through, and about the slope of the roof—illustrating the latter point again, if necessary, by pouring some water on the slate, and then inclining it so as to let the water run off.

Let them tell you of other uses of slate and compare the roofing-slate with one of their writing-slates. Ask them which of the two they would rather write on, and let them give their reasons for their choice. Draw a line with a pencil or piece of chalk on each of the two slates, and show that on the rougher slate the line is more broken and irregular than on the other; and remind them of the blackboard and writing-paper to prove that smooth surfaces are preferred for writing upon.

Show them next that slate is not soluble in water like sugar and salt, and let them explain why it would be unsuitable both for roofing and as a writing material if it were soluble.

Then devote the remainder of the lesson to the consideration of the slates that the children use for their writing. Let them distinguish between the slate itself

and the wooden frame surrounding it, and try to suggest some of the advantages gained by framing the slate—viz. that the sharp edges and corners of the slate are enclosed, and, therefore, it is better to hold ; that it may be laid down without the slate itself touching the desk or table, and, therefore, that it does not so soon get scratched (let them explain why scratches spoil a slate) ; and that the frame often prevents the slate itself from being broken when it falls. If there is time, the frame might be examined, and the children asked to point out the different pieces of which it is composed, and the pegs by which the pieces are fastened together. With a broken frame the groove in which the edges of the slate are held might also be pointed out.

LESSON 18.

WRITING PAPER.

Objects required—Sheet of white paper; brown paper; lead pencil ; pen and ink.

Remind the children that you were talking in the last lesson of something used for writing upon; let them tell you what it was, and name other substances used for the same purpose. Question them to see if they remember the fact that such substances should be fairly smooth.

Then show them a piece of white writing paper, and a piece of brown paper; let them compare them, and say which would be the better substance for writing upon. Point out one or two characters that they have in common, to justify the same name being applied to both—e.g. that they are both in sheets, that they will easily tear and burn, and that they can be bent and folded without

breaking. Promise to devote a subsequent lesson to brown paper and its uses, and confine yourself in the remainder of the present lesson to the consideration of the white writing-paper.

Speak next of the materials used for writing upon the paper, showing the children that slate pencils are unsuitable for this purpose, but that a special kind of pencil may be used. Let them compare the two pencils, and note that the substance which marks the paper is in the centre of the pencil, and enclosed by wood. (If the teacher has a coloured pencil, she might show it to the children, and let them see some writing done with it.) The children will mention pen and ink as writing materials, and the teacher might illustrate the difference between the marks made with pencil and those with ink, and let the children point out each on a sheet of paper, on which several marks of both kinds have been made.

Illustrate once more the necessity for having a great contrast between the colour of the substance used for writing with and the surface which is written on; show them that ink writing is inconspicuous on a black board, and writing with ordinary chalk almost invisible on white paper. Let them say if they have seen writing done with ink of any colour besides black.

Let them, if they can, mention other uses of white paper—e.g. for printing, drawing, and painting upon

Then speak of the necessity for keeping the paper clean if we would have it look nice, of the different ways in which it might be soiled, the use of covers to copy-books and reading books, and the general care that should be taken of these things.

It might be well to tell the children that we do not find paper in the ground, as we find slate, but that paper has to be made, and that some day they must learn a little about the making of paper.

Note.—One or two very interesting lessons might be given in connection with this subject—for example, a special lesson upon a *lead pencil* might be made very interesting, without making it, at the same time, too difficult for the children to follow. Another lesson might be given on *a letter*, using for illustrations a clean sheet of note paper and an envelope, and also a letter that the teacher has received. The children would be greatly interested if shown how the name and address of the person for whom the letter was intended had to be written on the envelope, and would be pleased to write on their slates their own addresses. The folding of the letter, the enclosing of it in the envelope, the stamp, &c, would all be sources of interest to them.

LESSON 19.

BROWN PAPER.

Objects required—One or two sheets of brown paper; lead pencil.

When the children have named the object as a piece of paper, let them state some characters that it possesses in common with the white paper dealt with in the last lesson—e.g. that it is readily torn or cut, that it will easily burn, that it may be folded, &c.; illustrating these characters experimentally as they are mentioned. Then let the children ascertain if the brown paper could be used for writing upon—e.g. with a lead pencil—and give their reasons for considering it inferior in this respect to the white paper. In this connection the teacher would do well to crush up a small sheet of the paper in her hands, and then open it out and let the children compare it with a sheet that has not been so treated, both as to its general appearance and its suitability for writing upon.

Lead the children next to suggest the term *sheet*, as the name given to large pieces of paper, and let them

mention other instances of the use of that term. Contrast the term 'sheet' with the terms 'lump' and 'drop' as applied to portions of matter.

Then point out and illustrate the stiffness of the paper, showing how after being folded it retains the mark or crease; illustrate the strength of the paper by showing that it will support the weight of several books resting on the sheet, as it is held between the two hands, and also that it does not easily give way when pulled steadily in opposite directions by two children.

Let the children suggest several uses to which they have seen brown paper put—e.g. to wrap up parcels, to cover over objects, to form the covers of books, &c.; explain to them that its stiffness and strength, and the fact that it can readily be bent and folded, render it more or less suitable for these various purposes. Remind them that articles are sometimes wrapped up in two separate sheets of paper, and let them give some reason for this fact.

If there is sufficient time, the teacher might ask the children to give instances of other kinds of paper—e.g. newspaper, wall-paper, blotting paper, tissue paper, &c.—and might just mention briefly some of the uses of these varieties. She might also suggest to the children to obtain specimens of several kinds of paper and to bring them to school on some stated day, when a little time might be spent in comparing them as to smoothness, colour, strength, &c.

LESSON 20.

SIZE AND SHAPE.

Objects required—Several sheets of paper (one small square, one larger square, one oblong, one circular and

one irregularly shaped); pair of scissors; wooden rod (or slate pencil) to break; rule (or strip of paper) to use as a measure.

[Some sheets of paper, by reason of the facility with which they may be cut or torn, afford excellent materials for illustrating lessons on shape and on size; and as a special lesson on these subjects seems to be desirable in a course of lessons which are intended to train and exercise the observing powers, it is introduced in this place. A lesson on FORM occurs in an earlier part of the series, but deals especially with solid forms; whereas the present lesson, so far as it treats of shape, is intended to deal more especially with outlines, and should be fully illustrated by figures drawn on the blackboard.]

Take the two square pieces and show them separately to the class, and let the children state which is the larger; let them also suggest how to verify their statements (e.g. by laying one on the other) and also how to make two pieces of equal size (e.g. by cutting from the larger or pasting on to the smaller.)

Take one of the square pieces, let the children state the number of sides and corners, and then point out the characters of a square—viz. that all the sides are equal in length, and all the corners are similar and of equal size. Show the children the other pieces of paper, one after another, letting them say of each piece whether it is square or not, and give their reasons for so saying. Let them name something in the room which is square, and measure the object to prove whether they are right. Let them explain how your oblong piece of paper might be made square, and fold (or cut) it as they suggest.

In the next place find the centre of the square (where the diagonals cross) and mark it in some way. Show by

measurement that the corners are farther from the centre than the sides are ; mark on the diagonals points at the same distance from the centre of the square as the middle points of the sides. Cut off the corners of the square through these points, making the cuts perpendicular to the diagonals. (The figure produced should be a regular octagon.) Let the children state the number of sides and corners and why the figure is not now to be called a square. Again show them that the corners are still more distant from the centre than the sides are, and cut off the corners all round until you produce a nearly circular figure. The children should then understand that every part of the edge (or circumference) of a circle is at the same distance from the centre ; and that there are no corners in a circle. (Remind them of the fact, illustrated in a former lesson, that bodies without corners roll easily and smoothly, and let them give examples of bodies having a circular outline.)

You might then show the children one or more irregularly shaped pieces of paper, and let the children suggest what figure might best be made from them (square, oblong, circle) with the least waste of paper, and either some one of the children, or the teacher, might mark with a pencil, or fold or cut the paper as suggested.

. . . . . .

The idea of simple aliquot parts might easily be explained by the aid of the circles and squares of paper. Each might be doubled and the attention of the children directed to the fact that they were thus marked into two exactly similar and equal parts, each of which is called a *half* ; and by again doubling the meaning of *quarter* might be illustrated. The experiment might then be repeated by breaking a thin stick or pencil first into halves and then into quarters ; and a strip of paper might be given to a child, with the request that he would tear

off and return one quarter of it. (If the children know anything of the clock face, the folding of the circular piece of paper into halves and quarters would illustrate the half-hour, and quarter-hours respectively.)

When the square or circle has been folded into four parts, the children might be asked to state beforehand what would be the effect of again folding it into half and so on, letting them note that the segments are not only equal in size but also similar in shape.

Note.—It will readily be seen that the subject of the preceding lesson might be very largely extended, and the lesson might probably with advantage be divided into two, if it were fully illustrated as suggested in the notes, and if the children were allowed to imitate the teacher in folding, &c. The triangle as a simple figure might also be introduced and considered.

LESSON 21.

A PIECE OF STRING.

Object required—A piece of string about two feet long and moderately thick.

Introduce the subject by referring to what was said in a previous lesson about the use of paper for wrapping articles in, and let the children suggest some different methods of securing the wrapper, amongst which will be mentioned tying it round with string.

Let the children suggest other uses of string, and give the names applied to very thin (thread) and thick (rope) varieties. Let several of them try to break the piece, first singly and then several pulling together, and ask them how they would describe a piece of string

which would thus resist a considerable force. (They would say it was very strong.) Explain to them that the strength of string (or rope) is one of its most valuable characters, that we tie pieces of string to articles by which to carry them, or to maps and pictures by which to suspend them; also that if we fear the string is scarcely strong enough singly we can use it double, just as paper is sometimes used double.

Then let them state how you might treat the string if too long for your purpose, and how you would proceed if you wished to cut it into two equal parts. First mark on the board the length of the string, and the middle point of that distance, and then cut the string. (It would be well, perhaps, to go over again, by aid of the string, the meaning of the terms *half* and *quarter*, and to show that two halves, or four quarters, make up the whole.) Ask them how you could join these separate pieces of string together again so as to form one piece; and whether the piece so formed would be as long as at first. Tie them together, compare with the distance previously marked on the board, and let the children suggest how the difference has arisen. Let them give the name 'knot,' and let some of them tie one or more knots on the string.

Then go on to consider the structure of the string—cut it up into several small pieces, one of which should be kept by the teacher and the others distributed amongst the children. The teacher might untwist her piece and show that it was made of several thinner pieces twisted together, each of which might be again untwisted and separated into numerous fibres; and these operations might be imitated by the children to whom the pieces of string had been given. Having thus shown that the string is composed of numerous fine threads or fibres twisted together (some of the children might be asked to

count the number of fibres in their piece of string, so far at least as to satisfy them that there is a great number), some of the fibres might be drawn out and broken by pulling, to show that the one strong piece of string is composed of a large number of weak pieces placed together. In this connection the increase of strength gained by doubling the string, as mentioned in the earlier part of the lesson, might be again referred to; and the fact might be still further illustrated, if thought desirable, by means of some thin cotton, which, when single, could be broken easily by the hands, but not when two or more threads were used together.

The teacher might inform the children that the threads of which string is made have been obtained from plants, and that if they take notice they may sometimes see parts of plants which are composed of (or can be separated into) strings or threads—e.g. sticks of rhubarb. When the children's interest in a subject has been aroused, the suggestion on the part of the teacher that there is still more for them to learn in connection with that subject may quicken in them the desire to learn, and prove a beneficial stimulus to their continued progress.

LESSON 22.

WOOL.

Objects required—A handful of clean wool; a piece of flannel; and a small piece of woollen or worsted yarn.

Take up the handful of wool and show the children that you have a substance composed of fibres or threads, similar therefore in that respect to the string examined in the preceding lesson. Let some of them examine the

wool closely to see that it is all composed of such fibres, and let several of them each pull out a single fibre to examine. The children would, perhaps, suggest the similarity of one of the fibres to a fine hair, and the teacher could explain that it was really a soft curly hair. This would lead naturally to a conversation as to whence the wool was obtained, the use it was to the sheep, to the comparison of this covering of the sheep's body generally with the hair which covers and protects the upper part of our heads, and also to the cutting of the long wool off the sheep in much the same way as a child's hair is sometimes cut when it has grown long. Let some of the children take the wool in their hands, and note what a soft warm covering it would make, and explain to them that in the warm weather, when the sheep does not require the wool, men cut it off in order to make nice soft warm clothes for us to wear when the cold weather comes. Promise the children to devote the next lesson to a talk about sheep, and then proceed to consider the wool and its uses more particularly.

Tell the children that wool is usually white, like your specimen, when obtained from the sheep—at any rate, after it has been washed—but that it is made into articles (stockings, scarves, &c.) of various colours. They would readily understand that if you dipped your specimen into red or black ink it would be made red or black, as the case might be, and from that they would probably understand that the wool might be dyed any colour whatever by steeping it in a suitable liquid. (Unless this point about the artificial colouring of wool is made clear, the children will not be so ready to recognise coloured scarves, shawls, &c., as made of wool.)

Then show the children, by experiment, that a single fibre of wool is easily broken, but that (as in the case of string) a number of fibres twisted together are very much

stronger. Show them that the yarn (which they will recognise as being used for making stockings, &c.) is really made of a number of woollen fibres twisted together, by untwisting it and letting them pull out some threads to compare with the unmanufactured wool.

Then show them the flannel, let them name it and say for what it is used, and afterwards let them examine it closely, and endeavour to recognise the fibres of which it is composed. Pull out several pieces of yarn from the flannel, and untwist them, to show that they are composed wholly of fibres. The children might then be told that if they look carefully at blankets, carpets, scarves, shawls, &c., they may usually see many of the woollen threads of which those articles are composed.

Note.—The children would be greatly interested if this lesson were followed by a short account of the washing and shearing of sheep, especially if the teacher could obtain any pictures illustrating those processes.

LESSON 23.

THE SHEEP.

Objects required—Wool (if possible, attached to the skin); a good picture of a sheep.

Briefly recapitulate the lesson on wool, and speak more fully of the use of wool to the sheep. Let the children say if they have observed that certain parts of the sheep's body have little or no wool on them, and name those parts (face and legs), pointing them out on the picture. Speak of the conditions under which the sheep lives, the food on which it lives, why it usually

keeps moving about in the field, and how it rests when it is tired.

Then consider the body of the animal, and let the children give their estimates as to the size of an ordinary sheep. Point out that, like the cat and dog, and unlike ourselves, it uses its four limbs for walking, and contrast its hard, horny-hoofed feet, with the soft feet and clawed toes of the cat and dog. It might also be explained that this difference is connected with a difference in the habits of these animals—that the sheep, feeding as it does upon grass and other vegetable substances, does not require claws for the purpose of seizing its food, as do beasts of prey. The way in which the sheep gathers together a quantity of grass with its tongue and lips, and bites it off with its sharp front teeth, eating away continuously for some time, and then lying down to quietly chew its food, might be briefly described.

The timidity of the sheep and the friskiness of young lambs might be mentioned. The wrong which is often done by children in driving and chasing sheep, and the wickedness of neglecting to provide them with water and food (e.g. when they are being taken on long journeys), should not be forgotten in this connection. (Something might also be said, if time permitted, of the shepherd and his dog.)

The use of the sheep as food should be referred to; and it might be pointed out that we keep some animals for the purpose of doing work, some for the supply of food and clothing, and others for protection and companionship, letting the children give examples of animals which come under each of these heads.

LESSON 24.

THE COW.

Objects required—A good model or picture of a cow; small piece of skin with hair attached (e.g. such as is sometimes used for making slippers); a piece of horn (e.g. a comb made of horn).

Tell the children that in this and the following lesson you wish to speak of other animals which, like the sheep, are very useful to us, and which live in fields and eat grass; let them suggest the names of such animals.

Show them the picture of the cow; ask which of them have ever seen a real cow, and whether it was like the one represented in the picture—note the variety in colour. Then let them compare the cow with the sheep, and suggest the obvious differences (in size, &c.) in a general manner; and afterwards proceed to discuss them in detail.

Compare the covering of the cow with that of the sheep—the short stiff hair of the one with the longer and softer wool of the other—the greater variety in colour, &c. Explain that, although not suited for clothing, the hair is useful in other respects, and that the skin is made into leather. Let them mention some of the uses of leather.

Draw the attention of the children to the horns, and show them by your specimen that horn is a hard strong substance; explain how the horns are useful as a means of defence, and let them name any other animals that they may have seen with horns (some sheep, goats, deer). Some of the useful simple articles that are manufactured from horn might be mentioned.

The hard horny feet of the cow, and its not very thick but strong legs, might be pointed out, and compared with the very similar but smaller ones of the sheep.

The long tail, with its brush of long hairs at the end, and its use in whisking away the flies which torment the cow in hot weather (just as we drive away with our hands the flies which sometimes annoy us by settling on our faces), should also be mentioned.

Reference should be made to the value of the cow as supplying us with valuable food, both while alive and at its death.

Note.—This lesson might be somewhat expanded, and divided into two parts—the first dealing with the general characters of the animal, and the second with the useful substances that we obtain from it.

LESSON 25.

THE HORSE.

Objects required—A good model or picture of a horse; a little horsehair.

[The subject of this lesson is naturally one of great interest to young children, and especially to young boys. If time permitted, it would be an advantage to go over the lesson first in a general way, letting the children state what they know and have observed about horses. The teacher might then put a few questions to them about matters that they seem to have overlooked, in such a manner as to suggest to them material for further observation, with an intimation that she intended having another lesson on the subject in the course of a few days,

on which occasion she would like them to have something to tell her about those matters.]

Compare the horse with the cow as to general form, covering, colour, size, &c. Let the children also point out some of the more obvious differences, such as the possession of a mane (show them some long strong horsehair, and let them know that some other animals possess manes—showing them a picture of a donkey, lion, &c., if necessary).

Refer to the ears of the horse—the use of ears in general—the evidence that a horse hears with its ears—and the wonderful way in which a trained horse not only hears but understands much that is said to it.

Speak of the uses of the horse to man, and tell the children that in countries where there are no horses man takes other animals (e.g. oxen, sheep, &c.) to work for him, but that as a general rule they are not so strong as horses. Speak briefly of the manner in which the horse is guided (referring in this connection to the strings that boys use in playing at horses)—how it is made to go faster or slower—the cruelty with which horses are sometimes treated, and the duty of treating these and other animals with kindness and care. Point out that the horse will feed on grass, but is also fed with other substances, some of which the children could perhaps mention.

Let the children describe one of the feet of the horse, point out that it is not divided as in the case of the cow and sheep, but that it is like one large finger or toe with a strong hoof at the end. Explain that the horse has to travel about a great deal on the hard and often stony roads, and that its hoofs, like our shoes, would wear away very fast. Let the children say what is often put on the bottom of our shoes to prevent them wearing away so fast, and what is done in the case of the horse. Some of

them may have seen the process of shoeing horses, and be able to tell what the shoes are like, what they are made of, and how they are fastened on. (Draw a simple outline of a horseshoe on the board and let the children copy it.)

LESSON 26.

GRASS.

Object required—A grass plant with long distinct leaves and roots. (It would be well to press such a plant, and mount it on a sheet of paper or cardboard for subsequent reference.)

[This lesson and the two lessons immediately following deal with certain of the common plants that grow in the fields, where sheep, cows, and horses live. There may be some difficulty in certain districts, and at certain times of the year, in obtaining specimens to illustrate these lessons —at least in the case of the flowers. The lessons should not, however, be given in the absence of the illustrations; and might, therefore, if necessary, be taken out of the order of the course at a time when specimens could most readily be obtained. It would be well to tell the children a day beforehand what the subject of the lesson was to be, in order that they might have an opportunity of providing themselves with specimens.]

Let the children tell you about the fields in which sheep live, what grows in them, and what use the grass is. Show them your grass plant, and let them point out the part which animals eat. If there is any soil adhering to the specimen, point it out and let the children explain how it came there and how it is attached to the plant

(viz. by the roots). Wash off the soil and show them the roots ; compare them with the leaves, and let the children state what they remember from previous lessons as to the use of the roots of plants.

Then examine the leaves carefully ; let the children describe them (e.g. long, narrow, pointed, green, &c.) and compare them with specimens of other varieties of leaves, such as those of the geranium or other plant which formed the subject of a former lesson. (This point might be illustrated by sketching the outlines of some simple forms of leaves on the board.) Let the children point out the difference between the two sides of the leaves, and note the lines traversing each leaf longitudinally. (These lines might be marked in the drawing on the board if it were done on a fairly large scale.)

Let the children examine the plant to find out the small soft and short stem, and contrast this kind of stem with the stem of an ordinary geranium (or similar plant) and with the stem of a large tree.

Then speak of the cutting and drying of grass in summer to form hay, and of the advantage of providing in time of plenty for the season when food is very scarce. A brief description of the processes of cutting the grass, of haymaking, and of the carrying and stacking of the hay might interest the children.

LESSON 27.

A DAISY.

Object required—One specimen, at least, of a common field-daisy plant with flowers.

[It is very easy to obtain, during the greater part of

the year, plants of the common field-daisy and buttercup, and, as they are very hardy, they may be kept for a long time growing and flowering in a pot or box of soil. They might thus be obtained beforehand and kept until required for the illustration of this lesson. The teacher would find it an advantage if she obtained one or two good specimens of the leaves and flowers of these plants, and pressed and dried them (e.g. between the leaves of a book subjected to considerable pressure), and when dry mounted them on paper or cardboard with a little gum. These mounted specimens would then be available, if necessary, at times when fresh specimens could not be obtained ; but in all cases when possible, fresh specimens should be used for the illustration of the lessons.]

Introduce the subject by means of a few questions about the sheep and its food. Ask the children which of them have been in a field, and whether they have ever seen anything growing amongst the grass. Let them point out the daisies on your specimen, and then call their attention to the fact that there are also certain green parts (leaves) belonging to the plant to which the daisy flowers are attached.

Compare the leaves on the plant with each other, and let the children explain why there are some very much smaller than others. Give a leaf to several children to examine ; let them compare it with the leaves of grass (noting that those of the daisy plant are shorter, broader in most parts, and rounded at the end instead of being pointed). Let them point out the part of the leaf by which it was attached to the plant ; and say which they would consider the front face of the leaf and which the back, pointing out some differences between the two faces by means of which they may readily be distinguished.

(They ought to notice the presence of minute hairs on the back—or under—face of the leaf.) The notched edges of the leaf should also be noted, and the teacher should draw on the board the outline of the leaf.

Then ask the children whether they consider the leaf the prettiest part of the plant, and which part it is that they gather in the fields. Let them describe how they get the flowers, and in what manner they hold them, thus directing their attention to the difference between the stalk and the head of the flower. Ask the children whether all flowers are like the daisy, and how they recognise this particular flower. Then examine the flower, and lead them to distinguish the long white flat pieces round the margin (often beautifully tipped with red), the mass of short yellow structures in the central portion, and the green cup-like structure underneath the white leaves. If there are any flower-buds on the plant, call the attention of the children to them.

The teacher might explain that the flower and the leaves spread themselves out to catch the warm sunshine, that in the ground there are roots drinking up moisture, and that without water and light the daisy could not live. The fact of the flower of the daisy closing up at night, and not opening at all on dull wet days, might be mentioned as something which the children could readily observe.

LESSON 28.

A BUTTERCUP.

Objects required—A growing buttercup plant, with flowers if possible; or dried specimens of the leaves and flowers.

Show the children the specimen, and ask them if it is

a daisy plant, and let them give their reasons for saying it is not. Let them also say if they could distinguish between the two plants in the absence of flowers. Then point out some of the characters which the buttercup has in common with the daisy and grass and most other plants—viz. that it grows on the ground, with roots penetrating the soil, that it spreads out its green leaves to the air and sunshine, and that it will not grow unless it can obtain water and light.

Then let the children compare a green leaf of the buttercup plant with a leaf of the daisy plant, and contrast the comparatively simple outline of the one with the more complex outline of the other. The difference in appearance between the upper and lower surfaces of the leaves should also be described by the children, and the markings on the leaves and the distinct leaf-stalk (of the leaves at the base of the plant) pointed out.

Take next a well-opened flower (and if possible distribute several amongst the children for examination), and note that, as in the daisy, the flower is composed largely of coloured leaves situated at the top of a long stalk. Note the cup formed of the five large yellow petals. (Let the children count the number for themselves.) Pull off one petal and note its form and point of attachment; and direct the children's attention to the difference between the two faces of the petal, contrasting the beautiful glossy inner face with the duller and paler outer face. There is a small scale at the base of the petals of the ordinary varieties of buttercup, which the children should have no difficulty in observing and pointing out. They might also be asked to give some explanation of the name of the flower.

The parts of the flower within the cup need not be particularised, unless it should happen that on the plant under examination there is an old flower-head from

which all the coloured leaves have fallen off, leaving only the green cluster of fruits (containing the seeds), in which case the same part might be pointed out at the bottom of the cup of a perfect flower.

The five small leaves (sepals) outside the petals should then be noticed (they may have fallen off from the older flowers), and also the position in which they stand—viz. opposite the spaces between the several petals.

If there are flower-buds on the plant, one should be examined and opened, to see how the inner parts of the flower are folded together and enclosed by the sepals.

[The teacher might draw on the board, as the lesson proceeds, an outline of a leaf, of a petal, and also a plan of the five petals in their natural position. The terms petal and sepal need not necessarily be used in speaking to the children, but are used in the notes for convenience.]

Note.—If the children are interested in these lessons about flowers, one or two additional lessons on other simple and familiar flowers might be given—e.g. on a primrose, violet, tulip, &c.

LESSON 29.

THE HONEY-BEE.

Objects required—To illustrate this lesson as it ought to be illustrated, the teacher should obtain a specimen of a bee, dead and pinned out on a piece of cork. Such a specimen could readily be prepared by the teacher, or obtained from any naturalist. Failing this, a good picture of a bee must be used. A specimen of honey and a piece of the honeycomb should also be shown.

The subject of the lesson might be introduced by means of a little conversation about the flowers described in the preceding lessons, and the visits of bees and other insects to flowers. Ask the children which of them have seen a bee come to a flower—how it came, what it did (e.g. put its head into the cup or hollow of the flower), and also ascertain if they know the object of the bee in visiting the flower.

Show the children your specimen of honey, and let several of them taste a small quantity of it, if they have not previously tasted honey; then lead them by a few questions to recognise honey as a variety of sugar. (Long before cane sugar was brought to this country, honey was used for the purpose of sweetening food.) Explain to the children how there is in many flowers, often at the base of the cup or tube, a little sweet syrup (honey), which the bees collect on their visits to the flowers, and which they carry off to their homes to serve as food. (The bees also collect pollen—the fine powder which frequently adheres to the finger on touching the stamens of a flower; but it would probably be best in this lesson to confine the attention of the children to the honey.)

Some of the children may have seen a bee-hive, and may be able to give a simple description of it; the teacher might make a sketch of one on the board. The children would be interested in a description of the busy lives which the bees lead in summer in flying backwards and forwards between the hives and flowers and bringing in their loads of honey. If the teacher has a specimen of the comb, she might then show it to the children, and explain that the little cups or cells were made by the bees (of bees' wax), and were many of them intended to hold the honey. (These cells might be compared to the pots or jars in which we keep honey, jam, &c.)

Then the specimen (or picture) of the insect itself

should be examined, and the most readily recognised structures pointed out by the children—e.g. the body of the insect, with its three well-marked divisions, the delicate wings, and the three pairs of legs attached to the middle division of the body. The feelers (or antennæ) on the head would be noticed, and the very large eyes might readily be observed. The fine hairs covering the whole body, and those on the legs, should be pointed out. (It would be well for the teacher to make a very simple sketch on the board of the bee with its outstretched wings and feet, and encourage the children to attempt to copy it.)

The children should be led to contrast the bee with a bird, and especially the wings of the bee with the wings of a bird. The movement of the wings in flying might be illustrated, and the children reminded of the humming sound produced during the flight.

In conclusion, it would be well to caution the children against interfering with bees, on account of their stings. And they might be told that there is very much more to learn, as they grow older, about bees and the manner in which they live.

LESSON 30.

A BUTTERFLY.

Objects required—A common variety of butterfly, prepared as in the case of the bee in the last lesson ; or, if possible, two specimens, one prepared with the wings extended horizontally as in flight, the other with the wings folded together vertically, as in a position of rest.

Many of the children would probably have seen a common butterfly, and would recognise the specimen

shown them. When they have done so, they might be questioned to ascertain what they have observed of the habits of the butterfly. They may have seen it fly from flower to flower, and can suggest its object in so doing; but the teacher should explain that the butterfly differs from the bee in living solitary and not in communities, and also in not storing up food against the winter, before which time indeed the insect dies.

Then let the children compare the butterfly with the bee, and note that the general form of the body is the same, but that the body is not so broad; that it carries a pair of feelers (antennæ) on the head and three pairs of legs underneath. Let them compare the large coloured powdery wings of the butterfly with the smaller and gauze-like wings of the bee. The beautiful colours of the wings of some butterflies should be mentioned, and, if possible, illustrated by specimens or pictures.

The eyes of the insect may be seen on its head, and its power of sight proved by the manner in which it avoids obstacles, &c., in its flight, and distinguishes the flowers from which it obtains the honey on which it feeds.

The careless and seemingly aimless manner of life of the butterfly might be contrasted with the active and energetic life of the bee; and the defenceless character of the one insect with the power of the other to defend itself by means of its sting.

The season of the year when butterflies are to be seen should be spoken of, and the children led to connect the presence of butterflies and the activity of bees in the spring and summer with the occurrence of flowers in those seasons.

Note.—A lesson on the common house-fly might appropriately be given in connection with these lessons on insects.

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