## THE YOUNG CHEMIST.

IT follows, as a necessary consequence of the manner in which it was proposed to treat the subject of Chemistry in the last paper, viz., by analysis, that to be consistent the beginning must be with some process of such simplicity, that the principles on which its operation is effected shall be obvious to all persons. Let the student, then, be assured that, by doing exactly as he is told, and working out the various analyses which will be furnished him, he will lay the foundation of sound chemical knowledge.

Analysis means a loosening or separation of parts, and is the reverse of synthesis, which means the combination of parts into a compound. To accomplish analysis, chemists have recourse either to *solution* or *fusion*,—the former being more frequently employed; and water being invariably used whenever it is capable of dissolving the substance to be analysed. If water fail, recourse is had to alcohol, ether, acids, alkaline leys, &c.

### Lesson I.

#### A MIXTURE OF SALT AND SUGAR BEING GIVEN—TO SEPARATE THEM.

*Materials Required to Perform this Experiment.*—Some teacups or tumblers; some glass rods; a few strips of window-glass, the thinner the better, 4 inches by ½ an inch; a glass retort; a spirit lamp; a saucepan; a saucer; some alcohol.

Take of sugar finely powdered and salt, as much of each as will lie on a ten cent piece, and mix intimately; the foregoing quantity will be sufficient,—the great fault with young chemists being, their operating on too large a quantity, which not only embarrasses them, but is also too expensive.

It is evident that water cannot be used to separate the salt from the sugar, as both are equally soluble in it; therefore, some solvent must be procured that will *act only on one ingredient:* this solvent is alcohol (high wines), which dissolves sugar, but will not dissolve salt.

Put the alcohol into a retort, and apply heat from the spirit lamp until it boils. Take care to apply the flame of the lamp gradually; and also see that the wick of the spirit-lamp does not touch the glass retort. Pour the alcohol, whilst hot, on the mixture of salt and sugar in a cup or tumbler: stir well together: allow it to settle, and then pour off the clear part. Repeat this operation until a portion of the liquor dropped upon a glass slip evaporates without leaving any stain. It will be found that the alcohol has dissolved out the sugar, leaving the salt behind. Evaporate the alcoholic solution of the sugar by means of a steam-bath, in the following manner:—Take a saucepan; and having put some water into it, cause the water to boil. Put the solution into a saucer, and place the saucer on the mouth of the saucepan,—the escaping steam will cause the alcohol to evaporate, and the sugar will be found adhering to the saucer. A stronger heat would act injuriously on the sugar.

### Lesson II.

#### A MIXTURE OF SALT AND STARCH BEING GIVEN—TO SEPARATE THEM.

*Apparatus and Materials Required.*—Some nitric acid (about ½ an oz.) in a stoppered bottle; two test-tubes; some slop-basins; a tea-saucer; some distilled water; a solution of nitrate of silver, 10 grains to the fluid oz. of distilled water, in a GLASS stoppered bottle; some ammonia in a stoppered bottle.

Having made a mixture, as before, only that the student may take about as much of each as will lie on a quarter dollar, proceed thus:—

Add cold distilled water to the mixture in a tumbler, and agitate well; allow it to stand; then pour off the clear supernatant liquor, and repeat the washing. That it may be known when all the salt is dissolved out, take a slip of window-glass *absolutely clean*, drop on it some of the last washing. Take a glass rod, moisten its end with a little nitrate of silver solution, and plunge it into the bead of water on the slip. If all the salt has been dissolved out by the first washing, no change will appear in the drop on the slip; but if some salt still remains, a peculiar white curdiness will be seen. Continue to add cold distilled water to the mixture as before, until a drop of fluid coming from the tumbler no longer produces a white cloudiness with nitrate of silver. Take the basin containing the solution of salt, put it in a hot oven, covering it loosely with paper to prevent the access of dust. Allow all the water to evaporate, when the salt will be found attached to the sides of the basin, crystallised. Hence, the starch remaining in the tumbler, *cold water* not acting on it, and the salt remaining in the basin, these two substances have been separated.

It was assumed that the cups, glasses, &c., in the preceding experiments were all perfectly clean. They are now no longer so, and must be made clean before using again. Absolute lustrous cleanliness cannot be impressed too strongly on the young chemist; and wanting this, persons never succeed as chemists. The test nitrate of silver is so delicate, that it is capable of indicating the presence of a grain of common salt diffused through a hogshead of water. The following experiment will suffice to make evident this assertion. Nitrate of silver produces no whiteness with pure distilled water. Add a drop to some distilled water, and observe that there is no change in the water. Now pour a tablespoonful of the distilled water over the arm several times, collecting it in a dish as it flows off. By this means the water will have dissolved off any soluble matter in the skin, of which matters common salt is one. Test the water so employed now, with a drop or two of the nitrate of silver, and the same white curdy appearance will be observed. After duly weighing this experiment, there will be no marvel at the importance chemists attach to perfect cleanliness in the vessels used. This white curdy appearance, the result of touching common salt with nitrate of silver, is a compound of silver with chlorine, and therefore termed *chloride of silver*. The chemical name for common salt is chloride of sodium—a compound of chlorine and the metal sodium, the rust or oxide of which metal is the caustic soda sold by druggists, not the carbonate of soda. Nitrate of silver is silver combined with nitric acid, and on adding the nitrate of silver to the common salt, the chlorine of the salt leaves it and combines with the silver, setting the nitric acid free, which combines with the soda; so that we have two new compounds, chloride of silver, the white curdy precipitate already met with, and nitrate of soda, which remains in solution. Take some of this white curdy precipitate, chloride of silver, put in into a test-tube) and add water; agitate, and remark that the white mass is quite insoluble in water, hot or cold: pour off the water, allowing the chloride of silver to remain at the bottom. Add a little nitric acid,—the chloride still is insoluble. Twist a bit of paper around the test-tube so as to form a handle, and apply the heat of the spirit-lamp; still the chloride remains insoluble; in point of fact, no acid will dissolve it. Take another test-tube, place a little of the chloride in it, and half fill the tube with distilled water; pour in a few drops of ammonia, and immediately it will be found the chloride dissolves. A number of important facts will be impressed on the mind of the young chemist from the foregoing experiments.

1st. That alcohol dissolves sugar, but not salt.

2nd. That starch is insoluble in *cold* water.

3rd. That neither hot nor cold water will dissolve chloride of silver.

4th. That nitric acid will not dissolve chloride of silver.

5th. That ammonia dissolves chloride of silver.

And, lastly, That nitrate of silver is a test for chlorine, throwing down a white curdy precipitate.

To cleanse the apparatus in the foregoing experiments, it is evident those vessels which contain the sugar or salt may be cleansed by water, the final rinsing being performed by distilled water, while the vessels which contained the chloride of silver must be cleaned by a solution of ammonia,—the final washing in every case being performed by distilled water. As for the starch, we have a few words for it in the next paper.

J. W. F.

NOTE.—The chemicals, &c., required for the above experiments may be procured at any druggist's establishment.

## PASTIMES.

### BACKGAMMON.

As a game of mingled chance and skill, Backgammon has always been a favourite. Its lineage is highly respectable; for the ancient game of "Tables," played by our Saxon ancestors, is almost identical with it. Antiquarians say that the name is derived from two Saxon words—*bæic* or *bac*, and *gamen* the "back-game," because the whole theory of the game consists in the players bringing their men back from the antagonists' table into their own; or because the pieces are taken up and obliged to go back, that is re-enter at the table they come from.

Backgammon is played by two persons on a board divided in the centre, and marked in divisions, called "tables." Each of these tables has six points alternately black and white, or blue and red. Thus there are in all twenty-four points, twelve on each side. These points are numbered on each side from one to twelve; and in play the French equivalents for our numbers are usually employed.

Most folding draught-boards have their interiors arranged for Backgammon; but a sheet of cardboard, with the points drawn, will serve equally well. The *instruments* with which the game is played are—first, the board, then fifteen draughtsmen for each player, and lastly a dice-box and two dice. The motive and object of the game is to bear or carry off your own men from your adversary's tables into your own inner table—technically called "bringing them home"—and thence removing them from the table. He who first succeeds in "bearing" or moving his men off the board wins the game. This is done by the throwing of two dice alternately by each player, and according to the number of pips on the face of the dice so thrown, he men are moved from point to point.

In the first place you must *set the board*. The players have each fifteen men, which are thus placed: two on your adversary's ace point on his inner table; five upon the sixth point of his outer table; five upon the sixth point of your own inner table, and three upon the outer cinque point of your outer table. The pieces or men are placed in precisely corresponding positions on each side of the board.

#### TECHNICAL TERMS.

To properly play Backgammon, you must acquaint yourself with its various *technical terms*. As already stated, French words are used for most of the numbers—*ace* for one, *deux* for two, (*trois* or *tray*) for three, *quatre* for four, *cinque* for five, and *six* for six.

*Backgammon.* The entire game won.

*Bearing your Men* Removing them from the table.

*Bar.* The division between the tables.

*Bar-point.* The point next the bar.

*Blot.* A single man upon a point.

*Doublets* Two dice of like value, as when two aces, fours, &c., are thrown face upward.

*Getting home.* The bringing your men from your adversary's tables into your own.

*Gammon.* The winning of two points out of the three which constitute the game.

*Hit.* The removing of all your men before your opponent has succeeded in doing so.

*Home.* The players' inner table.

*Making Points.* The winning of hits.

*Men.* The pieces or draughts used in the game.

*To enter.* The placing of a man again on the board after he has been excluded by the point being already occupied.

#### HOW TO PLAY.

The first move is determined by the throw of a single die, the highest thrower commencing. The points on the board are counted from one to six in each of the four compartments respectively, each player commencing from the point on the table opposite to him.

The game then goes on. The player may adopt and play the point and number of the preliminary throw; but if he do not then he throws out both dice, and according to the number of pips shown on the dice, he moves two of his men farther on; or he may move a single man to a point indicated by the pips on the second die The move is always made in one direction—from your adversary's inner table, over the bar, through his outer table.

The first player's move completed, his opponent throws, and moves his men in a similar manner, and so on alternately till the game is won by the men of one or the other side being all removed from their board. If there is but one man on a point, the opposite party may play one or more of his men on that point, having previously taken his opponent's man; the latter must then be entered on some one of the points of the adversary's inner table, before its owner can continue his game. The more points the adversary has closed in this inner table, the fewer the throws of the dice which will enable the man that has been taken to enter.

Double aces count four, and enable the player (say white) to move two men from 8 white to 7 white, and two from 6 white to 5 white, which covers the bar-point (seven), and also covers the cinque point in your inner table. Suppose your next throw to be five and six, you would play the five from 12 black to 8 white, and so cover the blot before left, and you would likewise play the six from 12 black to your bar-point. Pairs always count double. Double sixes, therefore, enable you to move four men, each one six points forward. You may either move four together (say from 12 black to 7 white) or two together, as, say, 2 from 1 black to your adversary's par-point (7), and two from 12 black to 7 white, your own bar point. Or you may move the men singly—a man from 1 black to 1 white in your own inner table, presuming that your opponent had left that point open.

We might go on with a number of illustrations of the method of playing Backgammon: but they would probably rather bewilder than assist the amateur. We therefore content ourselves with a few bits of necessary advice.

Do not crowd your game by placing too many men on the deux or trois points on your own table, as by that means you lose those men by not having them to play. Make a few blots occasionally, as the chances are they will not be hit. Two of your opponent's men in your table are better for a hit than any greater number. Always endeavour to prevent your adversary from bearing his men to advantage when you are trying to serve a gammon.

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A DOCTOR OF DIVINITY.—"I am attending a lady who is a perfect goddess of beauty," remarked Dr. Snobbs to Dr. Hobbs. "Then," said Hobbs, who was clever at repartee, "you are no longer a medico, but a Doctor of Divinity."