PRIMARY

MATHEMATICS KIT

INSTRUCTION MANUAL

CHINA EDUCATIONAL INSTRUMENT & EQUIPMENT CORP.

INTRODUCTION

: Primary mathematics kit is designed for schools grade 1-6,with a shortage of teaching aids which locate at rural and remote areas. The kits, consisting of mathematics teaching aids, were designed to meet the needs of mathematics teaching activities in primary schools based on the curriculum and textbooks.

The primary mathematics kit consists of 23 items and is mainly for teachers' demonstrations also can be used for student activities. since only one item is supplied for each type of teaching aids.

Primary mathematics kit is characterized by motivating pupils to learn mathematics through their own activities and to develop their abilities of observing, thinking and analyzing in the mathematics activities. The more items should be required individually if the teaching aids, such as, counting sticks, color cubes and etc., are used for pupils to do hand-on group activities based on the numbers of pupils in the classroom.

Some consumable materials, such as, paper and etc. are not included in the kit and those can be easily obtained locally.

List of Primary Mathematics Teaching kit

Series No	Descriptions	Specifications	Qunatyty
1	Protractor	0°-180°	piece
2	Horizontal abacus	2 rows , plastic bead	unit
3	Vertical abacus	5 columns, for demonstrations	unit
4	Square sets, triangle	60°,45° for each	set
5	Compasses		piece
6	Geographic board	335×535(mm)	5 piece
7	Oral practice unit		set
8	Angel demonstrator	0°-360°	each
9	Cubics	5 colors ,1000 piece, plastic	set
10	Counting rod	5 colors ,100 piece, plastic	5 set
11	Clock model	3 hands, Plastic	unit
12	Volume unit demonstrator	1 dm^3, 4 pieces	2 set
13	Volume and surface area demonstrator for cylinder	Φ100×150(mm)	set
14	Cone volume set	Φ100×150(mm)	set
15	Geometry set	5 piece, plastic	set
16	Relations between surface area and length for rectangular	140×100×60(mm)	set
17	Circular areas and diameter demonstrator	Φ200mm、Φ100mm	set
18	Capacity unit demonstrator	100ml, transparent	unit
19	Fraction kit	1/1-1/6, plastic	set
20	Geometry figures		set
21	Geometry figure making cards	4 sheets	set
22	Wooden box		each

PROTRACTOR

Specifications: 0-180° , with a handle, plastics,

Usages: To measure an angle in degrees and make an angle

Activities and notes:

1. Measuring the angle

Put a protractor along with a side of the angle and mark the other side of the angle on the protractor and it is showed the degree of the angle.

2. Drawing an angle

Put a protractor on the blackboard along with a line and mark a point in expected degree with the protractor. Connect the zero point with the marked point and draw the line. You can get the angle in the expected degree.

HORIZONTAL ABACUS

Specifications: Two rows of plastic beads with a wooden frame.

Usages: To learn the number, addition and subtraction within 20

Activities and notes:

1. Learn the number within 10

Put the abacus on the desk or hanging the abacus on the blackboard. Take 6 beads on the first row and count the beads one by one from 1 to 5 .The teacher asks how many beads are there on the first row , then add one bead asks how many beads are the totals ? The teacher writes down a " 6 "on the blackboard. The children know 6 is one more than 5 as shown as Fig.1.

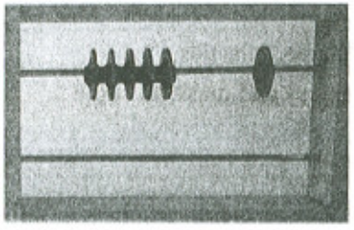


Fig.1

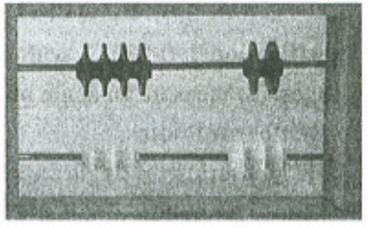


Fig.2

Also teacher can show the compose and decompose of 6. Teacher can ask how many ways can 6 be divided into two parts ? Ask children to do as follows as shown in Fig. 2:

i) Count 6 beads in one row and move 1 bead from the right to left, it is shown that 6 can be divided into 1 and 5 (5 and 1);

ii) Count 6 beads in one row and move 2 beads from the right to left, it is shown that 6 can be divided into 2 and 4 (4 and 2);

iii) Count 6 beads in one row and move 3 beads from the right to left, it is shown that 6 can be divided into 3 and 3.

2. Learn addition and subtraction within 20

The horizontal abacus is also a useful aid for children to learn addition and subtraction.

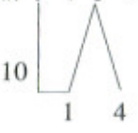
i) Addition and subtraction with number 8

Move 3 beads to left in the first row then move other 5 beads. It is shown 3 + 5 = 8;

Move 8 beads to left in the 2 nd row first, then move 5 beads to the right from the 8 beads. It is shown 8 – 3 = 5.

ii) Addition in carry and subtraction in abdication

a) Take 9 beads in the 1 st row and take 5 beads in 2 nd row .Ask pupils can 9 and 1 make a 10, therefore, move 1 bead from 5 to the right in 2nd row and move 1 bead from the right to the left to make up a 10 beads in 1st row. Total beads in two rows are 14 beads, it is expressed that 9 + 5 = 14



b) Take 10 beads in the 1st row and take 4 beads in 2nd now. Ask pupils move 9 beads to the right in 1st row and 1 bead left, therefore, total beads in two rows are 5 beads left, it is expressed that 14 — 9 = 5

VERTICAL ABACUS

Specifications: Five columns, nine beads in each column

Usages:

1.To show numbers up to one thousand.

2.To show the decimals and the relations between the places.

Activities and notes:

To show the decimals and the relations between the places.

1.Learn place value and the numbers from 1 to ten thousands

i) Show place value

Each column in the vertical abacus can be used for place value. From the right sides, 1st column is as a unit place, N beads in this column express N x 1 ; 2nd column is as a ten place, N beads in this column express N x 10; 3rd column is as a hundred place, N beads in this column express N x 100; ……

Also it can be shown in ten place column, 1 bead stands for a ten and 10 beads stand for 10 x 10 = 100; in the hundred place column,1 bead stands for a hundred and 10 beads stand for 10 x 100 = 1000,……

ii) Learn the numbers from 1 to ten thousands

The teacher moves one bead in the hundred column, two beads in the ten column and six beads in the unit column, it expresses 126, as shown as Fig. 3.

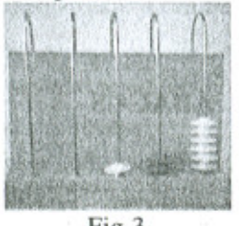


Fig.3

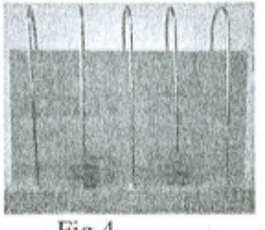


Fig.4

The teacher moves 3 beads in the thousand column and 3 beads in the ten column, there are no beads on the hundred column and on the unit column. It expresses 3030.

Ask pupils to write down 3030 and understand "0" expressing the column on which there are no beads. as shown as Fig. 4.

2. Show the decimals

Define the first column from the left side as the unit place column and make a spot in the column on the right side of unit place column as the decimal point. The column in order to the right will be decimated unit, percent unit and milli-unit in the vertical abacus.

Show a decimal by moving beads on the vertical abacus and explain the relation between the places.

SQUARE SETS , TRIANGLE

Specifications: Square Sets, triangle includes two triangles one triangle with 90° , 60° ,30° and another triangle with 90° ,45° , 45°

Usages:

1.To learn a special angles, such as 90° , 60° ,45° , 30° .

2. Draw lines and figures with the square sets, such as a straight line, a perpendicular line, a pair of parallel lines, an angle, and other geometric figures.

Activities and notes:

1.Draw a straight line with set square.

Put a piece of triangle set on the black board, draw a straight line along a side of the triangle set.

2.Draw a perpendicular line and a pair of parallel lines

i) Put a piece of triangle set on the black board, draw a straight

line along a side of the triangle set and put a right angle side of triangle set along the straight line and become a perpendicular with the straight line, make a line along the right angle side of triangle set. As shown as Fig.5.

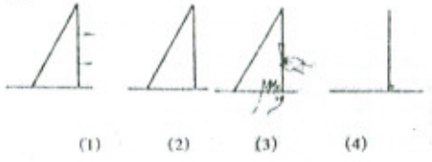


Fig.5

ii) Put a piece of triangle becoming perpendicular to another piece of triangle set on the black board. Draw a straight line along a right angle side of the triangle set and move this triangle set keeping perpendicular to another piece of triangle set, draw a straight line. Two straight lines become a pair of parallel lines.

3. Examine a right angle with set square.

COMPASSES

Specifications: The legs are with 36 cm in length.

Usages: To draw a circle or a curve .

Activities and notes:

Locate the point as the center of circle and stick the point the center. Draw a circle.

A sector of the circle can also be drawn in the similar way.

GEOGRAPHIC BOARD

Specifications: The wooden board is with size of 335 x 535 cm.

Usages: To learn different geometric figures on the geographic pin board with the rubber band; Calculate the areas and of the figures

Activities and notes:

1. Learn geographic figures

i) Rectangles and squares

The teacher make a rectangle and a square on the geographic pin board with rubber bands. Ask pupils how many sides/ angles in one rectangle/ square ? Tell pupils that a figure composing of 4 sides can be called as a quadrangle. Ask pupils to measure each angle of the rectangle/square. Questions: what pupils find out?

Notes: All angles in rectangles /squares are right angles. The two sides (face to face) in rectangles are equal and all sides in squares are equal.

Ask pupils practice to make rectangles /squares to know features.

ii) Parallelogram

The teacher makes a parallelogram on the pin board with rubber bands. The figure have 4 sides, but is not a rectangle /square, it is a parallelogram as shown as Fig.6.

Then ask pupils to observe the features in the angles/ and sides in a parallelogram.

Notes: The sides (face to face) of the parallelogram are equal but angles are not a right angles like a rectangle.

On the pin board, it is shown that the distance between the sides (face to face) keep a constant, therefore the sides are parallel. The quadrangles with parallel sides are called as the parallelogram.

Ask pupils to practice in making parallelograms

Questions: Can the figure as shown as Fig.7 be as a parallelogram? Why? How it can be changed into a parallelogram?

Fig.6

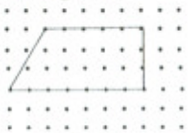


Fig.7

2. Calculate the perimeters of the figures

i) The concepts of perimeter and the calculation of the perimeters in a square

As shown as Fig.8, Let pupils to make a triangle with a right angle by threads and to measure the length of each side in the triangle. How long threads can be used in the triangle? How the perimeters of the triangle can be calculated?

The teacher guides pupils to calculate the perimeters of the square. The perimeters of the square are 4 sides of the square.

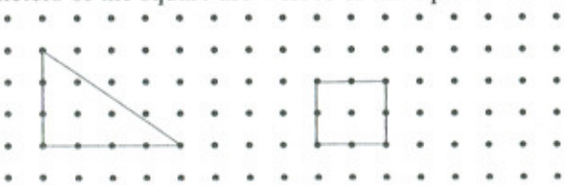


Fig.8

ii) The calculation of the perimeters in a rectangle

As shown as Fig. 9, let pupils to make a rectangle on the pin board and explain both of the sides of rectangle are length and width of the rectangle. Then, ask pupils to measure the length and width.

Notes: the perimeter of a rectangle = (length and width) x 2.

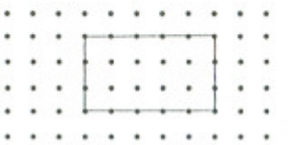


Fig.9

Pupils can make other figures as shown as Fig.10 and calculate the perimeters of those figures.

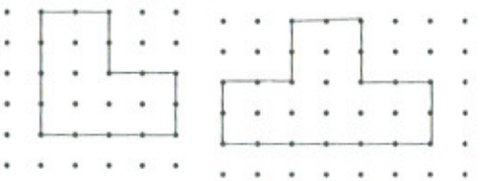


Fig10

3. The calculation of the areas in a figure

On the pin board, there are marked squares (1 cm^2 in a square), which can be used for calculating the areas of the figures.

Let pupils make a rectangle with length of 5 cm and width of 3 cm as shown as Fig. 11 and count how many marked squares (1 cm^2) takes in the rectangle? (15 squares) Therefore, the areas of the rectangle are 15 cm^2.

Also measure the length and the width of the rectangle and calculate the areas of the rectangle. The formula for the calculation of the areas in a rectangle is length x width.

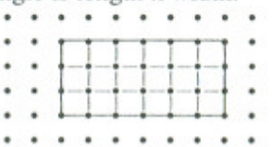


Fig.11

The geographic pin board also can be used for calculating the

areas of other figures. Make a figure with rubber band as shown as Fig. 12 (a). And guide pupils to calculate the areas. Let pupils to add a line with a red rubber band as shown as Fig.12 (b), (c), (d) (e), The areas of the figure can be calculated .

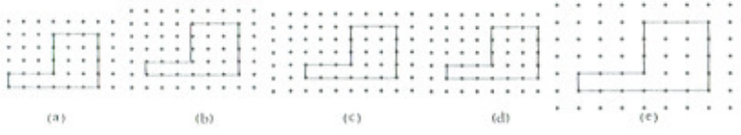


Fig12

ORAL PRACTICE UNIT

Specifications: The oral practice unit consists of demonstration board and cards which include number cards and sign ("+", "—" "×") cards.

Usages: To learn additions, subtraction, multiplication and compare the numbers .

Activities and notes:

Insert the sing cards on the demonstration board and rotate the sign wheel, then ask pupils to practice. Such as:

9 + 7 = ? 9 − 7 = ? 7 x 6 = ?

13 + ? = 17 11 − = 3 5 x ? = 15

Also the teacher can put the numbers on the demonstration board and ask pupils to compare numbers, for instance, which is larger between 7and 8 ? Which is smaller between 12 and 15?

Notes: The cards will be placed in orders and at a dry place.

ANGLE DEMONSTRATOR

Specifications: The angle demonstrator consists of a pair of plastic pieces and can make a movable angle.

Usages: Learn different types of angles.

Activities and notes:

1. Learn angles

The pupils begin to learn angles from a set square, a clock and etc. The angle demonstrator can be easy to show different angles and help pupils to learn angles.Make different angles with a angle demonstrator as shown as Fig. 13

2. Learn different types of angles

The angle can be thought as a piece of line rotating along its end point. A piece of line OA rotates along its end point O, with the direction of reverse clockwise , stops at the position OA' . It becomes an angle and angles can divided into different angles, such as, right angles, straight angles, perigons, acute angles, obtuse angles, etc. As shown as Fig.14.

Fig.13

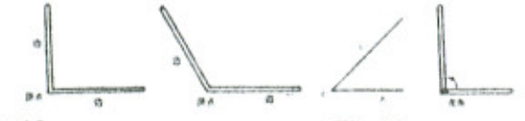


Fig.14

i) Learn right angles, straight angles, and perigons

Put the angle demonstrator on the black board and make a 1/4 circle, it becomes a 90° angle. Then let pupils measure the angle with a set square and find it is a right angle. Continue to rotate and

make a straight angle. It is a 180° angle, as shown as Fig.15. Then continue to rotate and it becomes a 360° angle. It is a perigon as shown as Fig.15

The teacher can ask what is the relationship among perigons, straight angles and right angles? Answer is that a perigon consists of two straight angles or of four right angles.

ii) Learn acute angles, obtuse angles

At first, make a right angle with the angle demonstrator, then, move one side in the direction of clockwise hand moving and the angle is less than a right angle. The angle is less than 90° is an acute angle. As shown as in Fig. 16.

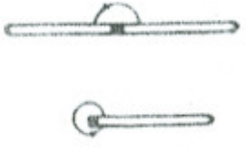


Fig.15

Return to the right angle then move one side in the direction of reverse clockwise and the angle is larger than a right angle. The angle is larger than 90° is an obtuse angle. As shown as in Fig. 17.

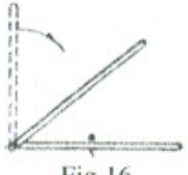


Fig.16

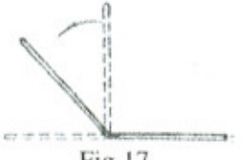


Fig.17

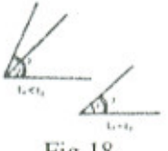


Fig.18

iii) Compare angles

The angles can be compared with each other by using the angle demonstrator. At first, fix one side of the movable angle then move another side to make different angles. As shown as Fig. 18.

CUBICS

Specifications: 1000 cubes in 5 colors, with each side of 1 cm, mass of 1 gram, a pin in one side and a slot in other five sides for connection with each other.

Usages: The cubes can be used in many purposes of counting, calculation, sorting, measuring, and probability. The cubes can be linked in three dimensions.

Activities and notes:

1. Learn to count

Take cubes and ask pupils to count one by one. 1, 2, 3, ……98, 99, 100, as shown as Fig.19

Fig. 19

Fig.20

2. Learn to place value

Take five different color cubes and blue one is unit place, red one is ten place, green one is hundred place, yellow one is thousand place. The teacher can ask pupils to take different color cubes to learn numbers, such as , 15, 105, 236, 8079 as Fig. 20.

make a straight angle. It is a 180° angle, as shown as Fig.15. Then continue to rotate and it becomes a 360° angle. It is a perigon as shown as Fig.15

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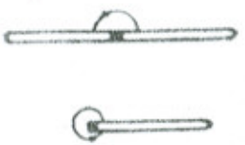

Fig.15

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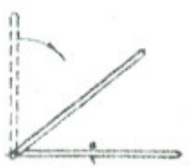


Fig.16

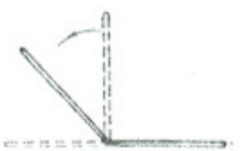
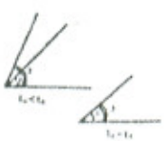


Fig.17



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Activities and notes:

1. Learn to count

Take cubes and ask pupils to count one by one. 1, 2, 3, ……98, 99, 100, as shown as Fig.19

Fig. 19

Fig.20

2. Learn to place value

Take five different color cubes and blue one is unit place, red one is ten place, green one is hundred place, yellow one is thousand place. The teacher can ask pupils to take different color cubes to learn numbers, such as , 15, 105, 236, 8079 as Fig. 20.

3. Learn to calculations

i) 9 + 5 = ?

Ask pupils to take nine blue cubes, then other five blue cubes, ask pupils how many cubic are totals ?

ii) 20 − 5 = ?

Ask pupils to take 20 green cubes, then take off five cubes, ask pupils how many cubic are ?

iii) 5 x 3 = ?

Ask pupils to place 3 row of yellow cubes and five cubes in each row, then ask pupils how many cubic are totals ?

iv) 12 ÷ 4 = ?

Ask pupils to take 12 blue cubes, then make 4 parts. Ask pupils how many cubic are in each part ?

4. Learn to sort

Ask pupils to take cubes at random then put same color cubes together and the teacher can ask pupils how many cubes in each color ?

5. Learn to measuring in length, in area, in volume

Cubes is 1 cm in length and can be linked together to make a ruler which can be used for measuring a length. Also can be linked together in plane, which can be used for measuring or calculating areas, as well as cubes can used for measuring volumes. Link 1000 cubes in three dimensions, it becomes one dm^3 cube, as shown as Fig.21

Fig. 21

6. Learn the concept of probability

Put cubes (five different colors) in a pocket and let pupils to take some tubes from the pocket, then, ask pupils what color cubes can be taken ? Do activities again and discuss probabilities.

Exploring orderliness

Example : Ask pupils take cubes in the order of 3 red cubes, 2 yellow ones, 1 green one, what color is the 16^{th} cubes?

7. Learn to make geographic figures

The cubes also can be used for helping pupils to make different geographic figure in three dimensions and establish the concepts in three dimensions

Ask pupils to make a rectangle consisting of 4 cubes and find how many rectangles and squares in six surfaces.

Ask pupils to make a rectangle (or a square) by 8 cubes and find how many rectangles and squares in six surfaces.

COUNTING ROD

Specifications: 100 rods in 5 colors, with Φ 4 x 100 mm, plastics

Usages:

1.Learn numbers and calculations up to 100;

2.To compare different numbers

Activities and notes:

1.Learn numbers up to 100

i) Take 20 rods in same color and count from 1 up to 20. For example: The teacher ask pupils to make a pentagon by 5 rods as shown as Fig. 22, then ask pupils to count. Questions: how many rods are there in this figure?.

Fig. 22

Fig.23

ii) Ask pupils to make a bundle of 10 rods and continue to count 11, 12 ····· 20, then make a 2nd bundle of 10 rods. Pupils know one bundle is 10 and two bundles are 20. Then, let pupils to take a bundle and 3 rods as shown as Fig.23, pupils learn it is 13.

2. Learn to calculate up to 100

i) For Example: 9 + 3 = ? Ask pupils to place 9 green rods on the left and 3 red rods on the right, how many are in totals. The teacher guide pupils to divide 3 into 1 and first 2, then make a ten (9 + 1), 10 + 2 = 12.

ii) For example: 20 +30 =? Ask pupils to place 2 bundles of green rods (each bundle consists of 10 rods) on the left and 3 bundle of red rods (each bundle consists of 10 rods) on the right, how many are in totals. 20 rods (in 2 bundles) and 30 rods (in 3 bundles), total is 5 bundles (50 rods), there are 20 + 30 = 50, as shown as Fig. 24.

Fig. 24

iii) Addition in carry

For example: 34 +28 =? Let pupils to understand that the unit place can make one into the ten place. Pupils put 3 bundles (1bundle consists of 10 rods) rods and 4 rods. Then, put 2 bundles (1bundle consists of 10 rods) rods and 8 rods. 8 rods and 4 rod can make 1 bundle (10 rods) and 2 rods. It is in carry, therefore 3 bundles + 2 bundles + 1 bundle = 6 bundles, it is 6 tens, total is 62. as shown as Fig. 25.

Fig. 25

Fig. 26

iv) Subtraction in abdication

For example: 42 – 28 = ? The rods can be used for help pupils to understand the subtraction in abdication. First pupils put 4 bundles (10 rods in each bundle) of rods and 2 rods. Ask pupils that 2 rods can not be taken off 8 rods and how do it? The teacher can guide pupils to take 1bundle and 2 rods, which become 12 rods, take 8 rods off , 4 rods left. Then take 2 bundles of rods off from 3 bundles

of rods, 1 bundle of rods left. Finally 14 rods left. As shown as Fig. 26.

CLOCK MODEL

Specifications: 3 clock hands (hour, minute, second) can linking-move and there are scales on the clock face.

Usages:

1. Learn the time unit of hours, minutes and seconds with the clock model;
2. Learn the scales on the clock model;
3. Learn 12 hour system/ 24 hour system.

Activities and notes:

1. Learn the time unit of hours, minutes and seconds, the relations of hours, minutes and seconds with the clock model

i) Put the clock model on the desk or on the wall. Turn the button on the back of the clock model, the second hand will move, which results in link-moving of the minute hand and the hour hand. Three clock hands stand for hours, minutes and seconds individually. Help pupils to know the thin one is second hand, the longer thick hand is minute hand and thick shorter one is hour hand. Ask pupils what is one hour? What is one minute? What is one second ?

ii) Learn to the relation among the hour, the minute, the second. 1 hour = 60 minutes; 1 minute = 60 seconds.

Ask pupils to count how many large scales (12 large scales) in the clock model and how many small scales (5 small scales) in one large scale ? Total scales are 60 scales in the clock model.

2.Learn the time of the day with the clock model

The teacher shows the minute hand at the position of 12 and the hour hand at the position of 1, ask the pupils what time it is ? Then, move to 4 hour to ask pupils what time it is ? As shown as Fig.27. The teacher moves the hour hand to 10 and minute hand to 3, ask pupils what time it is ? (10:15) Then moves the hour hand to 4 and minute hand to 9, ask pupils mo what time it is (4:45) ? As shown as Fig. 28.

Fig. 27

Fig. 28

3. 24 hour system

First the teacher can move the hour hand in two turns to show it is a day. A 24 hour system is used in the post office, transportation, TV and broadcast. Tell pupils when you express time in 24 hour system, you have to add 12 in the hour hand indicated for the time afternoon, for instance, 2 clock P.M can be expressed 14 clock in 24 hour system. As shown as Fig.29.

Fig. 29

VOLUME UNIT DEMONSTRATOR

Specifications: 1 dm^3 cube with 10 x 10 x 10 cm which includes 4 parts of a cube (1 x 1 x 1 cm), a piece (1 x 1 x 9cm), a piece (1 x 10 x 9cm) and a piece (10 x 10 x 9cm).

Usages: The volume unit demonstrator can be used for showing the volume of cubic meters, cubic decimeters, cubic centimeters; the relationship of cubic meters, cubic decimeters, cubic centimeters; Calculate the volumes.

Activities and notes:

1. Take a 1 dm^3 cube with 10 x 10 x 10 cm and show the relation of the side and volume.

2. Calculate the volume of a cube and a cuboid.

VOLUME AND SURFACE AREA DEMONSTRATOR FOR CYLINDER

Specifications: A cylinder and a rectangle with two circles.

Usages: It can be used for showing the concept of cylinder and the formula of cylinder volume, $V = \pi R^2 h$, also for showing the formula of cylinder surface areas, $S = Ch + 2\pi R^2$

Activities and notes:

1. The formula of cylinder volume

The cylinder is divided into 2 equal sectors (each sector consists of 15 small equal sectors), as shown as Fig. 30, so that it is changed into a cuboid. As shown as Fig.31. The base area of the

cubiod equals to the base areas of the cylinder and the height is the cylinder height.

The cubiod volume = bottom areas x height, therefore, the cylinder volume = bottom areas x height

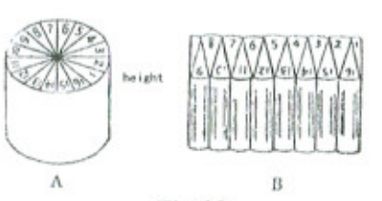

Fig.30

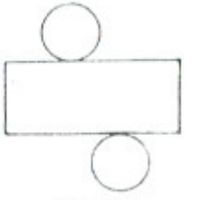

Fig. 31

2. The formula of cylinder surface areas

The surface areas of cylinder can be divided into two parts: two circle areas, and a rectangle area as shown as Fig.31. The side area of the cylinder equals to the rectangle areas; the length of the rectangle equals to a perimeter of the circle of the cylinder bottom and the width of the rectangle equals to the height of the cylinder.

Therefore, The surface areas of the cylinder = the perimeter of the circle x the height of the cylinder + circle area x 2

CONE VOLUME SET

Specifications: The cone volume set consists of a cone and a cylinder with same circle areas.

Usages: The apparatus is used for showing the formula of cone volume, V = 1/3 SH, S is the area of the cylinder circle and H is the height of the cylinder. As shown as Fig.32

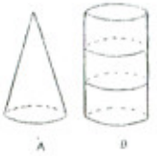

Fig.32

Activities and notes:

Put water into the cone then pour water into the cylinder from the cone, continue 3 times. The water fully pours the cylinder. It is shown that the cone volume is 1/3 volume of the cylinder with same circle.

GEOMETRY SET

Specifications: The geometry set consists of a cubiod with 140 x 100 x 60 mm, a cube with 100 x 100 x 100 mm, a cylinder with Φ 60 x 100 mm, a hollow cylinder with out diameter of Φ 100 x 100 mm, inner diameter of Φ 61 mm and a cone with the bottom of Φ 60 x 100 mm.

Usages: The set can be used for showing geometry figures and calculate the volume.

Activities and notes: The geometry set can be used for showing different geometry figures in accordance with the curriculum and textbooks.

RELATION BETWEEN SUFACE AREA AND LENGTH FOR RECTANGLE

Specifications: The apparatus consists of a cubiod with 140 x 100 x 60 mm as shown as Fig 33 (A) and 6 surfaces as shown as Fig.33 (B).

Usages: Showing the arris and surface areas of the cubiod.

Activities and notes:

1. As shown as Fig.33 (A), learn the concept of arris and measure all arris. Therefore,

Total length of the arris = length x 4 + width x 4+ height x 4

=(length + width + height) x 4

2. As shown as Fig. 33(B), the surface areas of the cubiod are the sum of top and bottom side areas, left and right side surface areas, front and back side areas.

The surface areas of the cubiod = length x width x 2 +width x height x 2 + length x height x 2

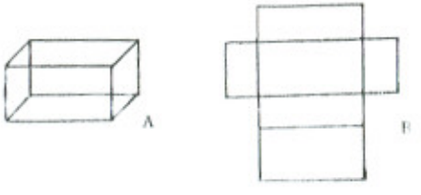

Fig. 33

CIRCULAR AREAS AND DIAMETER DEMONSTRATOR

Specifications: The apparatus consists of two parts with 16 equal sectors and a circle.

Usages: It is used for showing the ratio (π)of the circumference of

a circle to its diameter and areas of the circle.

Activities and notes:

1. Find a starting point on the circular wheel and aims at the "0" and turn the wheel. It is shown that the circumference of a circle is more than 3 times of the circle diameter. As shown as Fig.34 It is shown that the concept of the ratio (π) of the circumference of a circle to its diameter.

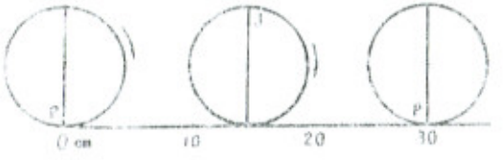

Fig.34

2. Construct the circular area demonstrator as shown as Fig.35 to make a rectangle and it s shown the circular areas equals to the areas of rectangle. The length of the rectangle is 1/2 of circle perimeter and the width of the rectangle is the radius of the circle. Therefore, the circular areas = 1/2 circle perimeter x circle radius = circle radius x circle radius x π .

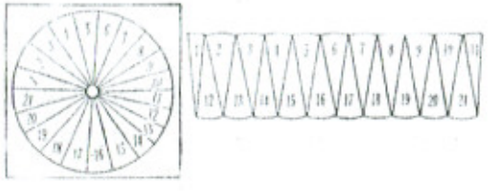

Fig.35

CAPACITY UNIT DEMONSTRATOR

Specifications: The apparatus consists of a 1000 ml transparent cubic vessel and a 1dm³ cube.

Usages: It can be used for showing capacity unit in primary mathematics.

Activities and notes:

1. Take 1000 ml water by a measuring cylinder (self prepared) and pour water into the transparent cubic vessel. Observe the scale on the transparent cubic vessel. Repeat the experiment.

2. Put a 1dm³ cube into the transparent cubic vessel and it is shown that the volume of 1dm³ cube equals to the 1000ml capacity. Therefore, 1 L =1000ml= 1dm³.

FRACTION KIT

Specifications: The fraction kit consists of a circle, two 1/2 circles, three 1/3 circles, four 1/4 circles, five 1/5 circles and six 1/6 circles.

Usages:

1. Learn the fractions;
2. Compare fractions
3 Proper fractions and improper fractions
4. Basic Characters of fractions

Activities and notes:

1. Learn fractions

The concept of fraction is abstract for pupils to understand. The fraction kit can be used for showing fractions through pupils hand-on activities.

i) Learn 1/2, 1/3, 2/5……

If one total is divided several parts, one is a part of the total. For example, a circle is divided into 2 parts, each part is 1/2 circles or a half circle. It is express one of second, as shown as Fig.36. The teacher shows a one of third circle as shown as Fig.37 and ask if the circle is divided into 3 parts, how many is the each part of the circle ? (1/3) It can be expressed as 1/3, one of third.

Fig. 36

Fig.37

Again show one 1/4 piece as shown as Fig.38, let pupils to know that one circle is equally divided into four parts and each part is one of forth, write down 1/4. Let pupils to practice and learn 1/5, 1/6. The pupils understand one / figure is equally divided into several part, each part is one of whole one, pupils will understand1/3, 1/4, 1/5, 1/6 and those numbers are fractions

Take a 1/4 piece and ask pupils what is one of those parts, if a circle is divided into four parts, then put 3 parts together ask pupils hoe can express 3 of 1/4 pieces, the teacher can explain 3 x 1/4 are 3 of fourths. Ask how many 1/4 there are in 3 of fourth as shown as Fig. 39.

Fig. 38

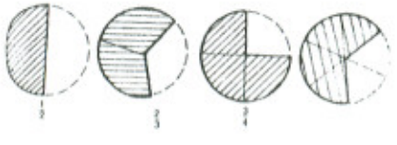

Fig.39

2. Compare fractions

i) Compare fractions with same denominator

Let pupils to learn which is larger and which is smaller in fractions. For example: Compare 1/4 with 3/4. As shown as in Fig. 40, it is obvious that 1/4 < 3/4, also the teacher can ask how many 1/4 there are in three of fourths, which is larger between 1 of 1/4 and 3 of 1/4 ? therefore 1/4 < 3/4. In same way, the teacher can be shown which is large between 3/5 and 2/5, as shown as in Fig. 41.

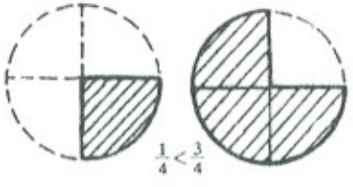

Fig. 40

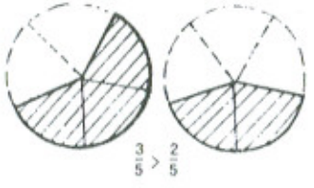

Fig. 41

Notes: The fractions with same denominators, the fraction with larger numerator is larger.

ii) Compare fractions with a same numerator

Let pupils to compare 1/2 with 1/3, as shown as Fig.42 and it is shown that 1/2 > 1/3.

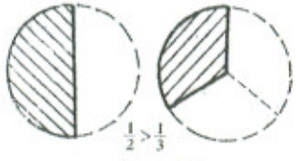

Fig. 42

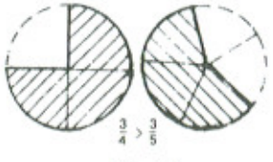

Fig.43

Compare 3/4 with 3/5, since 3/4 is 3 of 1/4, 3/5 is 3 of 1/5, and 1/4 > 1/5, therefore, 3/4 > 3/5, as shown as Fig. 43.

3. Proper fractions and improper fractions

i) The teacher shows proper fractions, such as, 1/2, 1/3, 3/4, 5/6 with the fraction kit, as shown as Fig. 44., then compare those fractions with each other.

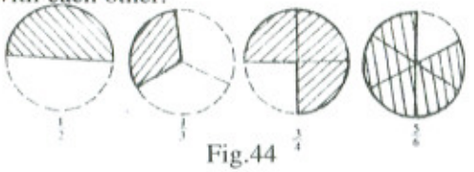

Fig.44

Notes: It is a proper fraction if the numerator < the denominator in the fraction.

The teacher shows improper fractions, such a 2/2, 3/3, 5/4 with fraction kit as shown as in Fig. 45. Ask pupils to observe the feature of those fractions and pupils find that the numerator ¾ the denominator or the numerator = the denominator in those fractions.

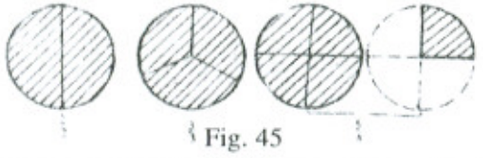

Fig. 45

Notes: It is a improper fraction if the numerator ⩾ the denominator in the fraction.

4. Basic Characters of fractions

The teacher shows a 1/2, 2 of 1/4, 3 of 1/6 with the fraction kit, as shown as Fig.46.

Fig.46

Pupils observe the figures individually and express 1/2, 2/4, 3/6. Compare one with other ones, that is 1/2 = 2/4 = 3/6.

Notes: In a fraction, numerators and denominators times a same number (excepting zero), the fraction keeps a constant value.

5. Simple additions /subtractions with fractions

i) Additions /subtractions in fractions with same denominators

For example: 1/5 + 2/5 = ? The teacher shows 1/5 with the fraction kit first and shows 2 of 1/5 with the fraction kit, as shown as Fig. 47, then the teacher put 3 of 1/5 together, ask how many is 1/5 + 2/5, it is 3/5.

It also can be used for subtractions, for examples, 5/6 − 4/6 = ?, The teacher can show 5 of 1/6 with the fraction kit, then take 4 of 1/6 pieces, ask pupils how many is left. As shown as Fig. 47.

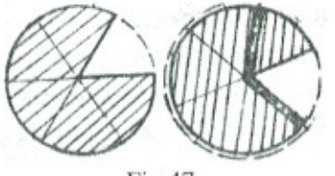

Fig.47

Another example : 1 − 3/4 =? The teacher shows a circle then shows 4 of 1/4 , as shown as Fig.48. Pupils object-observe that 4 of 4/4 equals to one, then take 3 of 1/4 piece off and one 1/4 piece left, therefore, 1 − 3/4 = 4/4 − 3/4 = 1/4.

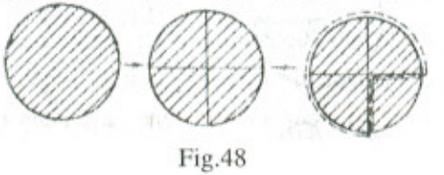

Fig.48

ii) Additions /subtractions in fractions with different denominators

For examples: 1/2 + 1/3 = ?, The teacher shows 1/2 and 1/3 with the fraction kit first, in order to help pupils to do 1/2 + 1/3, show 1/2 can be changed into 3/6 and 1/3 can be change 2/6 As shown as Fig. 49, therefore 1/2 + 1/3 = 5/6.

Fig. 49

Notes: In doing additions /subtractions in fractions with different denominators, first fractions are changed into the fraction with same denominators, then do additions/ subtractions.

GROMETRY FIGURES

Specifications: Several plastic geometry figures.

Usages: The set can be used for showing geometry shapes and calculate the areas.

Activities and notes: The geometry set can be used for showing different geometry figures, such as, a triangle, a square, a rectangle, a trapezoid, and etc. in accordance with the curriculum and textbooks.

i) Calculate the areas of parallelograms

The teacher shows a parallelogram figure as show as Fig.50 (A) , then take a triangle on the left of the parallelograms and put the triangle on the right side as shown as Fig. 50(B). It becomes a rectangle so that the length of rectangle is the length of parallelograms and the width of the rectangle is the height of parallelograms.

The areas of rectangle = length x width

Therefore, the areas of parallelogram = base length x height

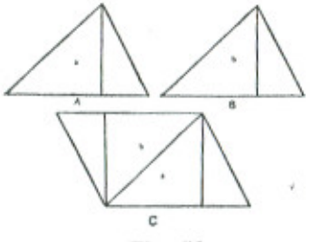

Fig. 50

ii) Calculate the areas of trapezoids

The teacher shows a trapezoid figure as show as Fig.51 (A) (B), those two figures and same ones. Then make two trapezoids together as shown as Fig 51 (c) and it becomes a parallelogram, so that the areas of the trapezoid are half of areas of the parallelogram .

The areas of trapezoid =1/2 (top length + base length) x height

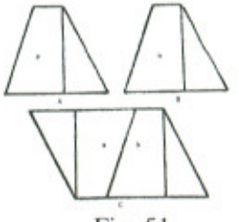

Fig. 51

iii) Calculate the areas of triangles

The teacher shows a triangle figure as show as Fig.52 (A) (B), those two figures and same ones. Then make two triangles together as shown as Fig 52 (c) and it becomes a parallelogram. so that the areas of the triangle are half of areas of the parallelogram.

Therefore, the areas of triangle =1/2 base length x height

(A)

(B)

Fig. 52

GROMETRY FIGURE MAKING CARDS

Specifications: Several geometry figures printed in a carton paper (a square, a cubiod, a cylinder, a cone) one of each.

Usages: The cards can be used for pupils to practice and understand geometry figures.

Activities and notes: The geometry figure making card can be used for pupils to learn different geometry figures, such as, an triangle, a square, a rectangle, a trapezoid, a circle and etc. in accordance with the curriculum and textbooks. Pupils can make geometry figures along the marked lines.

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