

# Mensuration 3D: Questions, Figures and Formulas in PDF!

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Mensuration 3D contains volume and surface area of the 3-D (dimension) figures. For example, Cube, Cuboid, Cylinder, Cone, Sphere, Frustum, Pyramid, Prism and Tetrahedron. Volume is the amount of space occupied by the object. Surface area is the surface area of a solid object is measured of the total area that the surface of the object occupies.

In this article, we are going to cover the key concepts of Mensuration 3D along with the various types of questions, and tips and tricks. We have also added a few solved examples, which candidates will find beneficial in their exam preparation. Read the article thoroughly to clear all the doubts regarding the same.

## Mensuration Maths- Definition

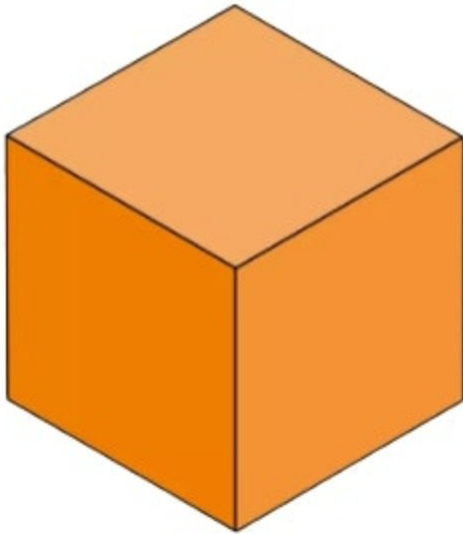
A section of mathematics that communicates about the length, volume, or area of various geometric shapes is termed Mensuration. These shapes or patterns exist in two dimensions or three dimensions.

## Mensuration 3D in Maths- Important Terminologies

Let us discover a few more definitions linked to the various geometric shapes.

Terms	Abbreviation	Unit	Definition
Area	A	$m^2$ or $cm^2$	The area is the surface that is covered by the closed shape.
Perimeter	P	$cm$ or $m$	The measure of the endless line by the boundary of the presented figure is named a Perimeter.
Volume	V	$m^3$ or $cm^3$	The space utilised by a 3D shape or object is termed a Volume.
Curved Surface Area	CSA	$m^2$ or $cm^2$	If there is a curved surface/shape/object, then the total area obtained is called a curved surface area.
Lateral Surface area	LSA	$m^2$ or $cm^2$	The total area of all the lateral surfaces that encloses the presented figure is termed the lateral surface area.
Total Surface Area	TSA	$m^2$ or $cm^2$	The aggregate of all the curved and lateral surface areas is designated as the total surface area.

## Properties of Cube

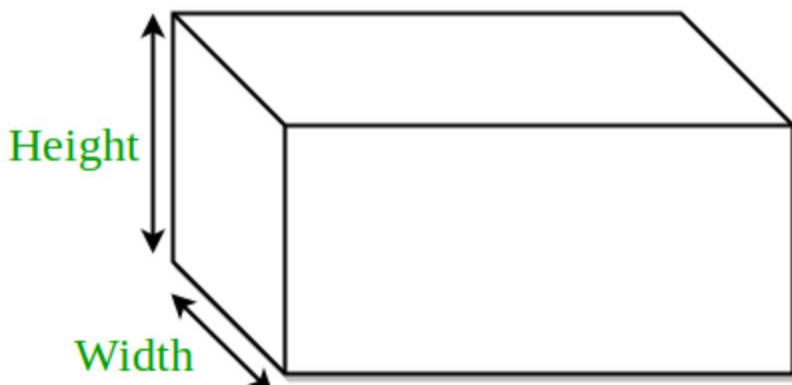


- All sides are equal.
- The Cube has all six faces in a square shape.
- Each of the faces meets the other four faces.
- The edges opposite to each other are parallel.
- Side =  $a$

### Formula for a Cube:

- Volume =  $a^3$
- Surface area =  $6a^2$
- Diagonal =  $\sqrt{3}a$

## Properties of Cuboid

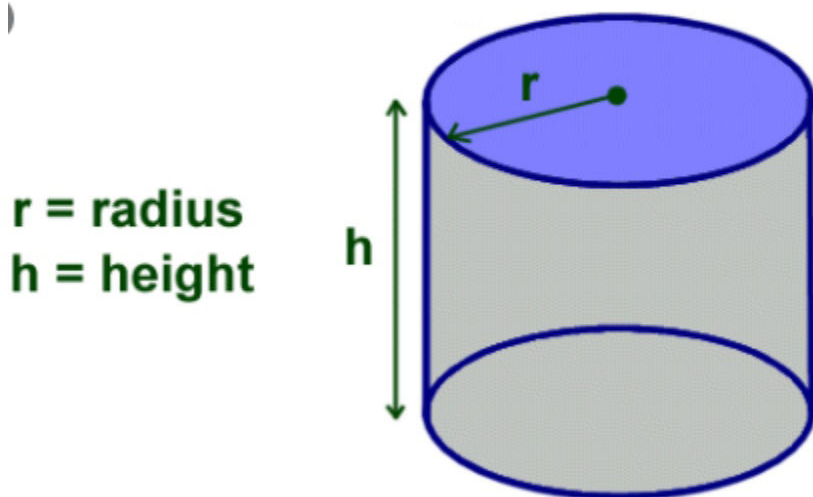


- Each of the faces meets the other four faces.
- The edges opposite to each other are parallel.
- Height = h, Length = l and Breadth = b

### Formula for a cuboid:

- Volume =  $l \times b \times h$
- Volume = Area of base  $\times$  height
- Surface area =  $2(lb + bh + hl)$
- Diagonal =  $\sqrt{l^2 + b^2 + h^2}$
- Area of four walls = Perimeter of base  $\times$  height =  $2(l + b) \times h$
- Volume of metal = External volume – internal volume

## Properties of Cylinder

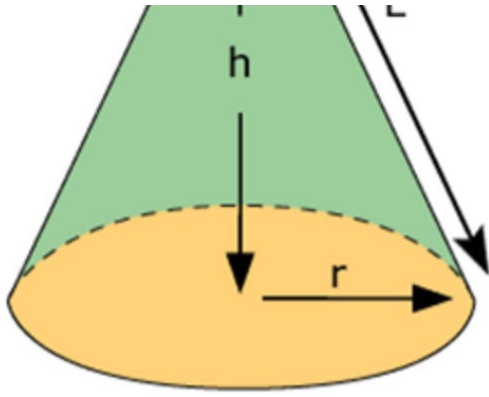


- A cylinder has one curved side.
- A cylinder has two vertical flat ends in the circular shape.

### Formula for a cylinder:

- Volume =  $\pi r^2 h$
- Surface area =  $2\pi r h$
- Total surface area =  $2\pi r(h + r)$

## Properties of Cone

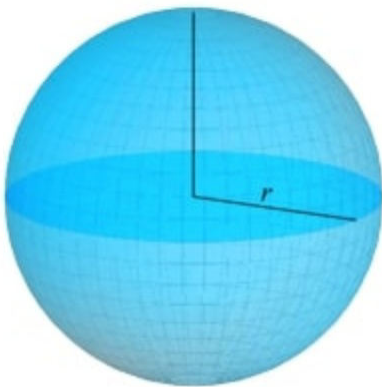


- Height = h, Slant height = l and Radius = r
- It has only one vertex point.
- It's base is circular.

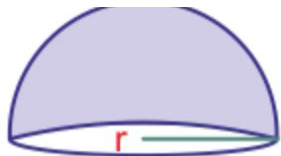
#### Formula for a cone:

- Volume =  $(1/3)\pi r^2 h$
- $l = \sqrt{h^2 + r^2}$
- Surface area =  $\pi r l$
- Total surface area =  $\pi r(l + r)$

## Properties of Sphere

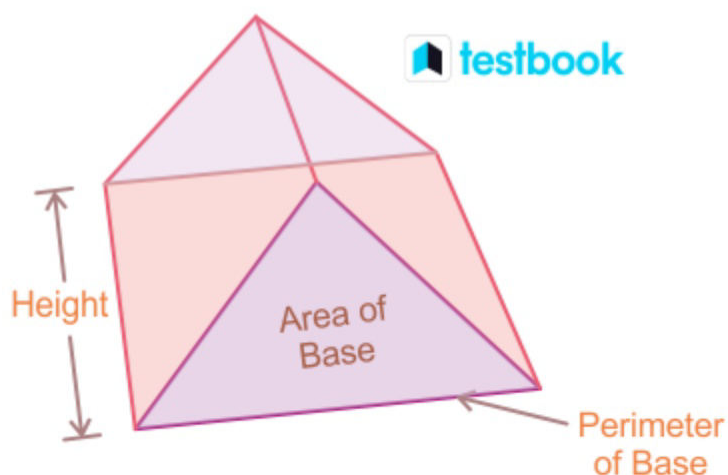


- Volume =  $\frac{4}{3}\pi R^3$
- Surface area =  $4\pi R^2$
- Volume of metal =  $\frac{4}{3}\pi(R^3 - r^3)$
- Volume of hollow sphere =  $\frac{4}{3}\pi(R - a)^3$
- Here, R = external radius, r = internal radius, a = thickness of wall



- Volume =  $\frac{2}{3}\pi r^3$
- Surface area =  $2\pi r^2$
- Total surface area =  $3\pi r^2$

## Properties of Prism



- Volume = Area of base  $\times$  height
- Lateral surface area = Perimeter of base  $\times$  slant height
- Total surface area = Perimeter of base  $\times$  slant height +  $2 \times$  Area of base

## Mensuration 3D Formulas

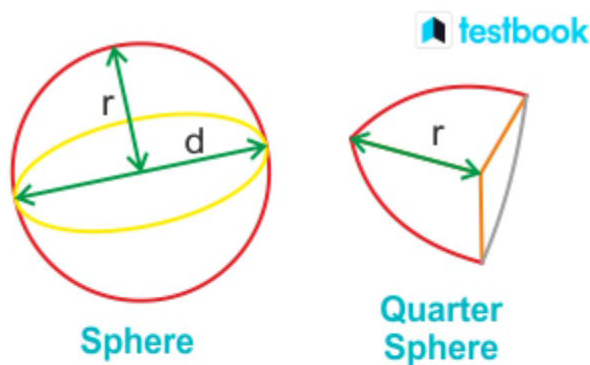
With the knowledge of terms, properties and formulas of 3D shapes let us summarise some of the important formulas in the below table, these mensuration formulas are very useful while solving mensuration problems.

Shape	Volume (in cubic units)	Curved Surface Area (CSA) or Lateral Surface Area (LSA) (Square units)	Total Surface Area (TSA) (Square units)
Cube	Volume = $a^3$	LSA = $4a^2$	TSA = $6a^2$
Cuboid	Volume = $l \times b \times h$	LSA = $2h(l + b)$	TSA = $2(lb + bh + hl)$

Cylinder	Volume= $\pi r^2 h$	LSA = $2\pi r h$	TSA= $2\pi r h + 2\pi r^2$
Cone	Volume= $\left(\frac{1}{3}\right)\pi r^2 h$	LSA = $\pi r l$	TSA= $\pi r(r + l)$

Here's some more 3D shapes with their formulas and images.

## Quarter Sphere



A quarter sphere is specifically one-fourth share of a full sphere. i.e., if we break a sphere into four equal sections, each portion is termed a quarter sphere. Therefore, the volume of a quarter sphere is one-fourth of the volume of a sphere.

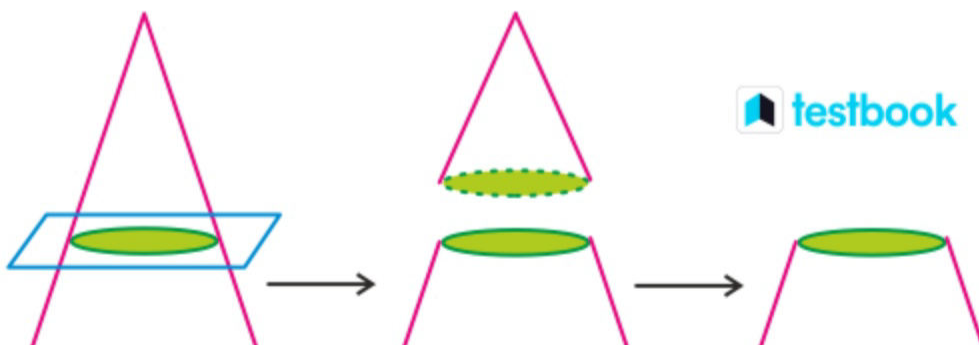
$$C.S.A = \pi r^2$$

$$T.S.A = \frac{\pi}{2} r^2 + \frac{\pi}{2} r^2 + C.S.A$$

$$T.S.A = \pi r^2 + \pi r^2 = 2\pi r^2$$

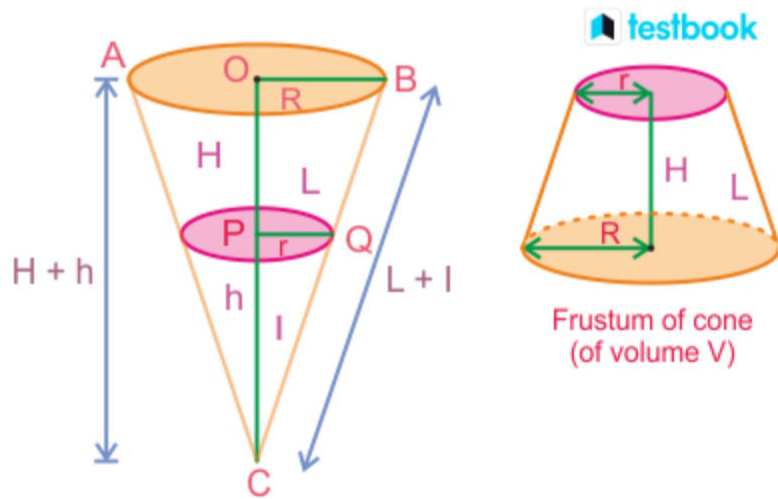
$$\text{Volume} = \frac{1}{3} \pi r^3$$

## Frustum of a Cone



The frustum of a cone is the section of the cone without vertex when the given cone is split into two pieces with a plane that is parallel to the bottom of the cone.

The frustum of a cone is also called a truncated cone. Similar to any other 3D shape or object, the frustum of a cone also holds surface area and volume. The formula for the same are as follows:



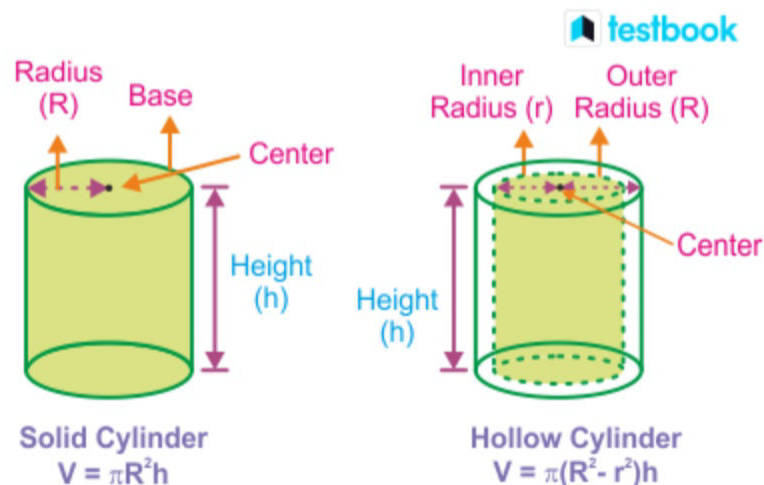
$$\text{Volume of frustum of cone} = \frac{\pi h}{3} \left[ \frac{(R^3 - r^3)}{r} \right] \text{ (OR)}$$

$$\text{Volume of frustum of cone} = \frac{\pi h}{3} (R^2 + Rr + r^2)$$

$$\text{CSA (or) LSA of frustum of cone} = \pi l \left[ \frac{(R^2 - r^2)}{r} \right] \text{ (OR) } \pi L (R + r)$$

$$\text{TSA of frustum of cone} = \pi l \left[ \frac{(R^2 - r^2)}{r} \right] + \pi (R^2 + r^2) \text{ (OR) } \pi L (R + r) + \pi (R^2 + r^2)$$

## Hollow Cylinder (Hollow Right Circular Cylinder)



Here the inner radius of the base is ‘r’, the outer radius of the base is ‘R’ and the height of the hollow right circular cylinder is ‘h’.

Volume =  $\pi h (R^2 - r^2)$

Curved Surface area =  $2\pi Rh + 2\pi rh = 2\pi h (R + r)$

Total surface area =  $2\pi H (R + r) + 2\pi (R^2 - r^2)$

## Differences Between Mensuration 3D and 2D shapes

Check out the difference between the Mensuration 2D and 3D shapes.

2D Shape (Mensuration)	3D Shape (Mensuration)
If a shape or pattern is enclosed by three or added straight lines in a plane, then such a shape is a 2D shape.	If a shape or pattern is enclosed by several surfaces or planes then it is a 3D shape.
Two-dimensional shapes hold no depth/height.	Three-dimensional shapes are also termed solid shapes and when compared to 2D they possess height or depth.
2D shapes as the name suggests have only two dimensions, that is the length and breadth.	The three-dimensional shapes as compared to 2D have three dimensions namely depth/height, breadth and length.
In two dimensions, we can measure the area and perimeter of shapes.	In three dimensions, we can measure the volume, CSA(Curved Surface area), LSA( Lateral Surface area.) or TSA(Total Surface area.) of the given shapes.

## How to Solve Question Based on Mensuration 3D – Tips and Tricks

- Candidates can find different tips and tricks from below for solving the questions related to Mensuration 3D.
- **Tip # 1:** Make sure you remember all the properties and formulas mentioned above to solve the questions related to this section quickly.
  - **Tip # 2:** Attempt mock and quizzes to brush up your concepts of Mensuration 3D.

## Mensuration 3D Sample Questions

$$\therefore a = 17 \text{ cm}$$

$$\Rightarrow \text{Total surface area} = 6a^2$$

$$\therefore \text{Total surface area} = 6 \times 17^2 = 1734 \text{ cm}^2$$

**Question 2:** If the sum of three sides is 45 cm and the length of diagonal is 21 cm in a cuboid, find the total surface area of this cuboid.

$$\textbf{Solution 2: } l + b + h = 45 \text{----- (1)}$$

$$\Rightarrow \text{Diagonal} = \sqrt{l^2 + b^2 + h^2}$$

$$\Rightarrow \sqrt{l^2 + b^2 + h^2} = 21$$

$$\Rightarrow l^2 + b^2 + h^2 = 441 \text{----- (2)}$$

$\therefore$  From (1),

$$\Rightarrow (l + b + h)^2 = 45^2$$

$$\Rightarrow l^2 + b^2 + h^2 + 2(lb + bh + hl) = 2025$$

$$441 + 2(lb + bh + hl) = 2025$$

$$\Rightarrow 2(lb + bh + hl) = 2025 - 441 = 1584 \text{ cm}^2$$

$$\therefore \text{Surface area of this cuboid is } 1584 \text{ cm}^2$$

**Question 3:** Find the total surface area and volume of a cylinder which has a height of 21m and a base of diagonal is 12m.

$$\textbf{Solution 3: } \text{Diagonal} = 2 \times \text{radius} \quad \text{Radius} = 12/2 = 6 \text{ m} \quad \text{Total surface area} = 2\pi rh$$

$$\Rightarrow \text{Total surface area} = 2 \times 22/7 \times 6 \times 21 = 792 \text{ m}^2$$

$$\Rightarrow \text{Volume} = \pi r^2 h$$

$$\therefore \text{Volume} = 22/7 \times 6^2 \times 21 = 2376 \text{ m}^3$$

**Question 4:** The base of a solid right prism is a triangle whose sides are 9 cm, 12 cm and 15 cm. The slant height of the prism is 5 cm, Find the total surface area of the prism.

$$\textbf{Solution 4: } \text{Perimeter of base} = 9 + 12 + 15 = 36 \text{ cm} \quad \text{Area of base} = \frac{1}{2} \times 12 \times 9 = 54 \text{ cm}^2$$

$$\Rightarrow \text{Total surface area} = \text{Perimeter of base} \times \text{slant height} + 2 \times \text{Area of base}$$

$$\text{Total surface area} = (36 \times 5) + 2 \times 54$$

$$\therefore \text{Total surface area} = 288 \text{ cm}^2$$

follows.

- [SBI PO](#), [SBI Clerk](#), [IBPS PO](#), [IBPS Clerk](#)
- [SSC CGL](#), [SSC CHSL](#), [SSC MTS](#)
- [LIC AAO](#), [LIC ADO](#)
- [RRB NTPC](#), [RRB ALP](#)
- [UPSC](#)
- [MPSC](#)
- [KPSC](#)
- [BPSC](#)
- [WBPSC](#)
- Other State Level Recruitment Examinations

**If you are checking Mensuration 3D article, also check the related maths articles in the table below:**

<a href="#">Mensuration 2D</a>	<a href="#">Parabola, Ellipse and Hyperbola</a>
<a href="#">Height and Distance</a>	<a href="#">Pie Diagram</a>
<a href="#">Data Interpretation</a>	<a href="#">Linear Equation In Two Variables</a>

We hope you found this article regarding Mensuration 3D was informative and helpful, and please do not hesitate to contact us for any doubts or queries regarding the same. You can also download the [Testbook App](#), which is absolutely free and start preparing for any government competitive examination by taking the mock tests before the examination to boost your preparation.

## Mensuration 3D FAQs

### Q.1 What is Mensuration 3D ?

**Ans.1** Mensuration 3D contains volume and surface area of the 3-D (dimension) figures. For example, Cube, Cuboid, Cylinder, Cone, Sphere, Frustum, Pyramid, Prism and Tetrahedron.

### Q.2 Where can I find the important properties and formulas related to Mensuration 3D ?

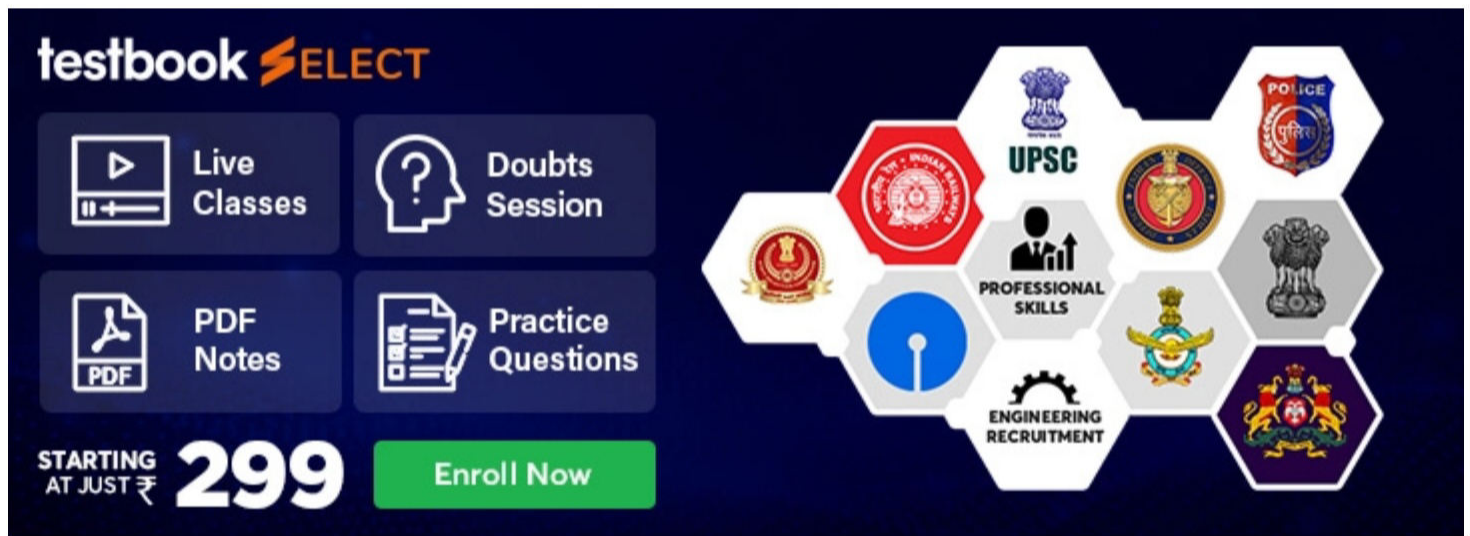
**Ans.2** Important properties and formulas related to Mensuration 3D can be found above in the article.

### Q.3 How to solve the problem related to Mensuration 3D ?

**Ans.3** Tips and tricks to solve the problems related to Mensuration 3D are given above in the article. Kindly go through the article for the same.

**Q.5** In which exam questions from Mensuration 3D come up?

**Ans.5** Mensuration 3D based questions come in various government competitive examinations on a regular basis. The names of such examinations are given above in the article.



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