SAMPLE QUESTION PAPER
SCIENCE (Theory)
Class - X (Code A)
Summative Assessment - II

Time : 3 to 3½ Hours Max. Marks : 80

General Instructions :

(i) The question paper comprises of two sections, A and B, you are to attempt both the sections.

(ii) All questions are compulsory.

(iii) There is no overall choice. However, internal choice has been provided in all the three questions of five marks category. Only one option in such questions is to be attempted.

(iv) All questions to section A and all questions of section B are to be attempted separately.

(v) Question number 1 to 4 in section A are one mark question. These are to be answered in one word or one sentence.

(vi) Question number 5 to 13 are two mark questions, to be answered in about 30 words.

(vii) Question numbers 14 to 22 are three mark questions, to be answered in about 50 words.

(viii) Question numbers 23 to 25 are five mark questions, to be answered in about 70 words.

(ix) Question numbers 26 to 41 in section B are multiple choice questions based on practical skills. Each question is a one mark question. You are to choose one most appropriate response out of the four provided to you.

SECTION - A

1. Why ethanol is used as a fuel? **[1]**

2. Define accommodation in human eye. **[1]**

3. Name a synthetic chemical which causes depletion of ozone layer. **[1]**

4. What are the components of an ecosystem? **[1]**

5. The electronic configurations of three elements are given below: **[2]**

X 2

Y 2, 6

Z 2, 8, 2

(i) Which element belongs to the second period of the periodic table?

(ii) Which element belongs to the eighteenth group of the periodic table?

6. Element X forms a chloride with the formula XCl_2, which is a solid with a high melting point. Element X will belong to which group of the periodic table? **[2]**

7. Write down the disadvantages of burning of fossil fuels. **[2]**

8. What are the social and environmental problems associated with large dams? **[2]**

9. State Snell's law of refraction. **[2]**

10. What is hypermetropia? How can it be corrected? **[2]**

11. What is dispersion? How does it occur in a glass prism? **[2]**

12. What are the advantages of vegetative propagation? **[2]**

13. Why are testes located in scrotum, outside the abdominal cavity in humans? **[2]**

14. The atomic radii of elements of second period are given below **[3]**

2^{nd} period elements	:	B	Be	O	N	Li	F	C
Atomic radii	:	88	111	66	74	152	64	77

(i) When these elements are arranged in the decreasing order of their atomic radii, are they arranged in the pattern of a period in the periodic table?

(ii) Write the electronic configuration of the smallest atom.

15. How many isomers of the following hydrocarbons are possible? **[3]**

(i) C_3H_8

(ii) C_4H_{10}

(iii) C_5H_{12}

16. Justify the statement "sexual reproduction is advantageous over asexual reproduction". **[3]**

17. How is sex determined in human beings? **[3]**

18. What are fossils? How is the age of the fossils determined? **[3]**

19. What is a monohybrid cross? Draw a Punnet square of a monohybrid cross and write the genotypic and phenotypic ratio obtained in the F_2 generation of the monohybrid cross. **[3]**

20. Find the magnification, if the object is placed at a distance of 20 cm in front of a concave mirror of focal length 40 cm. **[3]**

21. Find the ratio of refractive indices of two media, if the speed of light in first and second medium is 2×10^8 m/s and 1×10^8 m/s respectively. **[3]**

22. The near point of an elderly person is 50 cm from the eyes. Find the focal length and power of the corrective lens he needs. **[3]**

23. (a) Write the structural formula of the following: **[3]**

(i) Hexanal

(ii) Benzene

(b) Explain, why diamond is hard while graphite is soft. **[2]**

OR

Explain soaps and detergents. Write down advantages and disadvantages of detergents over the soaps also write cleansing action of soaps and detergents. **[5]**

24. Briefly explain the different categories of the methods used for contraception. **[5]**

OR

Draw a labelled diagram of an angiospermic flower and germination of pollen on stigma.

25. (a) Write the sign conventions used for spherical mirrors. **[2½]**

(b) An object is placed at a distance of 12 cm from a concave mirror of radius of curvature 16 cm. Find the position of the image. **[2½]**

OR

An object 1.0 cm high, is placed at a distance of 12 cm from a convex lens of focal length 16 cm.

(a) Find the position of the image. **[1½]**

(b) Is the image real or virtual? **[1]**

(c) Find the size of the image. **[1½]**

(d) Is the image erect or inverted? **[1]**

SECTION - B

Multiple Choice Questions (Q. 26 to 41)

26. Which of the following statements is not applicable to compounds of carbon?

(1) They have low melting and boiling points

(2) They are ionic in nature

(3) They form a homologous series

(4) They are generally soluble in organic solvents

27. Which of the following statements regarding the properties of graphite is incorrect?

(1) It is a non-metallic substance

(2) It does not conduct electricity

(3) It is used as a lubricant

(4) It is soft and slippery in touch

28. Which of following is incorrect regarding bonding in carbon?

(1) It forms only covalent bonds

(2) It forms ionic as well as covalent bonds

(3) It can bond with other atoms of carbon to form long chains, branched chains and cyclic chain structures

(4) It shares all of its four valence e^- for bonding to attain the noble gas configuration

29. Carbon forms _________ covalent bonds with other atoms owing to its ___________.

(1) Weak, small atomic size

(2) Strong, large atomic size

(3) Weak, large atomic size

(4) Strong, small atomic size

30. Which of the following does not show the property of catenation?

(1) C_2H_6 (2) C_2H_4

(3) CO_2 (4) C_2H_2

31. A female reproductive part, present at the centre of a flower is

(1) Sepals (2) Petals

(3) Stamens (4) Carpels

32. In bread mould (Rhizopus), asexual reproduction takes place through

(1) Budding (2) Regeneration

(3) Spore formation (4) Fragmentation

33. Which of the following occurs, if egg is not fertilised?

(1) Ovulation (2) Menarche

(3) Menopause (4) Menstruation

34. The parasite causing Kala-azar, which reproduces by binary fission is

(1) Trypanosoma (2) Leishmania

(3) Noctiluca (4) Plasmodium

35. In humans the site of fertilization is

(1) Vagina (2) Cervix

(3) Oviduct (4) Fallopian tube

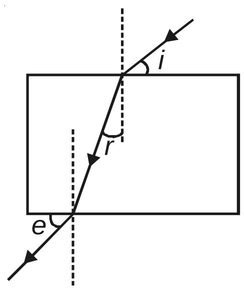
36. In which of the following plants, unisexual flower is formed?

(1) Papaya (2) Hibiscus

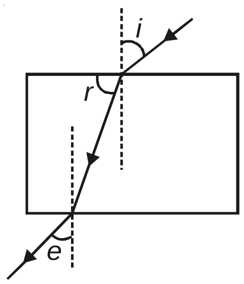
(3) Mustard (4) *Pisum sativum*

37. Diagrams given below are showing refraction of light through a rectangular slab, where *i* is the angle of incidence, *r* is the angle of refraction and *e* is the angle of emergence. The correct representation is

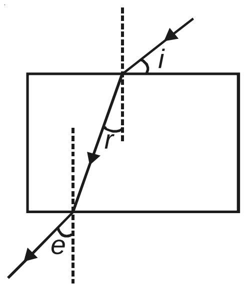
(1)



(2)



(3)



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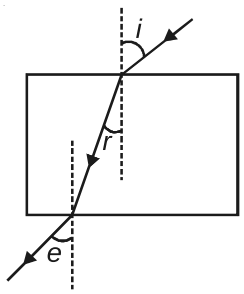


38. When a ray of light enters a glass slab from air

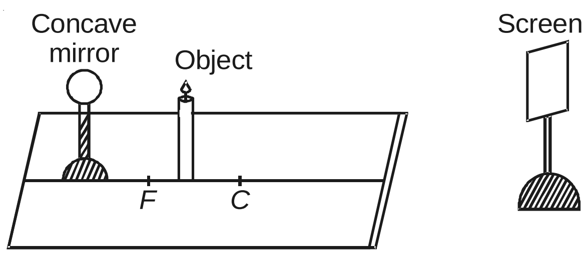
(1) Its wavelength decreases

(2) Its wavelength increases

(3) Its frequency increases

(4) Its frequency decreases

39. An object is placed in front of the concave mirror at a position as shown in the figure. Where should we put the screen to obtain the image of the object on it?



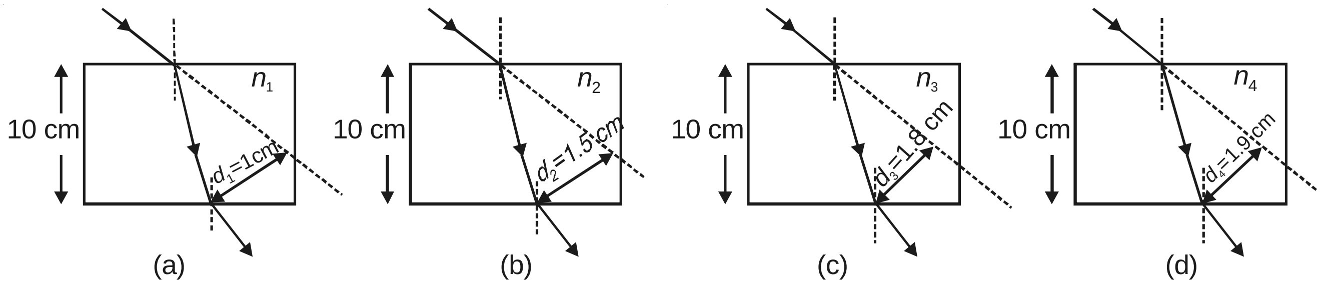
(1) Between the pole and focus

(2) Between *C* and *F*

(3) Beyond *C*

(4) Behind the mirror

40. Refraction of light through glass slabs with refractive indices n_1, n_2, n_3 and n_4 are shown in the figure. Which one of the following is correct?



(a) (b) (c) (d)

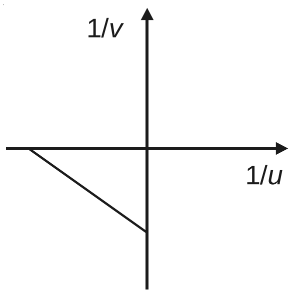
(1) $n_1 > n_2 > n_3 > n_4$

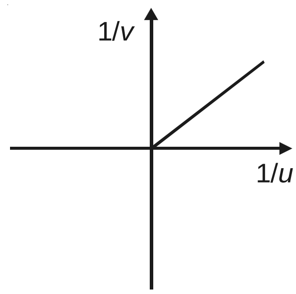
(2) $n_4 > n_3 > n_2 > n_1$

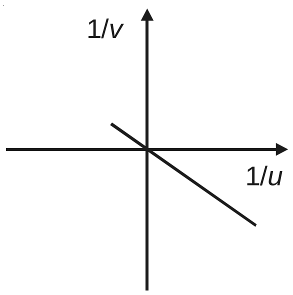
(3) $n_1 = n_2 = n_3 = n_4$

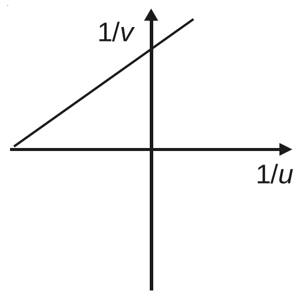
(4) $n_1 = n_2 > n_3 = n_4$

41. In an experiment to find the focal length of a concave mirror a graph is drawn between $\frac{1}{v}$ and $\frac{1}{u}$. The correct graph out of the following is

(1) 

(2) 

(3) 

(4) 

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SAMPLE QUESTION PAPER
MATHEMATICS
Class - X (Code A)
Summative Assessment - II

Time : 3 Hours **Max. Marks : 80**

General Instructions :

(i) All questions are compulsory.

(ii) The questions paper consists of 34 questions divided into four sections A, B, C and D. Section A comprises of 10 questions of 1 mark each, Section B comprises of 8 questions of 2 marks each, Section C comprises of 10 questions of 3 marks each and Section D comprises of 6 questions of 4 marks each.

(iii) Question number 1 to 10 in section A are multiple choice questions where you are to select one correct option out of the given four.

(iv) There is no overall choice. However, internal choice has been provided in 1 question of two marks, 3 questions of three marks and 2 questions of four marks. You have to attempt only one of the alternatives in all such questions.

SECTION - A

Question numbers 1 to 10 carry 1 mark each.

1. Discriminant of the equation $x^2\cos\theta - 2x\sin\theta - \cos\theta = 0$, $\left(\theta \neq \frac{\pi}{2}\right)$ is

(1) 0 (2) 4

(3) 1 (4) 2

2. If the first, second and the last term of an A.P. are *a, b* and 2*a* respectively, then its sum is

(1) $\frac{ab}{2(b-a)}$

(2) $\frac{ab}{b-a}$

(3) $\frac{3ab}{2(b-a)}$

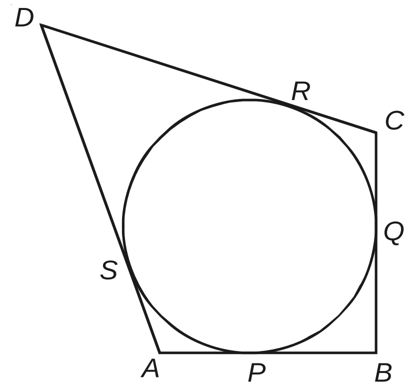
(4) $\frac{2ab}{3(b-a)}$

3. If the angles of elevation of the top of a tower from two points at a distance *a* and *b* (*a* > *b*), from its foot and in the same straight line from it are 30° and 60°, then the height of the tower is

(1) $\sqrt{a+b}$ (2) $\sqrt{ab}$

(3) $\sqrt{a-b}$ (4) $\sqrt{\frac{a}{b}}$

4. In the given figure, if a circle touches all the four sides of a quadrilateral *ABCD* with *AB* = 6 cm, *BC* = 7 cm and *CD* = 4 cm, then the length of *AD* is



(1) 2 cm (2) 3 cm

(3) 4 cm (4) 5 cm

5. Two circles touch each other externally at *C* and *AB* is the common tangent to the circles touching two circles at *A* and *B* respectively. Then, $\angle ACB$ =

(1) 60° (2) 45°

(3) 30° (4) 90°

6. If the diameter of a semi-circular protractor is 14 cm, then its perimeter is

(1) 36 cm (2) 22 cm

(3) 154 cm (4) 72 cm

7. If *TP* and *TQ* are two tangents to a circle with centre *O* such that $\angle POQ = 110°$, then $\angle PTQ$ is equal to

(1) 60° (2) 70°

(3) 80° (4) 90°

8. If a cone is cut into two parts by a horizontal plane passing through the midpoint of its axis, then the ratio of the volumes of the upper part and the cone is

(1) 1 : 2 (2) 1 : 4

(3) 1 : 6 (4) 1 : 8

9. The probability that a non-leap year has 53 Sundays is

(1) $\frac{2}{7}$ (2) $\frac{5}{7}$

(3) $\frac{6}{7}$ (4) $\frac{1}{7}$

10. The length of the tangent drawn from a point 8 cm away from the centre of a circle of radius 6 cm is

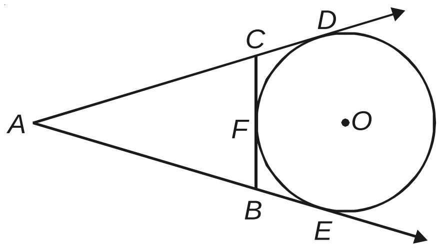
(1) $\sqrt{7}$ cm (2) $2\sqrt{7}$ cm

(3) 10 cm (4) 5 cm

SECTION - B

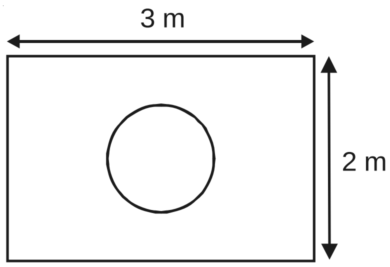
Question numbers 11 to 18 carry 2 marks each.

11. In the given figure, if *AD*, *AE* and *BC* are tangents to the circle at *D, E* and *F* respectively, then prove that 2*AD* = *AB* + *BC* + *CA*. **[2]**



12. Quadratic equation $x^2 - 2kx + (2k - 1)$ has equal roots. Find the value of *x*. **[2]**

13. Suppose you drop a handkerchief at random in the rectangular region, as shown in the figure. What is the probability that it will land inside the circle with a diameter 1 m? **[2]**



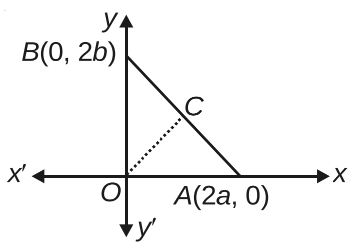
OR

A bag contains 3 red balls and 5 black balls. A ball is drawn at random from the bag. What is the probability that the ball drawn is (i) red (ii) not red?

14. Find the sum of *n* terms of the series $\sqrt{2} + \sqrt{8} + \sqrt{18} + \sqrt{32} + ...$ **[2]**

15. Find a point on *x*-axis which is equidistant from *A*(2, –5) and *B*(–2, 9). **[2]**

16. In the given figure, ΔBOA is a right angle triangle. *C* is the mid-point of the hypotenuse *AB*. Show that it is equidistant from the vertices *O, A* and *B*. **[2]**



17. A boy is cycling such that the wheels of the cycle are making 140 revolutions per minute. If the diameter of the wheel is 60 cm, then calculate the speed (in km per hour) with which the boy is cycling. **[2]**

18. Two circles touch each other externally. The sum of their areas is 130π sq.cm and the distance between their centres is 14 cm. Find the radii of the circles. **[2]**

SECTION - C

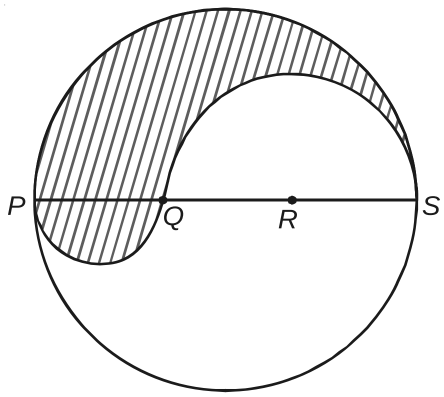
Question numbers 19 to 28 carry 3 marks each.

19. From a point *P*, two tangents *PA* and *PB* are drawn to a circle with centre *O*. If *OP* is equal to the diameter of the circle, then show that ΔAPB is an equilateral triangle. **[3]**

20. If two vertices of an equilateral triangle are (0, 0) and $(3, \sqrt{3})$, then find the third vertex. **[3]**

21. Two pillars of equal height are on either side of the road, which is 100 m wide. The angles of elevation of the top of the pillars are 60° and 30° at a point on the road between the pillars. Find the position of the point and the height of the pillar. **[3]**

22. *PQRS* is a diameter of a circle of radius 6 cm. The length of *PQ*, *QR* and *RS* are equal. Semi-circles are drawn with *PQ* and *QS* as diameter, as shown in the figure. Find the perimeter and area of the shaded region. **[3]**



23. The side of a square exceeds the side of the another square by 4 cm and the sum of the areas of two squares is 400 cm^2. Find the dimensions of the squares. **[3]**

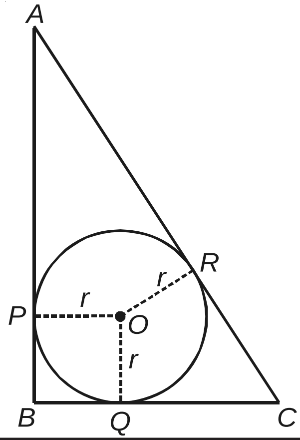
OR

Solve for *x* : $x = \cfrac{1}{2 - \cfrac{1}{2 - \cfrac{1}{2 - x}}}, x \neq 2$

24. Two tangents *TP* and *TQ* are drawn to a circle with centre *O* from an external point *T*. Prove that $\angle PTQ = 2\angle OPQ$. **[3]**

OR

In the given figure, *ABC* is a right triangle, right-angled at *B* such that *BC* = 6 cm and *AB* = 8 cm. Find the radius of its incircle.



25. Which term of the sequence 20, $19\frac{1}{4}, 18\frac{1}{2}, 17\frac{3}{4}, ...$ is the first negative term? **[3]**

26. If D, E and F are the midpoints of the sides BC, CA and AB respectively of ΔABC, then using co-ordinate geometry, prove that **[3]**

$$\text{area of } \Delta DEF = \frac{1}{4}(\text{Area of } \Delta ABC)$$

27. A solid is in the form of a right circular cone mounted on a hemisphere. The radius of the hemisphere is 3.5 cm and the height of the cone is 4 cm. The solid is placed in a cylindrical tub, full of water. If the radius of the cylinder is 5 cm and its height is 10.5 cm, then find the volume of water left in the cylindrical tub. $\left(\text{use } \pi = \frac{22}{7}\right)$.

[3]

OR

A cubical block of side 7 cm is surmounted by a hemisphere. What is the greatest diameter that the hemisphere can have? Also, find the total surface area of the solid.

28. A jar contains 54 marbles each of which is blue, green or white. The probability of selecting a blue marble at random from the jar is $\frac{1}{3}$ and the probability of selecting a green marble at random is $\frac{4}{9}$. How many white marbles does the jar contain? **[3]**

SECTION - D

Question numbers 29 to 34 carry 4 marks each.

29. The ratio of the sums of m and n terms of an A.P. is $m^2 : n^2$. Show that the ratio of the m^{th} and n^{th} terms is $(2m - 1) : (2n - 1)$. **[4]**

30. A man is standing on the deck of a ship, which is 10 m above the water level. He observes that the angle of elevation of the top of a hill is 60° and the angle of depression of the base of the hill is 30°. Calculate the distance of the hill from the ship and height of the hill. **[4]**

31. Draw a circle of radius 4 cm. Take a point P outside the circle. Without using the centre of the circle, draw two tangents to the circle from the point P. **[4]**

32. A cuboid of dimensions 3 cm × 4 cm × 5 cm is cut out from a corner of a cube of dimensions 12 cm × 12 cm × 12 cm. Find out the total surface area and volume of the resulting figure. **[4]**

OR

From a solid cylinder whose height is 2.4 cm and diameter 1.4 cm, a conical cavity of the same height and same diameter is hollowed out. Find the total surface area of the remaining solid to the nearest cm^2.

33. Two pipes running together can fill a cistern in $3\frac{1}{13}$ minutes. If one pipe takes 3 minutes more than the other to fill it, then find the time in which each pipe would fill the cistern. **[4]**

OR

A plane left 30 minutes later than the scheduled time and in order to reach its destination 1500 km away in time, it has to increase its speed by 250 km/h from its usual speed. Find its usual speed.

34. Water flows at the rate of 10 metre per minute through a cylindrical pipe of diameter 5 mm. How much time will it take to fill a conical vessel whose diameter of the base is 40 cm and depth 24 cm? **[4]**

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SCIENCE (Theory)

Class - X (Code A)

Summative Assessment - II

SOLUTIONS

SECTION-A

A1. Ethanol burns with a clean flame giving a lot of heat therefore it is used as a fuel.

A2. Accommodation is the ability of the eye to change the focal length of the eye lens such that a sharp image is always formed on the retina, for both nearby and distant objects.

A3. Chlorofluoro carbons.

A4. There are two main components of an ecosystem *i.e.* Biotic and Abiotic component.

A5. (i) The element which has two shells in its atom should belong to second period. Therefore, element Y belongs to second period.

(ii) The element having 2 electrons in K-shell only or 8 electrons in its valence shell should belong to eighteenth group that is of noble gases. So, element X belongs to eighteenth group.

A6. X would most likely to be in group 2 since it has two valence electrons.

A7. Air pollution is caused by burning of coal or petroleum products. The oxides of carbon, nitrogen and sulphur that are released on burning of fossil fuels are acidic oxides. These lead to acid rain which affects our water and soil resources. They are non-renewable resources and their amount is limited.

A8. **Social problems :** They displace large number of peasants and tribals without adequate compensation or rehabilitation.

Environmental problems : They contribute enormously to deforestation and loss of biological diversity.

A9. **Snell's law :** The ratio of sine of angle of incidence to the sine of angle of refraction is a constant, for the light of a given colour and for the given pair of media. This law is also known as Snell's law. If *i* is the angle of incidence and *r* is the angle of refraction, then $\frac{\sin i}{\sin r} = \text{constant}$.

A10. Hypermetropia is a defect of vision and is also known as far sightedness. A person with hypermetropia can see distant objects clearly but cannot see nearby objects distinctly. It can be corrected by using a convex lens of appropriate power.

A11. The splitting of white light into its constituent colours is called dispersion. When white light passes through a glass prism, its inclined refracting surfaces bend different colours of light through different angles with respect to the incident ray. Thus we obtain a spectrum of colours.

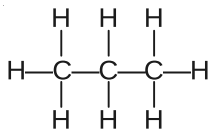
A12. Plants which are raised by vegetative propagation could bear flowers and fruits earlier than those produced from seeds. By this methods plants like banana, orange, rose and jasmine can be propagated which have lost the capacity of seed production.

A13. The sperm formation occurs in testes. Testes are located in scrotum outside the abdominal cavity because formation of sperms require a lower temperature as compared to the normal body temperature.

A14. (i) Yes, the elements are arranged in the pattern of a period of periodic table.

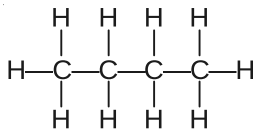
(ii) Fluorine 2, 7

A15. (i) C_3H_8 : None

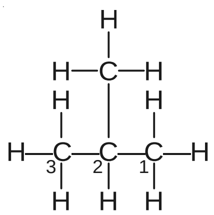


Common name : n-propane
IUPAC name : Propane

(ii) C_4H_{10} : 2

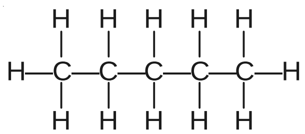


Common name : n-butane
IUPAC name : Butane

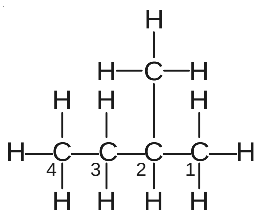


Common name : Isobutane
IUPAC name : 2-methyl propane

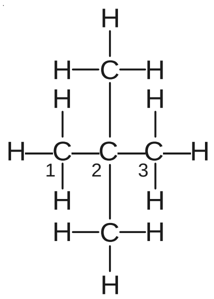
(iii) C_5H_{12} : 3



Common name : n-pentane
IUPAC name : Pentane



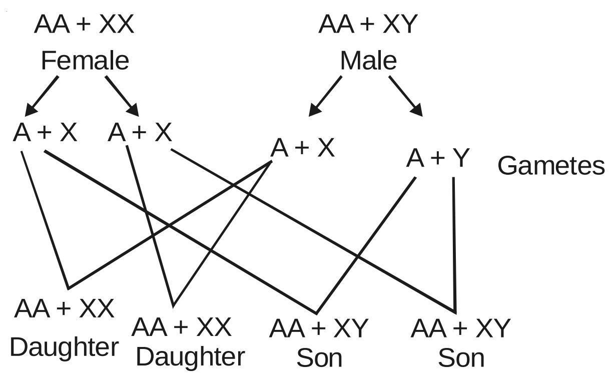
Common name : Isopentane
IUPAC name : 2-methyl butane



Common name : Neopentane
IUPAC name : 2,2-dimethyl propane

A16. Sexual reproduction is a highly evolved process and has many advantages over asexual reproduction. Sexual reproduction promotes diversity of characters in offsprings because it results from the fusion of two gametes coming from two sexually distinct individuals. In sexual reproduction, new combination of characters are formed which plays a prominent role in the origin of new species. It leads to variations, which are necessary for evolution.

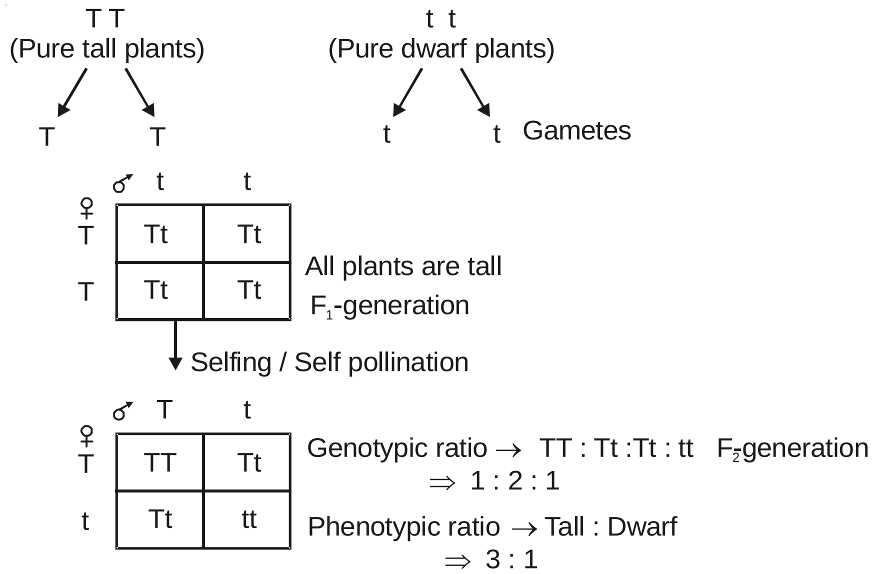
A17. Chromosomes which are associated with sex determination in humans are called sex chromosomes. Women have a perfect pair of sex chromosomes both called X. Men have one normal sized X and one short Y chromosome . So women are XX and Men are XY. Sex of a zygote depends on the fact that ovum get fertilized by which type of sperm *i.e.* sex of a child is determined by what they inherit from their father.



A18. Impressions, remains and traces of past organisms which are found in sedimentary rocks, peat, lava and snow etc. are called as fossils. There are two ways to determine the age of a fossil. The first way is relative. If we dig the earth and start finding fossils, it is reasonable to suppose that the fossils, we find closer to the surface are more recent than the fossils present in deeper layers. The second way of dating fossils is by detecting the ratios of different isotopes of the same element in the fossil material.

A19. A monohybrid cross is made by mating individuals from two parents, differing in only one pair of contrasting traits.

Punnet square



A20. $f = -40$ cm

$u = -20$ cm

Mirror formula :

$$\Rightarrow \frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{v} = \frac{1}{f} - \frac{1}{u}$$

$$\Rightarrow \frac{1}{v} = \frac{1}{-40} - \frac{1}{-20}$$

$$\Rightarrow \frac{1}{v} = \frac{1}{20} - \frac{1}{40}$$

$$\Rightarrow \frac{1}{v} = \frac{2-1}{40} = \frac{1}{40}$$

$\therefore \quad v = +40$ cm

Magnification : -

$$m = -\frac{v}{u}$$

$$\Rightarrow \quad m = -\frac{40}{-20} \qquad [\because \ u = -20 \text{ cm given}]$$

$$\Rightarrow \quad m = +2$$

A21. We are given

$v_1 = 2 \times 10^8$ m/s

$v_2 = 1 \times 10^8$ m/s

from the formula

$$n = \frac{c}{v} \qquad \text{(where } c \text{ is speed of light in air)}$$

$$n_1 = \frac{c}{v_1}$$

$$n_2 = \frac{c}{v_2}$$

$$\frac{n_1}{n_2} = \frac{c.v_2}{v_1.c} = \frac{v_2}{v_1}$$

$$\frac{n_1}{n_2} = \frac{v_2}{v_1} = \frac{1\times10^8}{2\times10^8} = \frac{1}{2}$$

$$\frac{n_1}{n_2} = \frac{1}{2}$$

A22. Since the near point is farther than the normal near point, the person is suffering from far-sightedness or hypermetropia. So convex lens is the corrective lens.

For a lens, we have,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

Object distance u = – 25 cm (For normal eye)

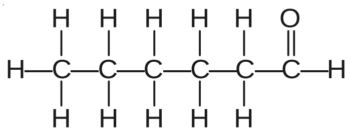
Image distance v = – 50 cm

$$\frac{1}{f} = -\frac{1}{50} - \frac{1}{-25} = \frac{-1}{50} + \frac{1}{25} = \frac{1}{50}$$

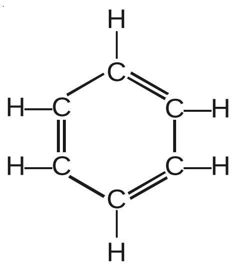
$\Rightarrow$ f = 50 cm = 0.5 m

$$P = \frac{1}{f\text{ (in metre)}} = \frac{1}{0.5} = \frac{100}{50} = +2\text{ D}$$

A23. (a) (i) Hexanal



(ii) Benzene



(b) Each carbon atom in a diamond crystal is linked to four other carbon atoms by strong covalent bonds. The four surrounding carbon atoms are at the four vertices of a regular tetrahedron. This structure of diamond is made up of carbon atoms which are tightly bonded to one another by a network of covalent bonds. Due to this the structure of diamond is very rigid. Whereas a graphite crystal consists of layers of carbon atoms which are joined to each other by covalent bonds to form flat hexagonal rings. But these layers are very far apart and are held together by weak van der Waals forces. Therefore, these layers can easily slide over one another, due to which graphite is a comparatively soft substance.

OR

Soap: "A soap is the sodium salt (or potassium salt) of a long chain carboxylic acid (fatty acid) which has cleansing properties in water". Soap is made by heating animal fat or vegetable oil with concentrated sodium hydroxide solution.

$$\underset{\text{(An ester)}}{\text{Fat or oil}} + \text{conc. NaOH} \xrightarrow{\Delta} \underset{\text{(Sodium salt of fatty acid)}}{\text{Soap}} + \underset{\text{(Alcohol)}}{\text{Glycerol}}$$

The process of making soap by hydrolysis of fats and oils with alkalis is called Saponification.

Detergents: A detergent is the sodium salt of a long chain benzene sulphonic acid (or the sodium salt of a long chain alkyl hydrogen sulphate). Which has cleansing properties in water.

Example: $CH_3 - (CH_2)_{11} - C_6H_4 - SO_3^- Na^+$

Sodium n-dodecylbenzenesulphonate

(A common detergent)

Advantages and disadvantages of detergents over soaps:

Detergents have a number of advantages over soaps

(i) Detergents can be used even with hard water whereas soaps are not suitable for the same.

(ii) Detergents have a strong cleansing action than soaps.

(iii) Detergents are more soluble than soaps.

An important disadvantage of detergents over soaps is that some of the detergents are not biodegradable while most of the soaps are biodegradable.

Cleansing action of soaps and detergents:

Cleansing action of soaps and detergents is same. The only difference is that soaps have relatively weak cleansing action than detergents.

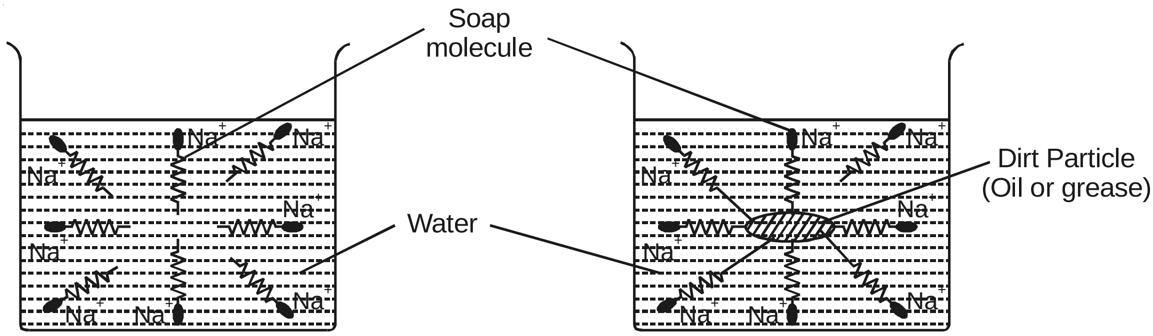


Figure: Cleansing Action of Soap

When a dirty cloth is put in water containing dissolved soap, then the hydrocarbon ends of the soap molecules in the micelle attach to the oil or grease particles present on the surface of dirty cloth. In this way the soap micelle entraps the oily or greasy particles by using its hydrocarbon ends.

A24. Contraceptive methods fall under a number of categories such as:

(a) **Barrier Methods:**

In this method, there is a creation of mechanical barrier so that sperms do not reach the ovum.

e.g.: **Condoms:** This not only helps in avoiding unwanted pregnancy but also protects individuals from S.T.Ds.

(b) **Hormonal Method:**

This category of contraceptive act by changing hormonal balance of the body so that eggs are not released and fertilization cannot occur. *e.g.* oral pills.

(c) **IUD: (Intrauterine devices):**

It includes loop, copper-T etc., which are placed in the uterus to prevent pregnancy.

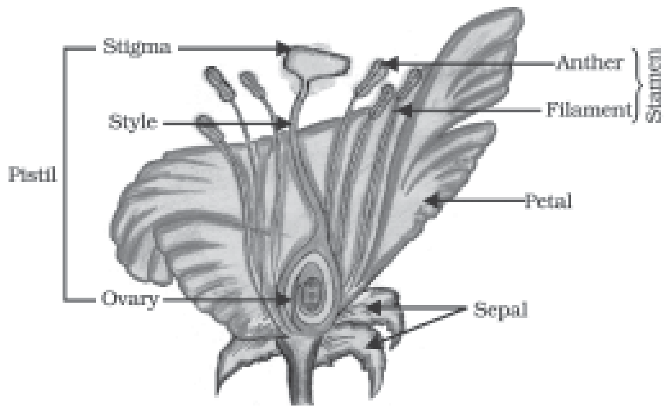
They can cause side effects such as irritation in uterine wall.

(d) **Surgical Methods:**

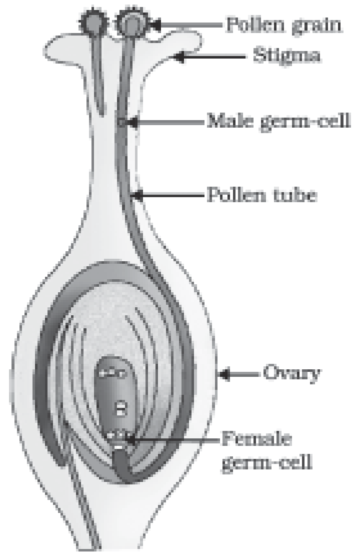
(i) **Male Sterilization:** It is performed by blocking the vas deferens so that transfer of sperms is prevented. It is also called **vasectomy**.

(ii) **Female Sterilization:** It can be achieved by blocking the fallopian tube so that fertilisation does not occur. It is also called **tubectomy**.

OR



Angiospermic Flower



Germination of pollen on stigma

A25. (a) Sign conventions used for spherical mirror are –

(i) The object is always placed to the left of the mirror.

(ii) All distances parallel to the principal axis are measured from the pole of the mirror.

(iii) All the distances measured to the right of the pole are taken as positive while those measured to the left of the pole are taken as negative.

(iv) Distances measured perpendicular to and above the principal axis are taken as positive

(v) Distances measured perpendicular to and below the principal axis are taken as negative

(b) Radius of curvature R = 16 cm

So, focal length $f = \frac{R}{2} = -8$ cm [$\because$ the mirror is concave]

Object distance u = –12 cm

So using mirror formula, $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$

$$\frac{1}{v} = \frac{1}{f}-\frac{1}{u}$$

$$= \frac{1}{-8}-\frac{1}{-12}=\frac{-1}{8}+\frac{1}{12}=-\frac{1}{24}$$

$\Rightarrow$ v = – 24 cm.

So, the image will be formed 24 cm from the mirror in front of it.

OR

Focal length f = 16 cm

Object distance u = – 12 cm

(a) We know that

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{v} = \frac{1}{f} + \frac{1}{u}$$

$$= \frac{1}{16} - \frac{1}{12}$$

$$\Rightarrow \frac{1}{v} = -\frac{1}{48}, \text{ so } v = -48 \text{ cm}$$

The image is at the distance 48 cm from the lens on the object side.

(b) Since the image is formed on the same side as the object, so the image formed is virtual.

(c) The magnification is

$$m = \frac{v}{u} = \frac{-48}{-12}$$

$$= 4$$

or $\frac{h\text{ (image)}}{h\text{ (object)}} = 4$

height of image = 4 × height of object

= 4 × 1.0

= 4.0 cm

(d) The image is erect.

SECTION-B

26. (2)	27. (2)	28. (2)	29. (4)
30. (3)	31. (4)	32. (3)	33. (4)
34. (2)	35. (4)	36. (1)	37. (4)
38. (1)	39. (3)	40. (2)	41. (1)

❑ ❑ ❑

MATHEMATICS

Class - X (Code A)

Summative Assessment - II

SOLUTIONS

SECTION - A

1. Answer (2)

$D = b^2 - 4ac$

$= (-2\sin\theta)^2 + 4\cos^2\theta$

$= 4\sin^2\theta + 4\cos^2\theta$

$= 4(\sin^2\theta + \cos^2\theta)$

$= 4$ $\quad \left[\because \sin^2\theta + \cos^2\theta = 1\right]$

2. Answer (3)

First term = a

Second term = b

Common difference , $d = b - a$

Last term = $2a$

$\therefore \; 2a = a + (n-1)(b-a)$

$2a = a + nb - na - b + a$

$nb - na = b$

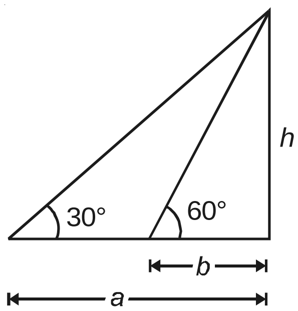
$n = \dfrac{b}{(b-a)}$

Also, sum = $\dfrac{n}{2}[a + 2a]$

$\therefore$ Sum = $\dfrac{3a.n}{2} \Rightarrow$ Sum = $\dfrac{3ab}{2(b-a)}$

Hence, the correct option is (3)

3. Answer (2)



$\dfrac{h}{b} = \tan 60° = \sqrt{3} \quad \Rightarrow \quad h = b\sqrt{3} \quad$ ... (1)

$\dfrac{h}{a} = \tan 30° = \dfrac{1}{\sqrt{3}} \quad \Rightarrow \quad h = \dfrac{a}{\sqrt{3}} \quad$ ... (2)

On multiplying (1) & (2), we get

$h^2 = ab \Rightarrow h = \sqrt{ab}$

Hence, (2) is the correct option.

4. Answer (2)

Now, $AP = AS$

$BP = BQ$ [∵ Tangents drawn from an external point to the circle are equal in length]

$DR = DS$

$CR = CQ$

On adding all the equations, we get

$AB + CD = BC + AD$

⇒ $6 + 4 = 7 + x$ (Let $AD = x$)

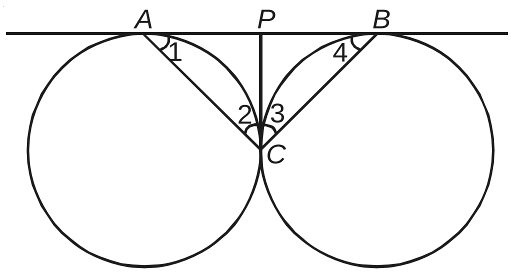
⇒ $10 = 7 + x$

⇒ $x = 10 - 7 = 3$

5. Answer (4)

In ΔAPC

$AP = PC$ (Tangents drawn from an external point to the circle are equal in length)



∴ $\angle 1 = \angle 2$

Similarly, $BP = PC$

∴ $\angle 3 = \angle 4$

Now, In ΔABC

$\angle 1 + \angle 2 + \angle 3 + \angle 4 = 180^o$

$2(\angle 2 + \angle 3) = 180^o$

$\angle 2 + \angle 3 = 90^o$

$\angle ACB = 90^o$

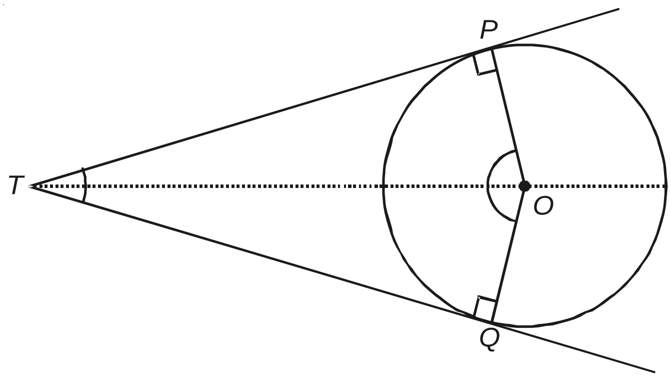
6. Answer (1)

Perimeter of semi-circular protactor $= \pi r + d$

$= \frac{22}{7} \times 7 + 14$

$= 36$ cm

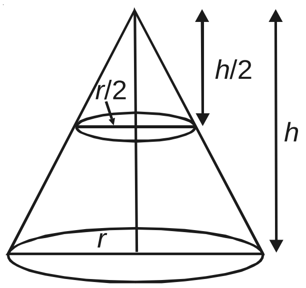
7. Answer (2)



Angle between two tangents drawn from an external point to a circle is supplementary to the angle subtended by the line segments joining the points of contact at the centre.

8. Answer (4)

Volume of the cone $= \frac{1}{3}\pi r^2 h$



$$\frac{\text{Volume of the upper part}}{\text{Volume of the cone}} = \frac{\frac{1}{3}\pi\left(\frac{r}{2}\right)^2\left(\frac{h}{2}\right)}{\frac{1}{3}\pi r^2 h}$$

$$= \frac{\frac{r^2}{4}\cdot\frac{h}{2}}{r^2.h} = \frac{1}{8}$$

Hence, (4) is the correct option.

9. Answer (4)

A non-leap year (365 days) has 52 Sundays.

The remaining one day can be Sunday, Monday, Tuesday, Wednesday, Thursday, Friday or Saturday.

Hence, the probability that a non-leap year will have 53 Sundays is $\frac{1}{7}$.

Hence, (4) is the correct option.

10. Answer (3)

11. $AD = AE$ ... (1) (Tangents drawn from an external point to the circle are equal in length.)

Also, $AE = AB + BE$ ... (2)

and $BE = BF$ ... (3)

$\Rightarrow AE = AB + BF$ ... (i)

Similarly, $AD = AC + CF$ ... (ii)

On adding (i) and (ii), we get

$2AD = AB + AC + (BF + FC)$

$\Rightarrow 2AD = AB + AC + BC$

Hence proved

12. For equal roots

$D = 0$

$\Rightarrow b^2 - 4ac = 0$

$\Rightarrow (-2k)^2 - 4 \times (2k - 1) = 0$

$\Rightarrow 4[k^2 - 2k + 1] = 0$

$\Rightarrow k^2 - 2k + 1 = 0$

$\Rightarrow (k - 1)(k - 1) = 0$

$\therefore k = 1$

13. Diameter of the circle = 1 m.

$\therefore$ Radius of the circle is $\frac{1}{2}$m

Area of the circle $= \pi r^2 = \pi\left(\frac{1}{2}\right)^2 = \frac{\pi}{4}\text{m}^2$

Area of the rectangle = Length × Breadth

= 3 m × 2 m

= 6 m^2

$\therefore$ Required probability $= \frac{\text{Area of the circle}}{\text{Area of the rectangle}}$

$= \frac{\frac{\pi}{4}}{6} = \frac{\pi}{4} \times \frac{1}{6}$

$= \frac{\pi}{24}$

OR

Number of Red balls = 3

Number of Black balls = 5

Total balls = 3 + 5 = 8

P (Red ball) = $\frac{3}{8}$

P (Not a red ball) = $1 - \frac{3}{8} = \frac{5}{8}$

14. Consider

$\sqrt{2} + \sqrt{8} + \sqrt{18} + \sqrt{32} + ...$ upto n terms

$= \sqrt{2} + 2\sqrt{2} + 3\sqrt{2} + 4\sqrt{2} + ...$ upto n terms

$= \sqrt{2}(1 + 2 + 3 + 4 + ...$ upto n terms)

$= \sqrt{2}.\frac{n(n+1)}{2} = \frac{\sqrt{2}n(n+1)}{2}$

15. We know that any point on x-axis is of the form (x, 0). So, let P(x, 0) be the point equidistant from A(2, –5) and B(–2, 9). Then,

$PA = PB$

$\Rightarrow \sqrt{(x-2)^2 + (0+5)^2} = \sqrt{(x+2)^2 + (0-9)^2}$

$\Rightarrow (x-2)^2 + 25 = (x+2)^2 + 81$

$\Rightarrow x^2 - 4x + 4 + 25 = x^2 + 4x + 4 + 81$

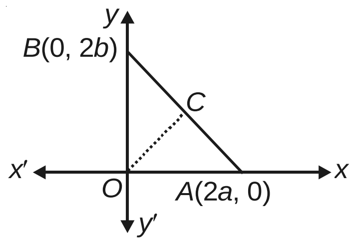
$\Rightarrow -8x = 56$

$\Rightarrow x = -7$

Hence, the point is (–7, 0)

16. Since, C is the mid point of AB

$\therefore$ Co-ordinates of C are $\left(\frac{0+2a}{2}, \frac{2b+0}{2}\right) = (a, b)$



Now, $CO = \sqrt{(a-0)^2 + (b-0)^2} = \sqrt{a^2 + b^2}$

$CA = \sqrt{(a-2a)^2 + (b-0)^2} = \sqrt{a^2 + b^2}$

$CB = \sqrt{(a-0)^2 + (b-2b)^2} = \sqrt{a^2 + b^2}$

$\therefore$ C is equidistant from the vertices A, B and O.

17. We have,

Radius of the wheel = $r = \frac{60}{2} = 30$ cm

Circumference of the wheel = $2\pi r = 2 \times \frac{22}{7} \times 30 \text{ cm} = \frac{1320}{7}$ cm

Distance covered in one revolution = Circumference $= \frac{1320}{7}$ cm

$\therefore$ Distance covered in 140 revolutions $= 140 \times \frac{1320}{7}$ cm

= 26400 cm

$= \frac{26400}{100}$ m

= 264 m

$= \frac{264}{1000}$ km

It is given that the wheels are making 140 revolutions per minute.

So, distance covered in one minute = Distance covered in 140 revolutions

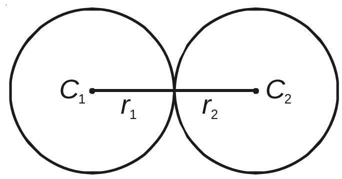
$\Rightarrow$ Distance covered in one minute $= \frac{264}{1000}$ km

$\Rightarrow$ Distance covered in one hour $= \frac{264}{1000} \times 60$ km

= 15.84 km

$\therefore$ Speed of the boy = 15.84 km/h

18. Let the radii of the two circles be r_1 cm and r_2 cm respectively.
Let C_1 and C_2 be the centres of the given circles, then



$C_1C_2 = r_1 + r_2$

$\Rightarrow$ $r_1 + r_2 = 14$ ... (1)

It is given that the sum of the areas of the two circles is 130π sq. cm

$\pi r_1^2 + \pi r_2^2 = 130\pi$

$r_1^2 + r_2^2 = 130$ ... (2)

Now, $(r_1 + r_2)^2 = (14)^2$

$r_1^2 + r_2^2 + 2r_1r_2 = 196$

$130 + 2r_1r_2 = 196$

$2r_1r_2 = 66$

$r_1r_2 = 33$ ... (3)

Now, $(r_1 - r_2)^2 = r_1^2 + r_2^2 - 2r_1r_2$

$= 130 - 2 \times 33$

$= 130 - 66$

$= 64$

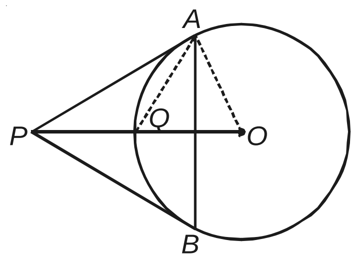
$\Rightarrow$ $r_1 - r_2 = 8$ ... (4)

Solving (1) & (4), we get

$r_1 = 11$ cm and $r_2 = 3$ cm

$\therefore$ Radii of the two circles are 11 cm and 3 cm.

19. Suppose *OP* meets the circle at *Q*. Join *AQ* and *AO*.



We have,

OP = diameter

$\Rightarrow$ *OQ* + *PQ* = diameter

$\Rightarrow$ *PQ* = diameter – radius [$\because$ *OQ* = radius]

$\Rightarrow$ *PQ* = radius

Thus, *OQ* = *PQ* = radius

Thus, *OP* is the hypotenuse of the right triangle *OAP* and *Q* is the mid-point of *OP*.

$\because$ *OA* = *AQ* = *OQ* [$\because$ Mid-point of hypotenuse of a right triangle is equidistant from the vertices]

$\Rightarrow$ ΔOAQ is equilateral

$\Rightarrow$ $\angle AOQ = 60°$

So, $\angle APO = 30°$

$\therefore$ $\angle APB = 2\angle APO = 60°$ [$\because$ Tangents drawn from an external point to the circle are equal in length]

Also, *PA* = *PB*

$\Rightarrow$ $\angle PAB = \angle PBA$

But, $\angle APB = 60°$. Therefore, $\angle PAB = \angle PBA = 60°$

Hence, ΔAPB is an equilateral triangle.

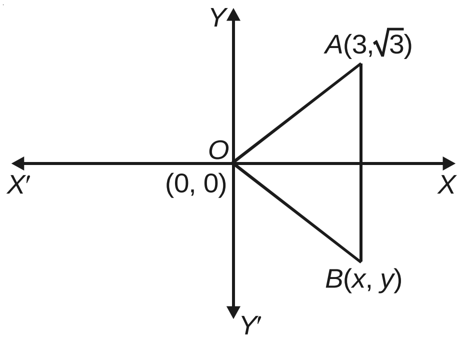
20. Let $B(x, y)$ be the third vertex of equilateral ΔOAB and $O(0, 0)$ and $A(3, \sqrt{3})$ be the other two vertices.

Then,

$$OA = OB = AB$$

$$\Rightarrow \quad OA^2 = OB^2 = AB^2$$

We have, $OA^2 = (3-0)^2 + (\sqrt{3}-0)^2 = 12$



$OB^2 = x^2 + y^2$

$AB^2 = (x-3)^2 + (y-\sqrt{3})^2$

$\Rightarrow AB^2 = x^2 + y^2 - 6x - 2\sqrt{3}y + 12$

$\therefore OA^2 = OB^2 = AB^2$

Now, $OA^2 = OB^2$ and $OB^2 = AB^2$

$\Rightarrow x^2 + y^2 = 12$ ... (1)

and $x^2 + y^2 = x^2 + y^2 - 6x - 2\sqrt{3}y + 12$

$$6x + 2\sqrt{3}y = 12$$

$$\Rightarrow 3x + \sqrt{3}y = 6$$

$$\Rightarrow y = \frac{6-3x}{\sqrt{3}} \quad \text{... (2)}$$

$$x^2 + \left(\frac{6-3x}{\sqrt{3}}\right)^2 = 12 \quad \text{[From (1) \& (2)]}$$

$$3x^2 + (6-3x)^2 = 36$$

$$12x^2 - 36x = 0$$

$$x = 0, 3$$

when, x = 0, $y = 2\sqrt{3}$

and $x = 3$, $y = -\sqrt{3}$

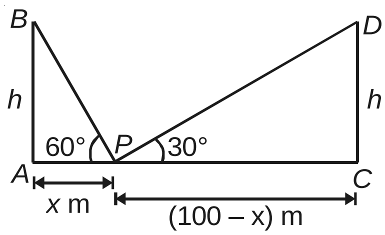
$\therefore$ The co-ordinates of the third vertex B are $(0, 2\sqrt{3})$ or $(3, -\sqrt{3})$

21. Let AB and CD be two pillars, each of height h m. Let P be the point on the road such that $AP = x$ m.

$\therefore CP = (100 - x)$ m

$\angle APB = 60°$, $\angle CPD = 30°$

In ΔPAB,



$$\tan 60^\circ = \frac{AB}{AP}$$

$$\Rightarrow \sqrt{3} = \frac{h}{x}$$

$$\Rightarrow h = \sqrt{3}x \quad \text{...(i)}$$

In ΔPCD,

$$\tan 30° = \frac{CD}{PC}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{100 - x}$$

$$h\sqrt{3} = 100 - x \qquad \text{...(ii)}$$

From (i) & (ii), we get

$3x = 100 - x$

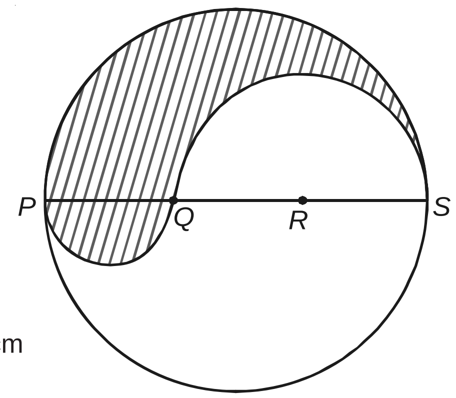
$\Rightarrow \quad x = 25$

$\Rightarrow \quad h = 25\sqrt{3} = 43.3$ m

Thus, the required point is at a distance of 25 m from the first pillar and 75 m from the second pillar.

The height of the pillar is 43.3 m.

22. We have,



PS = Diameter of the circle of radius 6 cm = 12 cm

$\therefore \quad PQ = QR = RS = \frac{12}{3} = 4$ cm

$QS = QR + RS = (4 + 4)$ cm = 8 cm

Hence, required perimeter

= arc of semicircle of radius 6 cm + arc of semicircle of radius 4 cm + arc of semicircle of radius 2 cm

= $(\pi \times 6 + \pi \times 4 + \pi \times 2)$ cm

= 12π cm

Required area = Area of semi-circle with PS as diameter + Area of semi-circle with PQ as diameter – Area of semi-circle with QS as diameter.

$$= \frac{1}{2} \times \frac{22}{7} \times 6^2 + \frac{1}{2} \times \frac{22}{7} \times 2^2 - \frac{1}{2} \times \frac{22}{7} \times 4^2$$

$$= \frac{1}{2} \times \frac{22}{7}(6^2 + 2^2 - 4^2)$$

$$= \frac{1}{2} \times \frac{22}{7} \times 24 = \frac{264}{7} \text{ cm}^2 = 37.71 \text{ cm}^2$$

23. Let S_1 and S_2 be two squares. Let the side of the square S_2 be x cm in length.

Then, the side of the square S_1 will be $(x + 4)$ cm.

$\therefore$ Area of square $S_1 = (x + 4)^2$

Area of square $S_2 = x^2$

According to the given conditions,

$(x + 4)^2 + x^2 = 400$

$2x^2 + 8x - 384 = 0$

$x^2 + 4x - 192 = 0$

$x^2 + 16x - 12x - 192 = 0$

$(x + 16)(x - 12) = 0$

$\Rightarrow$ x = 12 or –16

As length can't be negative

$\therefore$ $x = 12$

Side of the square $S_1 = 12 + 4 = 16$ cm and side of the square $S_2 = 12$ cm.

OR

We have,

$$x = \frac{1}{2 - \frac{1}{2 - \frac{1}{2 - x}}}$$

$$\Rightarrow x = \frac{1}{2 - \frac{1}{\frac{2(2-x)-1}{2-x}}}$$

$$\Rightarrow x = \frac{1}{2 - \frac{2-x}{4-2x-1}}$$

$$\Rightarrow x = \frac{1}{2 - \frac{2-x}{3-2x}}$$

$$\Rightarrow x = \frac{3-2x}{2(3-2x)-(2-x)}$$

$$\Rightarrow x = \frac{3-2x}{4-3x}$$

$\Rightarrow$ $x(4 - 3x) = 3 - 2x$

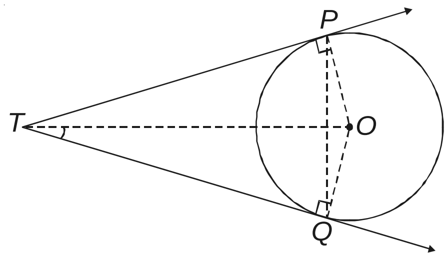
$\Rightarrow$ $4x - 3x^2 = 3 - 2x$

$\Rightarrow$ $3x^2 - 6x + 3 = 0$

$\Rightarrow$ $x^2 - 2x + 1 = 0$

$\Rightarrow$ $x = 1, 1$

24. Length of tangents drawn from an external point to a circle are equal.



$\therefore$ $TP = TQ$

$\Rightarrow$ ΔTPQ is an isosceles triangle

$\angle TPQ = \angle TQP$

In ΔTPQ, we have

$\angle TPQ + \angle TQP + \angle PTQ = 180°$

$2\angle TPQ = 180° - \angle PTQ$

$$\angle TPQ = 90 - \frac{1}{2}\angle PTQ$$

$$\frac{1}{2}\angle PTQ = 90 - \angle TPQ \quad ...(i)$$

Since, $OP \perp TP$

$\therefore$ $\angle OPT = 90°$

$\Rightarrow$ $\angle OPQ + \angle TPQ = 90°$

$\Rightarrow$ $\angle OPQ = 90° - \angle TPQ$ ...(ii)

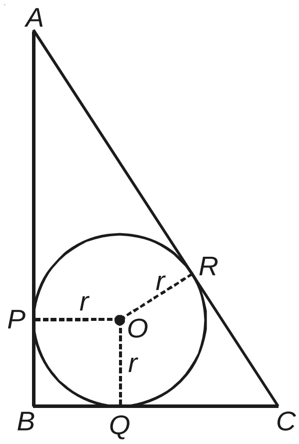
From (i) and (ii), we get

$$\frac{1}{2}\angle PTQ = \angle OPQ$$

$\angle PTQ = 2\angle OPQ$

Hence proved

OR



We have,

$AR = AP = AB - BP = (8 - r)$ cm

and, $CR = CQ = CB - BQ = (6 - r)$ cm

$\therefore$ $AC = AR + CR = (8 - r + 6 - r)$ cm $= (14 - 2r)$ cm

Now, $AC^2 = AB^2 + BC^2 \Rightarrow (14 - 2r)^2 = 8^2 + 6^2 \Rightarrow r = 2$ cm $(\because r \neq 12)$

25. $a = 20$

$$d = \frac{-3}{4}$$

Let n^{th} term be the first negative term then, $a_n < 0$

$\Rightarrow$ $a + (n - 1)d < 0$

$$\Rightarrow \quad 20 + (n-1)\left(\frac{-3}{4}\right) < 0$$

$$\Rightarrow \quad \frac{83}{4} - \frac{3n}{4} < 0$$

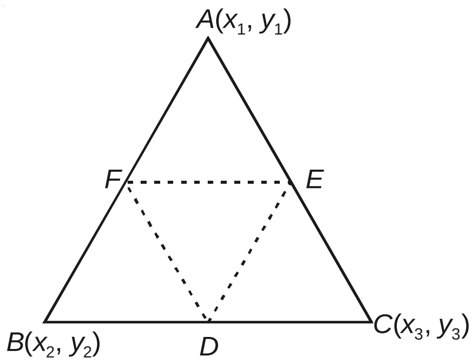
$\Rightarrow$ $83 - 3n < 0$

$\Rightarrow$ $3n > 83$

$$\Rightarrow \quad n > 27\frac{2}{3} \Rightarrow n \geq 28$$

Thus, 28^{th} term is the first negative term of the given AP.

26. Let $A(x_1, y_1)$, $B(x_2, y_2)$ and $C(x_3, y_3)$ be the vertices of ΔABC.



$\therefore$ The co-ordinates of $D = \left(\frac{x_2 + x_3}{2}, \frac{y_2 + y_3}{2}\right)$

The co-ordinates of $E = \left(\frac{x_1 + x_3}{2}, \frac{y_1 + y_3}{2}\right)$

The co-ordinates of $F = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

Now,

Δ_1 = Area of ΔABC

$$= \frac{1}{2} | x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2) |$$

Δ_2 = area of ΔDEF

$$= \frac{1}{2}\left|\left(\frac{x_2 + x_3}{2}\right)\left(\frac{y_1 + y_3}{2} - \frac{y_1 + y_2}{2}\right) + \left(\frac{x_1 + x_3}{2}\right)\left(\frac{y_1 + y_2}{2} - \frac{y_2 + y_3}{2}\right) + \left(\frac{x_1 + x_2}{2}\right)\left(\frac{y_2 + y_3}{2} - \frac{y_1 + y_3}{2}\right)\right|$$

$$= \frac{1}{8} | (x_2 + x_3)(y_3 - y_2) + (x_1 + x_3)(y_1 - y_3) + (x_1 + x_2)(y_2 - y_1) |$$

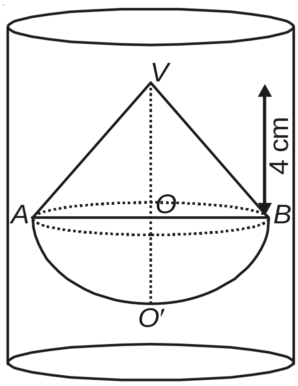
$$\Delta_2 = \frac{1}{8} | x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2) |$$

$$\Delta_2 = \frac{1}{4}(\text{Area of } \Delta ABC) = \frac{1}{4}\Delta_1$$

Hence, Area of $\Delta DEF = \frac{1}{4}$ Area of ΔABC

27. We have, $VO = 4$ cm, $OA = OB = OO' = 3.5$ cm

Volume of solid = volume of conical part + volume of semi-spherical part



Volume of solid = $\left\{\frac{1}{3} \times \frac{22}{7} \times (3.5)^2 \times 4 + \frac{2}{3} \times \frac{22}{7} \times (3.5)^3\right\}$ cm^3

$$= \left\{\frac{1}{3} \times \frac{22}{7} \times \left(\frac{7}{2}\right)^2 \times 11\right\} \text{ cm}^3$$

We known that, when the solid is submerged in the cylindrical tub, then the volume of the water that flows out of the cylinder is equal to the volume of the solid.

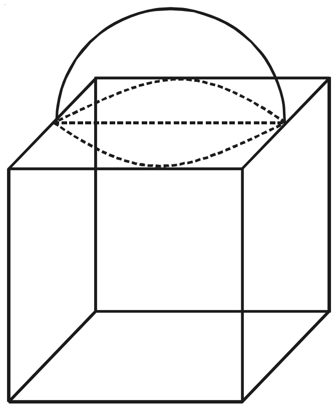
Hence,

Volume of water left in cylinder = volume of cylinder – volume of solid

$$= \left\{\frac{22}{7}\times(5)^2\times 10.5-\frac{1}{3}\times\frac{22}{7}\times\left(\frac{7}{2}\right)^2\times 11\right\}\text{ cm}^3$$

$$= 683.83 \text{ cm}^3$$

OR



We know that the greatest diameter of the hemisphere is equal to the length of the edge of the cube *i.e.* 7 cm.

∴ Radius of the hemisphere = $\frac{7}{2}$ cm

Now,

total surface area of the solid = surface area of the cube
+ curved surface area of hemisphere
– area of the base of the hemisphere.

$$= \left\{6\times 7^2+2\times\frac{22}{7}\times\left(\frac{7}{2}\right)^2-\frac{22}{7}\times\left(\frac{7}{2}\right)^2\right\}\text{ cm}^2$$

$$= \left\{294+77-\frac{77}{2}\right\}\text{ cm}^2$$

$$= \left(294+\frac{77}{2}\right)\text{ cm}^2$$

$$= 332.5 \text{ cm}^2$$

28. Let there be b blue, g green and w white marbles in the jar.

Then, $b + g + w = 54$ ...(i)

∴ $P(\text{blue marble}) = \frac{b}{54}$

But, $P(\text{blue marble}) = \frac{1}{3}$ (given)

∴ $\frac{1}{3} = \frac{b}{54}$

⇒ $b = 18$

Similarly, $P(\text{green marble}) = \frac{4}{9} = \frac{g}{54}$

∴ ⇒ $g = 24$

On substituting values of b and g in (i), we get

$18 + 24 + w = 54$

∴ $w = 12$

∴ The jar contains 12 white marbles.

29. Let a be the first term and d be the common difference of the given A.P. Then, the sum of m and n terms are given by

$$S_m = \frac{m}{2}\{2a+(m-1)d\} \text{ and } S_n = \frac{n}{2}\{2a+(n-1)d\}$$

$$\therefore \frac{S_m}{S_n} = \frac{m^2}{n^2} \qquad \text{(given)}$$

$$\Rightarrow \frac{\frac{m}{2}\{2a+(m-1)d\}}{\frac{n}{2}\{2a+(n-1)d\}} = \frac{m^2}{n^2}$$

$$\Rightarrow \frac{2a+(m-1)d}{2a+(n-1)d} = \frac{m}{n}$$

$\Rightarrow$ $\{2a + (m - 1)d\}n = \{2a + (n - 1)d\}m$

$\Rightarrow$ $2a(n - m) = d\{(n - 1)m - (m - 1)n\}$

$\Rightarrow$ $2a(n - m) = d(n - m)$

$\Rightarrow$ $d = 2a$

Now, $\frac{T_m}{T_n} = \frac{a+(m-1)d}{a+(n-1)d} = \frac{a+(m-1)2a}{a+(n-1)2a} = \frac{2m-1}{2n-1}$

30. Suppose the man is standing on the deck of a ship at point A and let CD be the hill. It is given that the angle of depression of the base C of the hill CD observed from A is 30° and the angle of elevation of the top D of the hill CD observed from A is 60°. Then,

$\angle EAD = 60°$, $\angle BCA = 30°$

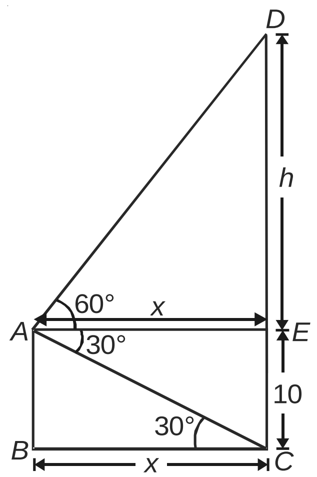
Also, $AB = 10$ m

In ΔAED,

$$\tan 60° = \frac{DE}{EA}$$

$$\Rightarrow \sqrt{3} = \frac{h}{x}$$

$\Rightarrow$ $h = \sqrt{3}x$ ...(i)



In ΔABC,

$$\tan 30° = \frac{AB}{BC}$$

$\Rightarrow$ $\frac{1}{\sqrt{3}} = \frac{10}{x} \Rightarrow x = 10\sqrt{3}$ ...(ii)

Putting $x = 10\sqrt{3}$ in (i), we get

$h = \sqrt{3} \times 10\sqrt{3} = 30$

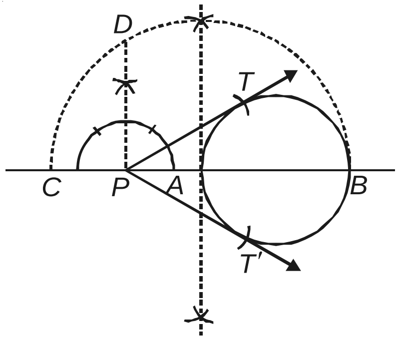
$\Rightarrow$ $DE = 30$ m

and $CD = CE + ED = 10 + 30 = 40$ m

$\therefore$ Distance of the hill from the ship = $10\sqrt{3}$ m

Height of the hill = 40 m

31. Steps of construction :



(i) Draw a circle of radius 4 cm.

(ii) Take a point *P* outside the circle and draw a secant *PAB*, intersecting the circle at *A* and *B.*

(iii) Produce *AP* to *C* such that *AP* = *CP.*

(iv) Draw a semicircle with *CB* as diameter.

(v) Draw $PD \perp CB$, intersecting the semicircle at *D*.

(vi) With *P* as centre and *PD* as radius, draw two arcs intersecting the given circle at *T* and *T′*.

(vii) Join *PT* and *PT′*.

Hence, *PT* and *PT′* are the required tangents.

32. Total surface area remains same

$\therefore$ $TSA = 6 \times (\text{side})^2 = 6 \times (12)^2$

$= 864 \text{ cm}^2$

Volume of the resulting figure = volume of cube – volume of cuboid

$= (\text{side})^3 - l \times b \times h$

$= (12 \times 12 \times 12 - 3 \times 4 \times 5) \text{ cm}^3$

$= (1728 - 60) \text{ cm}^3$

$= 1668 \text{ cm}^3$

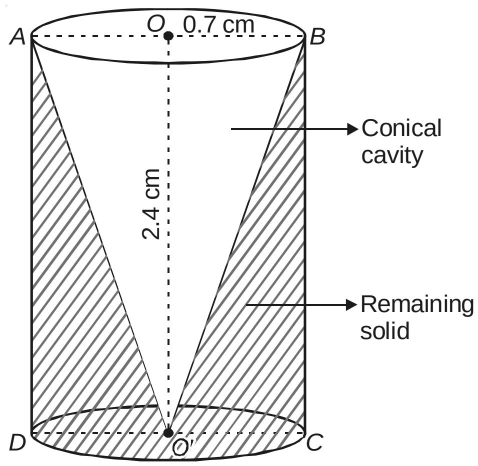
OR

Total surface area of the remaining solid

= curved surface area of cylinder

+ area of base of cylinder

+ curved surface area of cone.



$$= 2 \times \frac{22}{7} \times 0.7 \times 2.4 + \frac{22}{7} \times (0.7)^2 + \frac{22}{7} \times 0.7 \times \sqrt{(2.4)^2 + (0.7)^2}$$

$= 44 \times 0.24 + 22 \times 0.1 \times 0.7 + 22 \times 0.1 \times 2.5$

$[\because \; l = \sqrt{r^2 + h^2}]$

$= (10.56 + 1.54 + 5.5) \text{ cm}^2$

$= 17.6 \text{ cm}^2$

Hence, the total surface area to nearest cm^2 = 18

33. Let faster pipe takes *x* minutes to fill the cistern.

Therefore, the slower pipe will take $(x + 3)$ min

It is given that both the pipes together fill the cistern in $3\frac{1}{13}$ min *i.e.* $\frac{40}{13}$ min.

$\therefore$ The portion of cistern filled by the faster pipe in 1 min = $\frac{1}{x}$.

and the portion of the cistern filled by the slower pipe in 1 min = $\frac{1}{x+3}$

The portion of the cistern filled by both the pipes together in 1 min = $\frac{13}{40}$

According to the given condition,

$$\frac{1}{x}+\frac{1}{x+3}=\frac{13}{40}$$

$\Rightarrow$ $\frac{x+3+x}{x(x+3)}=\frac{13}{40}$

$\Rightarrow$ $40(2x + 3) = 13x(x + 3)$

$\Rightarrow$ $80x + 120 = 13x^2 + 39x$

$\Rightarrow$ $13x^2 - 41x - 120 = 0$

$\Rightarrow$ $(x - 5)(13x + 24) = 0$

$\Rightarrow$ $x = 5,\ x = \frac{-24}{13}$

Time can't be negative

$\therefore$ $x = 5$

Hence, faster pipe takes 5 minutes and slower pipe takes 8 minutes to fill the cistern.

OR

Let the usual speed of the plane be x km/h, then

time taken to cover 1500 km with the usual speed = $\frac{1500}{x}$ h

and time taken to cover 1500 km with the speed of $(x+250)$ km/h = $\frac{1500}{x+250}$ h

$\therefore$ According to the question,

$$\frac{1500}{x}=\frac{1500}{x+250}+\frac{1}{2}$$

$\Rightarrow$ $\frac{1500}{x}-\frac{1500}{x+250}=\frac{1}{2}$

$\Rightarrow$ $\frac{1500x+1500\times 250-1500x}{x(x+250)}=\frac{1}{2}$

$\Rightarrow$ $\frac{1500\times 250}{x^2+250x}=\frac{1}{2}$

$\Rightarrow$ $750000 = x^2 + 250x$

$\Rightarrow$ $x^2 + 250x - 750000 = 0$

$\Rightarrow$ $x^2 + 1000x - 750x - 750000 = 0$

$\Rightarrow$ $x(x + 1000) - 750(x + 1000) = 0$

$\Rightarrow$ $(x + 1000)(x - 750) = 0$

$\Rightarrow$ $x = -1000$ or $x = 750 \Rightarrow x = 750$

[$\because$ speed cannot be negative]

Hence, the usual speed of the plane is 750 km/h.

34. We have,

Volume of the water that flows out in one minute

= Volume of the cylinder of diameter 5 mm and length 10 m

= Volume of the cylinder of radius $\frac{5}{2}$ mm$\left(=\frac{1}{4}\text{cm}\right)$ and length 1000 cm

$$= \frac{22}{7} \times \frac{1}{4} \times \frac{1}{4} \times 1000 \text{ cm}^3$$

Volume of a conical vessel of base radius 20 cm and depth 24 cm

$$= \frac{1}{3} \times \frac{22}{7} \times (20)^2 \times 24 \text{ cm}^3$$

Suppose the conical vessel is filled in x minutes

$\therefore$ Volume of the water that flows out in x minutes = volume of the conical vessel

$$\Rightarrow \frac{22}{7} \times \frac{1}{4} \times \frac{1}{4} \times 1000 \times x = \frac{1}{3} \times \frac{22}{7} \times (20)^2 \times 24$$

$$\Rightarrow x = \frac{1}{3} \times \frac{400 \times 24 \times 4 \times 4}{1000}$$

$$= \frac{512}{10} \text{ minutes}$$

$\Rightarrow$ x = 51 minutes 12 seconds

❑ ❑ ❑