2025

(vii) For a real image formed by a convex lens, the ratio of **I : O = 2 : 5**, then the object is: *(I is the height of the image and O is the height of the object)*

(a) between O and F

(b) beyond 2F

(c) at F

(d) between F and 2F

(viii) A ray of light is incident normally on a face of an equilateral prism. The ray gets totally reflected at the second refracting surface. **The total deviation** produced in the path of the ray is:

(a) 30°

(b) 60°

(c) 90°

(d) 120°

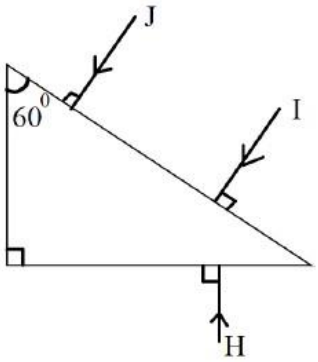
(b) Refractive index of a medium is **independent** of _____ *[temperature / angle of incidence / wavelength of light]*.

Question 3

(i) A ray of light enters a rectangular glass slab submerged in water at an angle of incidence 55°. Does this ray undergo **total internal reflection** when it moves from water to glass? Justify your answer. *(The critical angle for glass-water interface is 54°.)* [2]

Question 4

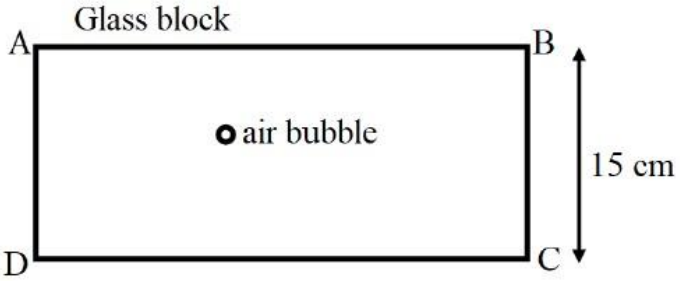
(i) [3]



(a) Out of the three rays (**I, J, H**) shown in the diagram, which ray will suffer **Total Internal Reflection** while inside the prism? *(Critical angle of the prism is 42°.)*

(b) Copy the diagram to complete the path of the ray which you have named in (a) till it comes out of the prism.

(ii) A rectangular glass block of refractive index 1.5 has an air bubble trapped inside it as shown in the diagram. When seen from the surface **AB**, it **appears** to be 4 cm deep. [3]



(a) Calculate the **actual depth** of the air bubble from the surface **AB**.

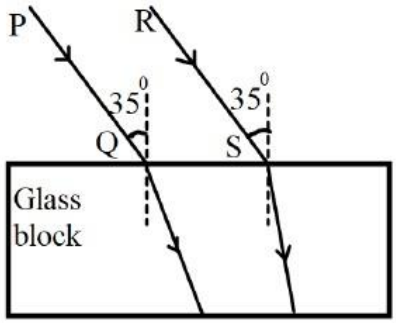
(b) For which colour of light, blue or yellow, the apparent depth will be **greater**?

(c) Turning the glass block upside down, **DOES NOT** change the apparent depth of the air bubble. State **True** or **False.**

Question 5

(i) An object is placed in front of a concave lens at a distance of 45 cm from it. If its image is formed at a distance of 30 cm from the lens, calculate the focal length of the lens. [3]

(ii) Two rays **PQ** and **RS** are incident on a rectangular glass block as shown in the diagram. Observe the diagram and answer the questions that follow. [3]



Which of these two rays will:

(a) have **greater** lateral displacement on emerging out of the block?

(b) travel with **greater** speed in the block?

(c) scatter **more** in the atmosphere?

2024

(xii) Linear magnification(m) produced by a concave lens is:

(a) $m < 1$

(b) $m > 1$

(c) $m = 1$

(d) $m = 2$

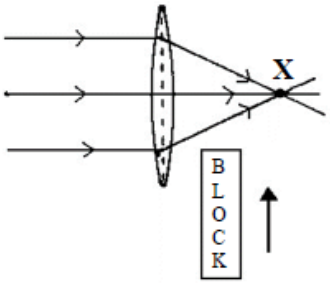
(xv) A block of glass is pushed into the path of the light as shown below. Then the converging point **X** will:

(a) Move away from the slab

(b) Move towards the slab

(c) Not shift

(d) Move towards the left side of the lens



Question 3

(i) (a) In a reading glass what is the position of the object with respect to the convex lens used? [2]

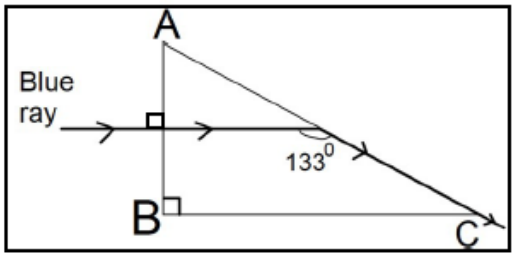
(b) Why can we **not** use concave lens for the same purpose?

Question 4

(i) The image of a **candle flame** placed at a distance of 36 cm from a spherical lens, is formed on a screen placed at a distance of 72 cm from the lens. Calculate the focal length of the lens and its power. [3]

(iii) (a) Why do we use red colour as a danger signal on the top of a skyscraper?

(b) The diagram below shows the path of a blue ray through the prism:



1. Calculate the critical angle of the material of the prism for blue colour.
2. What is the measure of the angle of this prism (A)?
3. Which colour should replace the blue ray, for the ray to undergo Total Internal Reflection?

(i) [3]

(a) Refractive index of glass with respect to water is $\frac{9}{8}$.

Find the refractive index of water with respect to glass.

(b) Name the principle used to find the value in part (a).

(c) If we change the temperature of water, then will the ratio $\frac{9}{8}$ remain the same? Write **Yes** or **No**.

(ii) Light travels a distance of ***'10x'*** units in time ***'t_1'*** in vacuum and it travels a distance of ***'x'*** units in time ***'t_2'*** in a denser medium. Using this information answer the question that follows: [3]

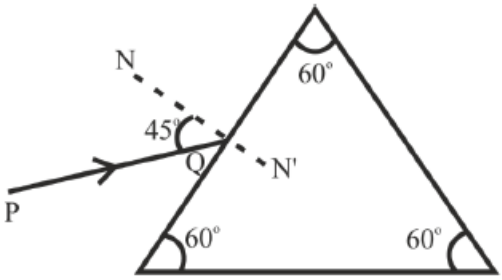
(a) *'Light covers a distance of **'20x'** units in time **'t_1'** in diamond.'* State true or false.

(b) Calculate the refractive index of the medium in terms of *'t_1'* and *'t_2'*.

(iii) A monochromatic ray of light is incident on an equilateral prism placed at **minimum deviation position** with an angle of incidence 45° as shown in the diagram. [4]

(a) Copy the diagram and complete the path of the ray PQ.

(b) State *two* factors on which the angle of deviation depends.



2023

(v) Speed of blue light in water is:

(a) more than green light

(b) more than orange light

(c) more than violet light

(d) more than red light

(vi) A concave lens produces only _____ image.

(a) real, enlarged

(b) virtual, enlarged

(c) virtual, diminished

(d) real, diminished

(xiv) When a ray of light travels normal to the given surface, then the angle of refraction is:

(a) 180°

(b) 90°

(c) 0°

(d) 45°

(xv) Small air bubbles rising up a fish tank appear silvery when viewed from some particular angle is due to the:

(a) reflection

(b) refraction

(c) dispersion

(d) total internal reflection

Question 3

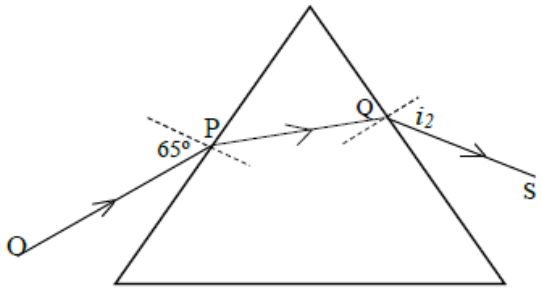
(i) (a) Is it possible for a concave lens to form an image of size two times that of the object? Write *Yes* or *No*. [2]

Question 4

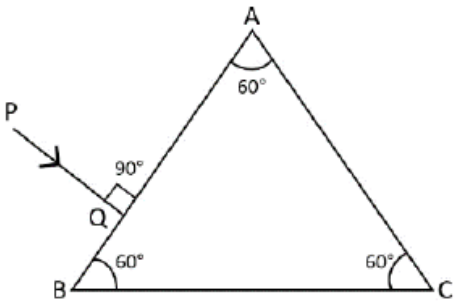
(i) The diagram below shows the ray **OP** travelling through an *equilateral* prism of a certain material. [3]

(a) Calculate the value of i_2, if the angle of deviation is 43°.

(b) What is the ray **QS** called?



(ii) Copy the diagram given below and complete the path of the light ray **PQ**, as it emerges out of the prism by marking necessary angles. The critical angle of glass is 42°. [3]

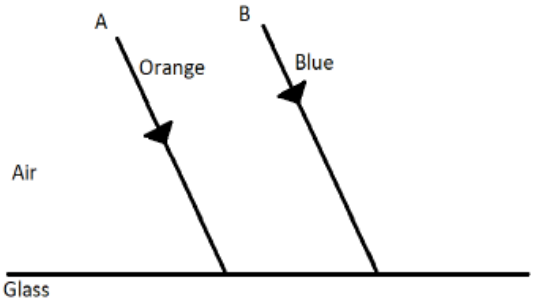


(iii) The diagram below shows two parallel rays **A** (Orange) & **B** (Blue) incident from air, on air-glass boundary. [4]

(a) Copy and complete the path of the rays **A** and **B**.

(b) How do the speeds of these rays differ in glass?

(c) Are the two refracted rays in glass parallel? Give a reason.



Question 5

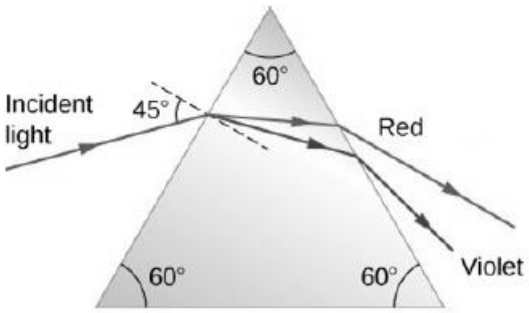
(i) A convex lens of focal length 10 cm is placed at a distance of 60 cm from a screen. How far from the lens should an object be placed so as to obtain a real image on the *screen*? [3]

(ii) (a) A coin kept inside water [μ=4/3] when viewed from air in a vertical direction appears to be raised by 3.0 mm. Find the depth of the coin in water. [3]

(b) How is the critical angle related to the refractive index of a medium?

(iii) (a) Infrared radiations are used in warfare. Explain with reason, why. [4]

(b) A ray of light is incident at 45° on an equilateral prism in the diagram below.



1. Name the phenomenon exhibited by the ray of light when it enters and emerges out of the prism.
2. State the cause of the above phenomenon mentioned by you.

2022

1. **The deviation produced by an equilateral prism does not depend on** [1]
   (a) the angle of incidence.
   (b) the size of the prism.
   (c) the material of the prism.
   (d) the colour of light used.

2. **The refractive index of a diamond is 2.4. It means that** **[1]**
   (a) the speed of light in vacuum is equal to 2.4 times the speed of light in diamond.
   (b) the speed of light in the diamond is 2.4 times the speed of light in a vacuum.
   (c) the speed of light in a vacuum is 2.4 times the speed of light in the diamond.
   (d) the wavelength of light in diamond is 2.4 times the wavelength of light in vacuum.

3. **An object of height 10 cm is placed in front of a concave lens of focal length 20 cm at a distance 25 cm from the lens. Is it possible to capture this image on a screen? Select a correct option from the following** [1]

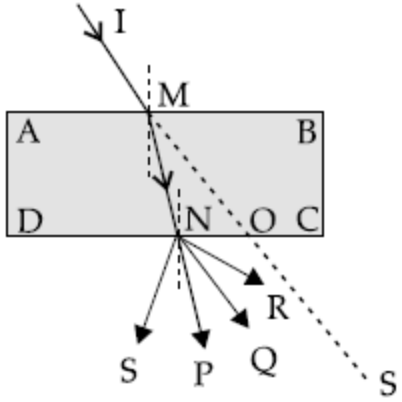
(a) Yes, as the image formed will be real.

(b) Yes, as the image formed will be erect.

(c) No, as the image formed will be virtual.

(d) No, as the image formed will be inverted.

4. **A ray of light IM is incident on a glass slab ABCD as shown in the figure below. The emergent ray for this incident ray is** [1]



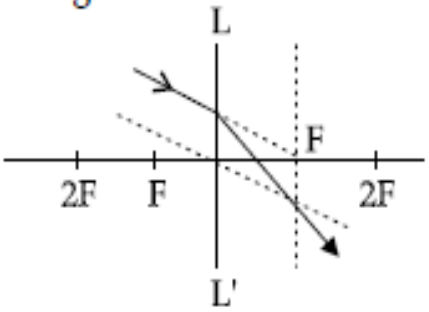
(a) NQ (b) NR
(c) NP (d) NS

5. **The colour of white light which is deviated least by a prism is** **[1]**
   (a) green
   (b) yellow
   (c) red
   (d) violet

6. The wavelength range of visible light is [1]

(a) 40 nm to 80 nm
(b) 4000 nm to 8000 nm
(c) 4 nm to 8 nm
(d) 400 nm to 800 nm

7. Observe the diagram which shows the path of an incident ray through an optical plane LL' of a lens. The focal length of the lens is 20 cm.



(i) If an object is placed at a distance of 30 cm in front of this lens, then [1]
   (a) the image will be virtual
   (b) the image will be diminished and inverted.
   (c) the image will be diminished.
   (d) the image will be real and magnified.

(ii) This type of lens can be used [1]
   (a) to correct hypermetropia.
   (b) to correct myopia.
   (c) to diverge light.
   (d) in the front door peepholes.

(iii) An object is placed in front of this lens at a distance of 60 cm. Then the image distance from the lens with proper sign convention is [1]
   (a) +60 cm (b) +30 cm
   (c) –30 cm (d) +15 cm

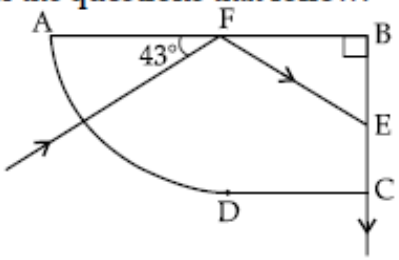
(iv) An object is placed in front of this lens at a distance of 60 cm. Then the magnification of the image is [1]
   (a) 0.25 (b) 1.25
   (c) –0.5 (d) 1

21. **The ratio of velocities of light of wavelength 400 nm and 800 nm in a vacuum is** **[1]**

(a) 1 : 1 (b) 1 : 2

(c) 2 : 1 (d) 1 : 3

24. The diagram below shows a ray of light travelling from air into a glass material as shown below. Answer the questions that follow:



(i) The angle of incidence at the surface AB is [1]

(a) 43° (b) 47°
(c) 90° (d) 0°

(ii) Select a correct statement from the following. [1]

(a) The speed of light at the curved surface AD does not change while entering the block.
(b) The ray at the surface AD is not travelling along the radius of the curved part.
(c) The ray at the surface AD is travelling along the radius of the curved part.
(d) Light never refracts when it enters a curved surface.

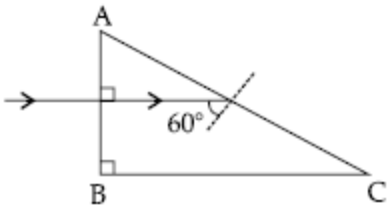
(iii) The angle of incidence on the surface BC is [1]

(a) 43° (b) 47°
(c) 90° (d) 0°

(iv) The critical angle of this material of glass [1]

(a) 47° (b) 43°
(c) 42° (d) 45°

25. **The diagram below shows the path of light passing through a right-angled prism of critical angle 42°.**



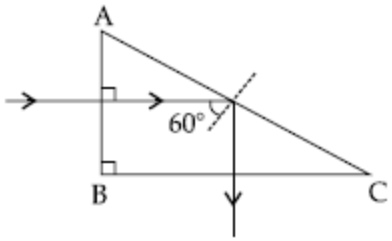
(i) **The angle C of the prism is** [1]

(a) 45° (b) 60°

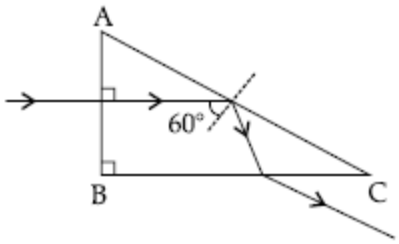
(c) 90° (d) 30°

(ii) **Which one of the following diagrams shows the correct path of this ray till it emerges out of the prism?** [1]

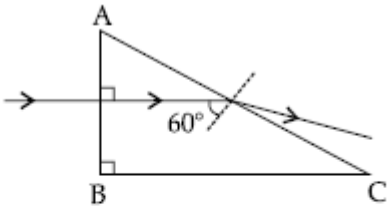
(a)



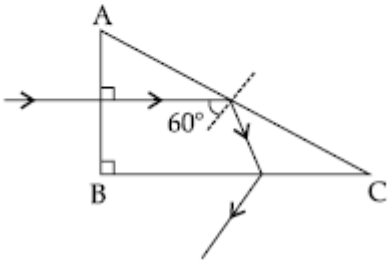
(b)



(c)

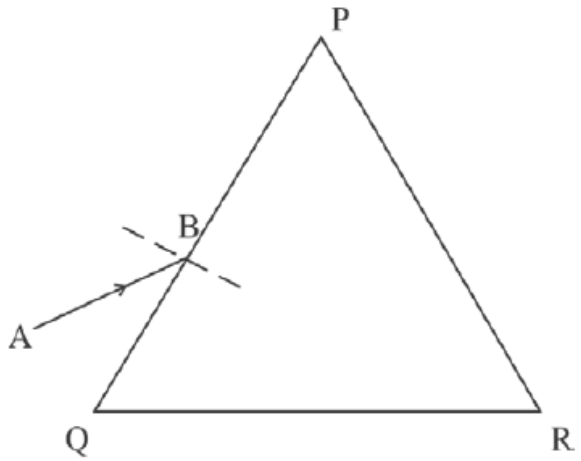


(d)



2020

(c) Complete the path of the monochromatic light ray AB incident on the surface PQ of the equilateral glass prism PQR till it emerges out of the prism due to refraction. [2]



(d) Where should an object be placed in front of a convex lens in order to get: [2]

(i) an enlarged real image

(ii) enlarged virtual image?

(e) A pond appears to be 2.7 m deep. If the refractive index of water is $\frac{4}{3}$, find the actual depth of the pond. [2]

Question 3

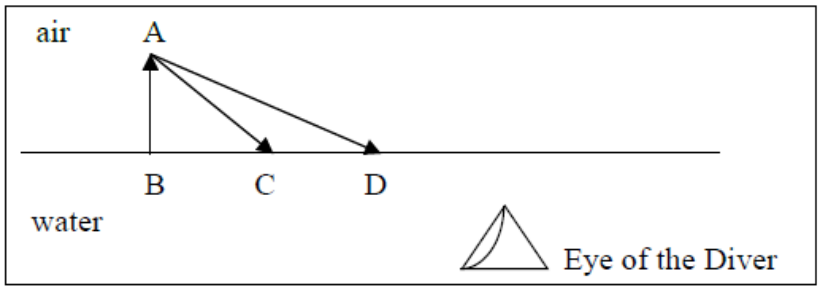
(a) The wave lengths for the light of red and blue colours are nearly 7.8×10^{-7} m and 4.8×10^{-7} m respectively. [2]

(i) Which colour has the greater speed in a vacuum?

(ii) Which colour has a greater speed in glass?

Question 6

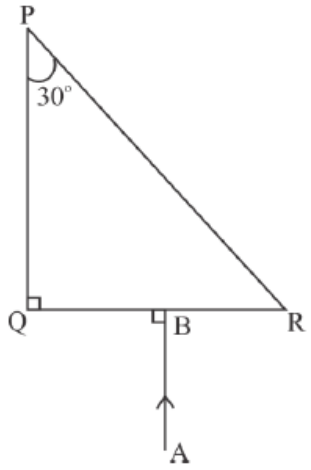
(a) A diver in water looks obliquely at an object AB in air. [3]



(i) Does the object appear taller, shorter or of the same size to the diver?

(ii) Show the path of two rays AC & AD starting from the tip of the object as it travels towards the diver in water and hence obtain the image of the object.

(b) Complete the path of the ray AB through the glass prism in PQR till it emerges out of the prism. Given the critical angle of the glass as 42°. [3]



(c) A lens of focal length 20 cm forms an inverted image at a distance 60 cm from the lens. [4]

(i) Identify the lens.

(ii) How far is the lens present in front of the object?

(iii) Calculate the magnification of the image.

Question 7

(a) Give reasons for the following: [3]

During the day:

(i) Clouds appear white.

(ii) Sky appears blue.

(c) (i) When a tuning fork [vibrating] is held close to ear, one hears a faint hum. The same [vibrating tuning fork] is held such that its stem is in contact with the table surface, then one hears a loud sound. Explain. [4]

(ii) A man standing in front of a vertical cliff fires a gun. He hears the echo after 3.5 seconds. On moving closer to the cliff by 84 m, he hears the echo after 3 seconds. Calculate the distance of the cliff from the initial position of the man.

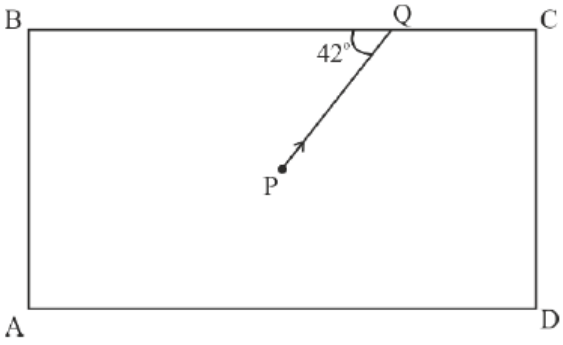
(e) (i) Define critical angle. [2]

(ii) State one important factor which affects the critical angle of a given medium.

(b) (i) What is the relation between the refractive index of water with respect to air (${}_a\mu_w$) and the refractive index of air with respect to water (${}_w\mu_a$). [2]

(ii) If the refractive index of water with respect to air (${}_a\mu_w$) is $\frac{5}{3}$.
Calculate the refractive index of air with respect to water (${}_w\mu_a$).

(e) The diagram below shows a light source P embedded in a rectangular glass block ABCD of critical angle 42°. Complete the path of the ray PQ till it emerges out of the block. [Write necessary angles.] [2]



Question 3

(a) (i) If the lens is placed in water instead of air, how does its focal length change? [2]

(ii) Which lens, thick or thin has greater focal length?

2019

Question 6

(a) How does the angle of deviation formed by a prism change with the increase in the angle of incidence? [3]

Draw a graph showing the variation in the angle of deviation with the angle of incidence at a prism surface.

(b) A virtual, diminished image is formed when an object is placed between the optical centre and the principal focus of a lens. [3]

(i) Name the type of lens which forms the above image.

(ii) Draw a ray diagram to show the formation of the image with the above stated characteristics.

(c) An object is placed at a distance 24 cm in front of a convex lens of focal length 8 cm. [4]

(i) What is the nature of the image so formed?

(ii) Calculate the distance of the image from the lens.

(iii) Calculate the magnification of the image.

2018

(d) (i) Why is the ratio of the velocities of light of wavelengths 4000Å and 8000Å in vacuum 1:1? [2]

(ii) Which of the above wavelengths has a higher frequency?

Question 2

(a) The power of a lens is –5D. [2]

(i) Find its focal length.

(ii) Name the type of lens.

(b) State the position of the object in front of a converging lens if: [2]

(i) It produces a real and same size image of the object.

(ii) It is used as a magnifying lens.

(c) (i) State the relation between the critical angle and the absolute refractive index of a medium. [2]

(ii) Which colour of light has a higher critical angle? Red light or Green light.

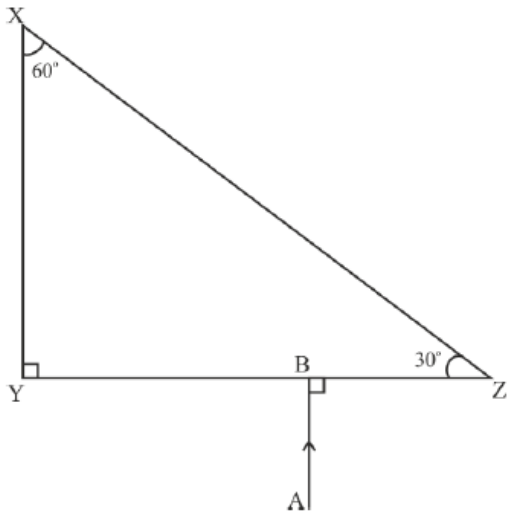
(d) (i) Define scattering. [2]

(ii) The smoke from a fire looks white.

Which of the following statements is true?

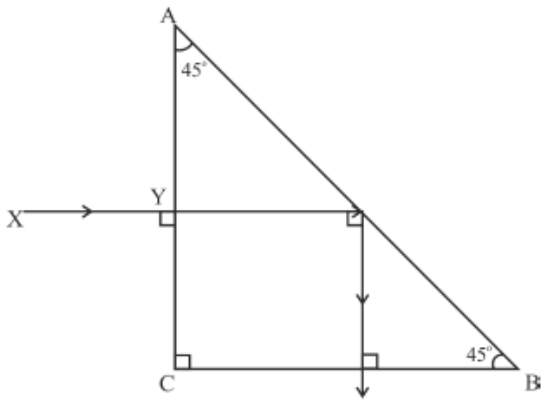
1. Molecules of the smoke are bigger than the wavelength of light.
2. Molecules of the smoke are smaller than the wavelength of light.

(e) The following diagram shows a 60°, 30°, 90° glass prism of critical angle 42°. [2]
Copy the diagram and complete the path of incident ray AB emerging out of the prism marking the angle of incidence on each surface.



Question 6

(a) A ray of light XY passes through a right angled isosceles prism as shown below. [3]

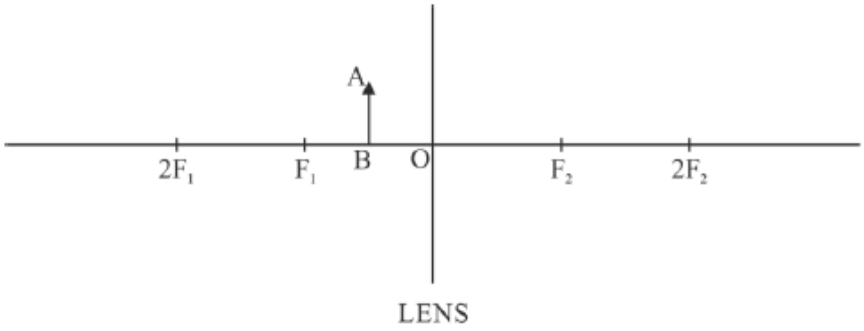


(i) What is the angle through which the incident ray deviates and emerges out of the prism?

(ii) Name the instrument where this action of prism is put into use.

(iii) Which prism surface will behave as a mirror?

(b) An object AB is placed between O and F_1 on the principal axis of a converging lens as shown in the diagram. [3]



Copy the diagram and by using three standard rays starting from point A, obtain an image of the object AB.

(c) An object is placed at a distance of 12 cm from a convex lens of focal length 8 cm. Find: [4]

(i) the position of the image

(ii) nature of the image

2017

(d) How is the refractive index of a material related to: [2]

(i) real and apparent depth?

(ii) velocity of light in vacuum or air and the velocity of light in a given medium?

(e) State the conditions required for total internal reflection of light to take place. [2]

Question 3

(a) Draw a ray diagram to show the refraction of a monochromatic ray through a prism when it suffers minimum deviation. [2]

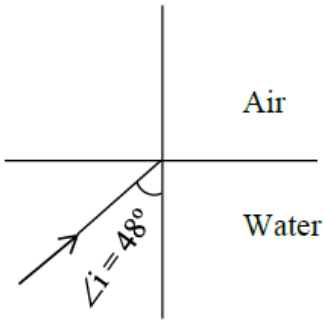
Question 7

(a) A Lens forms an upright and diminished image of an object when the object is placed at the focal point of the given lens. [3]

(i) Name the lens.

(ii) Draw a ray diagram to show the image formation.

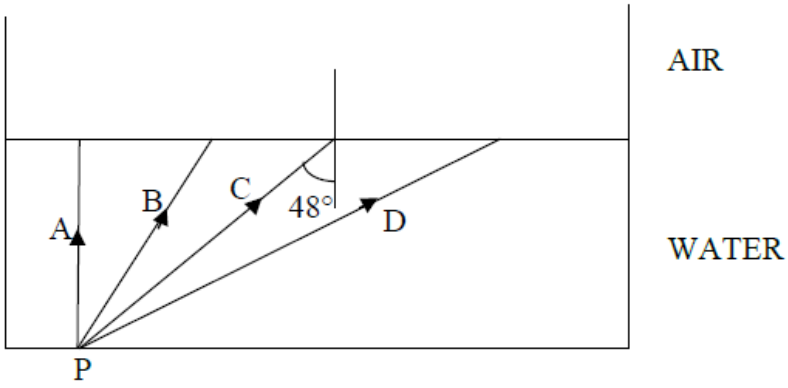
(b) A ray of light travels from water to air as shown in the diagram given below: [3]



(i) Copy the diagram and complete the path of the ray. Given the critical angle for water is 48°.

(ii) State the condition so that total internal reflection occurs in the above diagram.

(c) The diagram below shows a point source P inside a water container. Four rays A, B, C, D starting from the source P are shown upto the water surface. [4]



(i) Show in the diagram the path of these rays after striking the water surface. The Critical Angle for water air surface is 48°.

(ii) Name the phenomenon which the rays B and D exhibit.