17. Our colourful world

Exercises

1 A. Question

Rear view mirror of motor vehicles is a

A. plane mirror

B. convex mirror

C. concave mirror

D. convex lens

Answer

Mirrors fitted on motor vehicles are convex because convex mirrors always formed a virtual and much-diminished image. Hence we can see large traffic in a smaller area of the mirror. Thus it gives a wide field of view. As shown in the figure below.

1 B. Question

If a ray of light is travelling from a denser medium to rarer medium and if the angle of incidence is greater than the critical angle, then the following takes place

A. total internal reflection

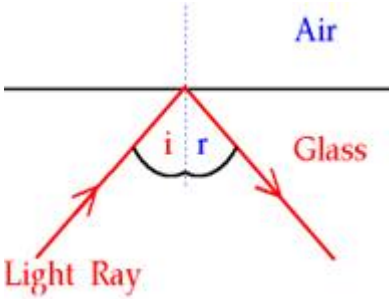
B. refraction

C. dispersion

D. multiple refraction

Answer

The Critical angle is the largest angle of incidence for which refraction can still occur. For any angle of incidence greater than the critical angle, the light will undergo total internal reflection. And will obey the laws of reflection of light. The figure below illustrates it in more detail.



1 C. Question

A concave mirror forms a magnified inverted image when the object is placed at

A. 'F'

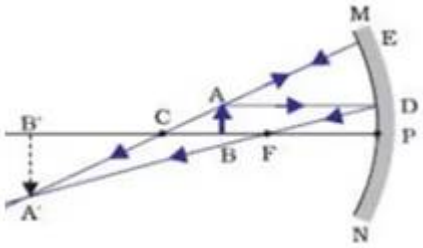
B. 'C'

C. between 'F' and 'C'

D. beyond 'C'

Answer

When an object is kept between the Centre of curvature and the focus of the mirror the image formed is Magnified and inverted. The figure below shows the ray diagram for the same.



1 D. Question

On a new stainless steel spoon if you see the image of your face upside down, then that part of the spoon acts like,

A. convex lens

B. concave mirror

C. convex mirror

D. concave lens

Answer

Concave mirror forms the inverted image of an object, therefore the portion of the spoon in which our face is upside down is a concave mirror. A convex mirror always forms the erect and virtual image. And since the spoon is not transparent hence it is not any type of lens.

The figure below illustrates the situation.

1 E. Question

You can see the image of your face on the surface of stagnant water. But if the water is disturbed, your image will not be clear because of

A. total internal reflection

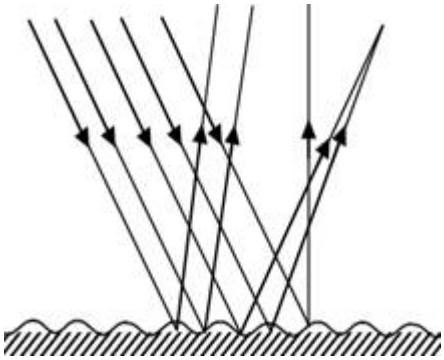
B. refraction

C. irregular reflection

D. dispersion

Answer

In irregular reflection, the parallel beam of light gets reflected in many directions on striking the rough or uneven surface like walls, trees, etc. Due to the rays of light not going in any particular direction the image obtained is not clear. The figure below shows the irregular reflection.



2 A. Question

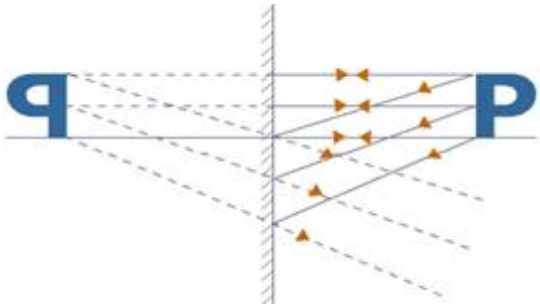
Fill in the blanks with suitable words :

The letter “P” looks like _____ in a plane mirror.

Answer

The letter “P” look like **Laterally Inverted** in a plane mirror.

Explanation: During lateral inversion left side becomes right and right side becomes left. The figure below shows the lateral inversion of the letter “P” by the plane mirror.



2 B. Question

Fill in the blanks with suitable words :

The type of lens used by watch repairers is _____.

Answer

Watch repairers use **Convex Lens**

Explanation: A convex lens is used by watch repair men. The object is kept between the focus and optical center of the lens and an enlarged and erect image is obtained of it. This helps to see the parts clearly.

2 C. Question

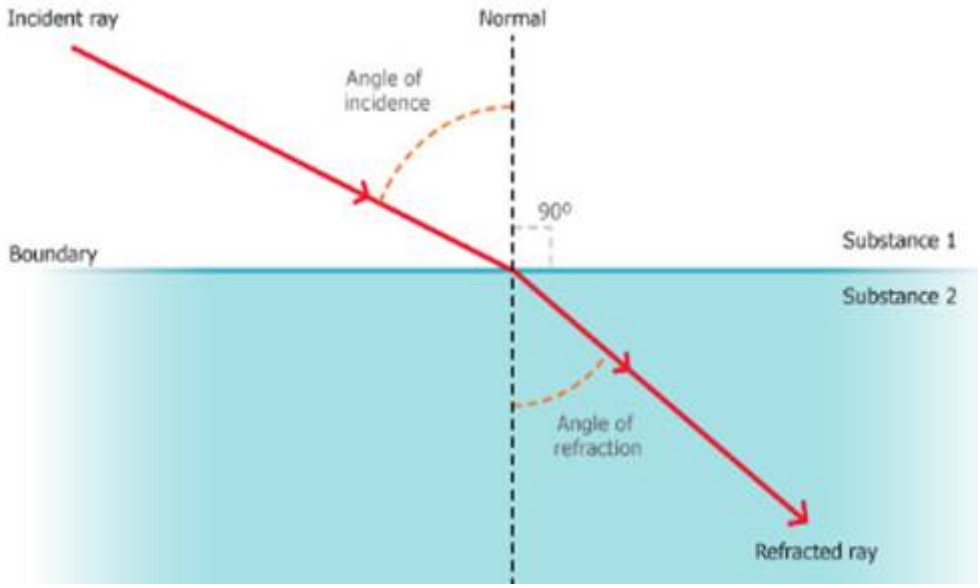
Fill in the blanks with suitable words :

Bending of light when it passes from one transparent medium to another is called _____.

Answer

Refraction

Explanation: Refraction is the bending of light rays when it passes from one medium to another. Normally, light travels in a straight line, but it changes direction and speed when it travels from one transparent medium to another, such as from air into glass. The figure below shows the diagram of refraction of light.



2 D. Question

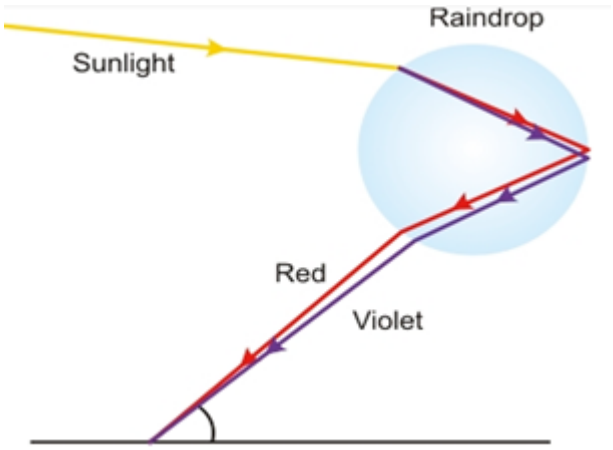
Fill in the blanks with suitable words :

Formation of rainbow is due to _____ .

Answer

Formation of the rainbow is due to the **Dispersion** of the light.

Explanation: Rainbow is formed due to the dispersion of sunlight by raindrops suspended in air. Water drops act like tiny prisms. These water drops refract the sunlight, disperse, then they reflect internally and then refract it again. This is how a rainbow is formed. The figure below shows it in detail.



3 A. Question

Answer the following:

Give one reason to prove that light is a form of energy.

Answer

Light which we see is basically a electromagnetic radiation, The photon is the basic "unit" of light and all forms of electromagnetic radiation are the force

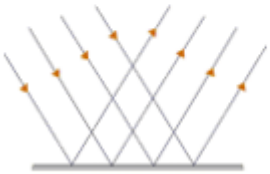
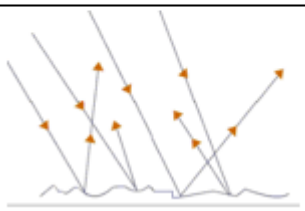
carrier for the electromagnetic force.And as we know energy is the ability to do work on another physical system, also one form of energy can be converted into other. So light photon can cause electricity (which is a form of energy) and the photon possesses some energy which used in exciting electron of a conductor.This we all have experienced when we go out in the blazing sun you feel your body getting warmed up which shows light possess energy (heat a form of energy).

3 B. Question

Answer the following:

What is the difference between regular and irregular reflections?

Answer

Regular reflection	Irregular reflection
1. It occurs when a parallel beam of incident rays remains parallel after reflection.	It occurs when a parallel beam of incident light doesn't remain parallel after reflection.
2. The reflected rays are reflected in one direction	The reflected rays are not reflected in one direction
3. Image formation takes place	Image formation does not take place
4. Occurs from smooth surfaces like mirror, silver spoon etc.	Occurs from rough surfaces like wood, table, door, book etc.
	

3 C. Question

Answer the following:

State the laws of reflection.

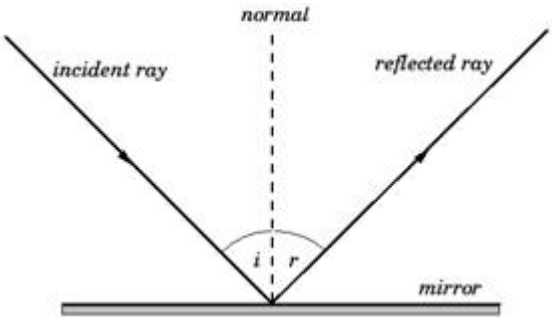
Answer

Following are the two laws of reflection of light.

1. The normal line, the incident ray and the reflected ray will be on the same plane.

2. The angle of incidence is always equal to the angle of reflection of light.

Figure below illustrates these laws.



Here ∠ I = ∠ r .

3 D. Question

Answer the following:

Mention the uses of concave mirrors.

Answer

Following are the uses of the concave mirrors.

1. Concave Mirrors are used in shaving mirrors because when the face is kept between the focus and pole of the mirror the magnified, erect and virtual image is formed. The figure below shows a shaving mirror.

2. Concave mirrors are used in the Head Lamp of the car because if the bulb is kept at the focus of the mirror the rays from the bulb will go to larger distances. The figure below shows the head lamp of the car.

3. Concave Mirrors are used in the solar devices like Solar Cooker, Solar Furnace etc. because they are the only mirror which reflects the light towards the focus.

4. Concave Mirrors are also used in the floodlights.

5. Concave mirrors are also used in the reflecting telescopes shown in the figure below.

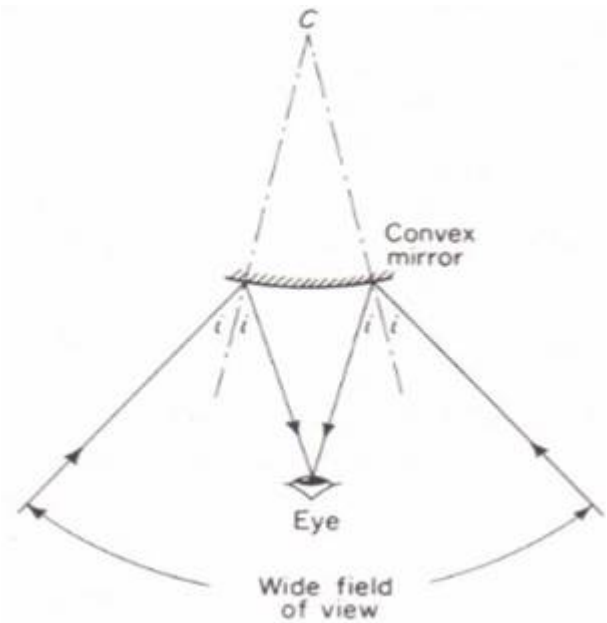
3 E. Question

Answer the following:

Why is convex mirror used as rear view mirror in motor vehicles?

Answer

The convex mirrors are diverging in nature and they have the wide field of view due to which we can see the image of the large area in the mirror. The light rays incident on it gets diverged following the laws of reflection, the reflected rays form the wider path as shown in the figure below. Also, the image formed by the convex mirror is always the erect and diminished image of an object; therefore the convex mirrors are used in the motor vehicles.



3 F. Question

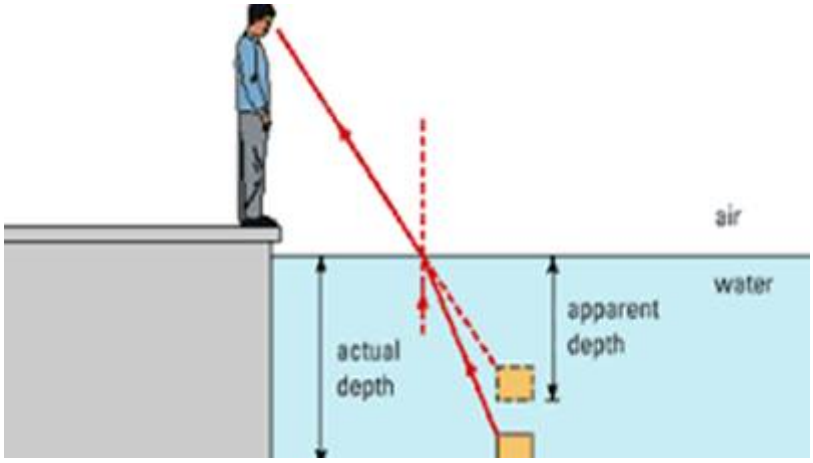
Answer the following:

Mention any two effects of refraction of light in daily life.

Answer

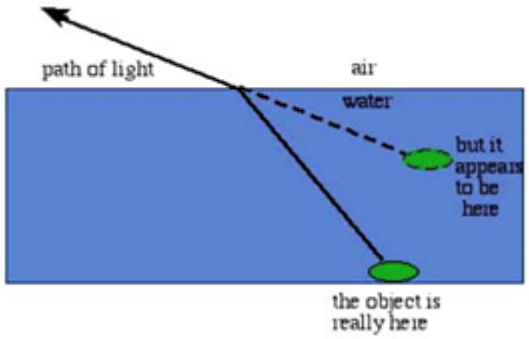
Following are the effects of refraction of light in our daily life.

1. A swimming pool always looks shallower than it really is, because the light coming from the bottom of the pool bends when it comes out at the surface due to refraction of light.



2. A straight stick which is immersed partly in water always looks to be bent at the surface of the water, because the light coming from the stick bends when it comes out at the surface due to refraction of light. The figure below illustrates it.

3. A coin or stone lying at the bottom of a container filled with water appears to be raised because of refraction of light. The figure below shows the above phenomenon.



3 G. Question

Answer the following:

What are the conditions for total internal reflection to take place?

Answer

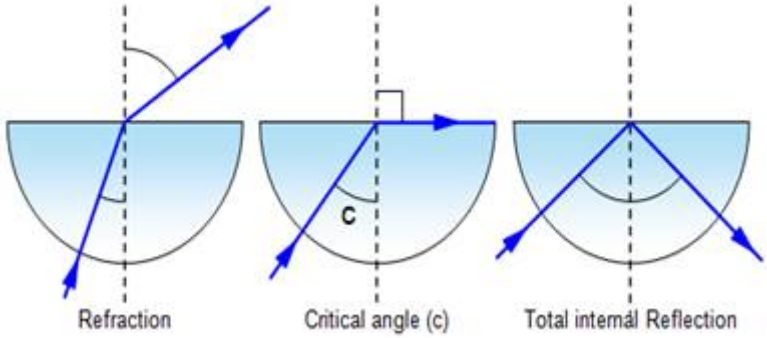
When a ray of light, travelling from an optically denser medium into an optically rarer medium is incident at an angle greater than the critical angle for the two media, the ray is totally reflected back into the medium, obeying the laws of reflection. This phenomenon is called total internal reflection.

Two important conditions for total internal reflection are:

1. The angle of incidence (i) should be greater than the critical angle (i_c).

2. Ray should travel from denser medium to rarer medium.

The critical angle is that angle of incidence in a denser medium, for which the angle of refraction in the rarer medium is 90 °.The figure below illustrates the critical angle and total internal reflection.



3 H. Question

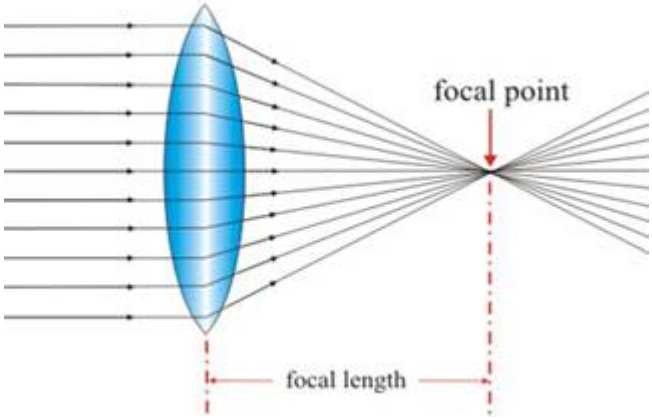
Answer the following:

Write diagrams to show the refraction of parallel rays of light in (i) convex lens and (ii) concave lens.

Answer

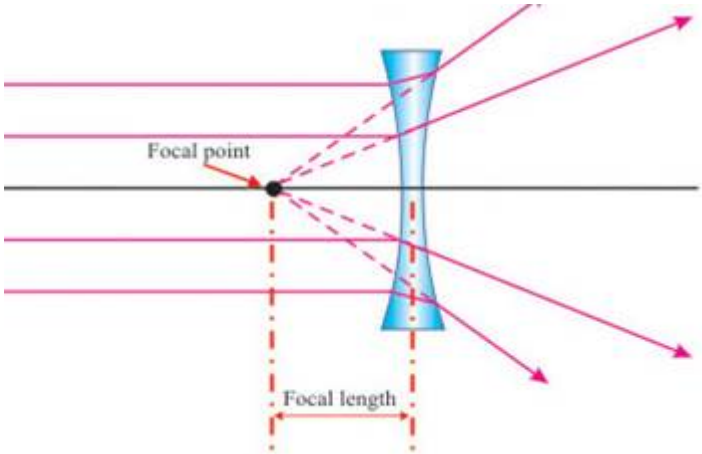
<u>Convex Lens:</u>

Convex lens is thicker at the middle and the rays of light that pass through it are brought closer together, therefore, they are converging lens. The figure below shows the refraction in the convex lens.



Concave Lens:

Concave lens are thinner at the middle and thicker at the edges the rays of light that pass through it spread out or diverged, therefore, they are the diverging lens. The figure below shows the refraction of parallel rays of the light by the concave lens.



3 I. Question

Answer the following:

Mention any four devices that contain a convex lens.

Answer

Convex lens are used in many days to day use devices below are some of them.

1. Magnifying Glass = Magnifying glass is a convex lens which produces a magnified and erect image of the object when an object is kept between the pole and the focus. The figure below shows the magnifying glass.

2. Camera = Convex lens is used in the camera lens to focus the light for a clean picture of an object. The figure below shows the camera lens.

3. Telescope = In a telescope the convex lens are used to collect the light coming from infinity and form its clear image at the focus. The figure below shows the telescope.

4. Microscope = Convex lens is used in the microscope because they are converging lens and focuses all the light at a specific point, and forms magnified the image of an object.

3 J. Question

Answer the following:

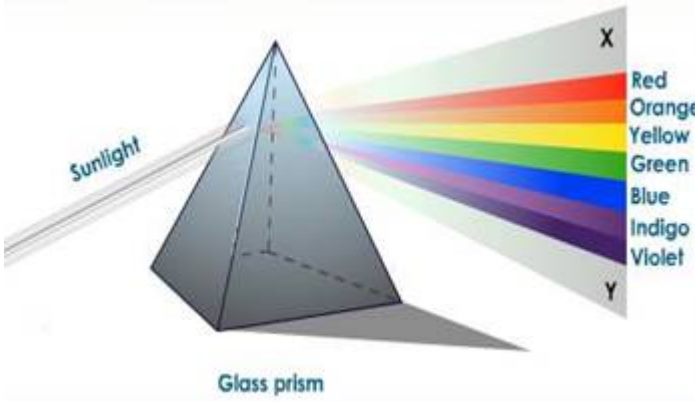
What is dispersion of light?

Answer

The dispersion of light is the phenomenon of splitting of a beam of white light into its seven constituent colours when passed through a transparent medium. It was discovered by Isaac Newton in 1666.

Cause of dispersion of light is that white light consists of seven different colors, and each colour has a different angle of deviation. Therefore, on passing through the prism different colours deviate from different angles.

Hence the seven colours of white light separate and form a spectrum. Out of the seven colours, the red colour deviates the least, and the violet colour deviates most. The figure below shows the spectrum of white light after passing it through the prism.



4. Question

Match the following:

1. dispersion	a. plane mirror
2. diminished image	b. concave lens
3. laterally inverted image	c. mirage
4. total internal reflection	d. convex mirror
	e. rainbow
	f. multiple reflections
	g. glass slab

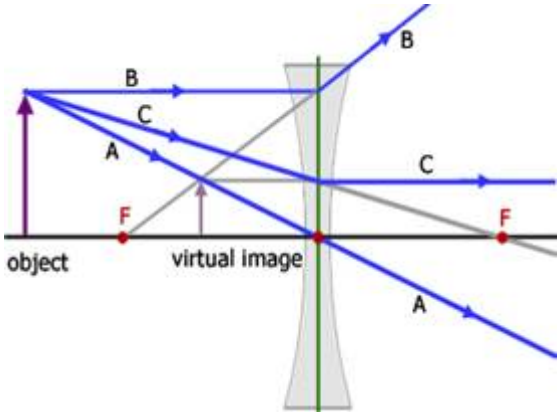
Answer

1. Dispersion – e. rainbow

Explanation: The formation of the rainbow is based on the process of dispersion of light. Water drops act like tiny prisms. These water drops refract the sunlight, disperse, then they reflect internally and then refract it again. This is how a rainbow is formed

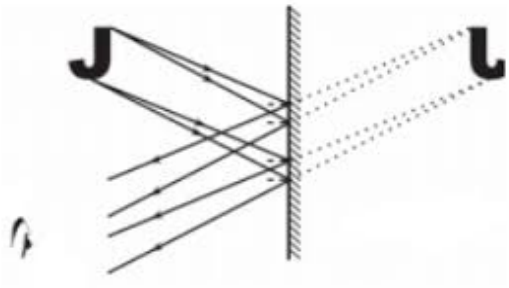
2. Diminished image – b. concave lens.

Explanation: Image formed by the concave lens is diminished in size and is erect and virtual in nature. The figure below shows the image formation by a concave lens.



3. Laterally inverted image – a. plane mirror

Explanation: The image formed by the plane mirror is laterally inverted means that the left side of an object becomes right and the right side becomes the left. The figure below shows the lateral inversion by the plane mirror.



4. Total internal reflection – f. multiple reflections

Explanation: Total internal reflection occurs when the ray of light strikes the medium at an angle greater than the particular incidence angle called as the critical angle. The ray of light after reflection obeys the law of reflection of light. The figure below shows the multiple reflections in the diamond which is the cause of diamond brightness.