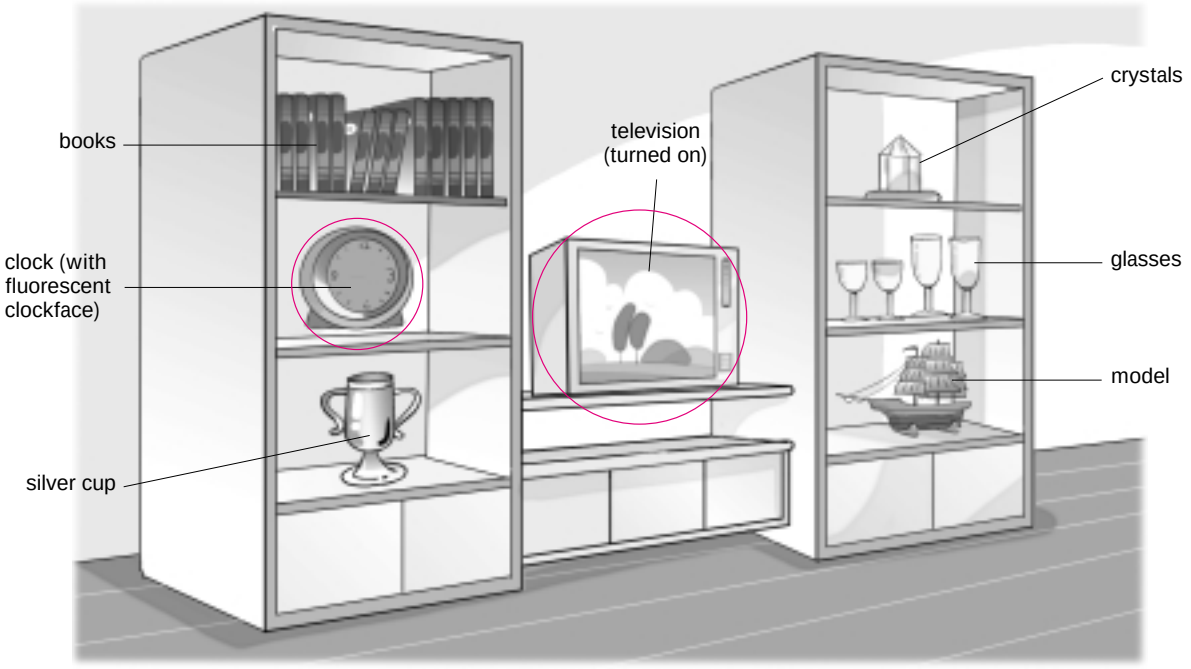
15 Light, Colours and Beyond

Activity 15 (a) (p.3)

There are several objects placed on the shelf as shown in the figure below:



1. Guess which objects you can still see when all lights in this room are turned off. Circle these objects in the picture above.

2. What features do these objects have in common?

   They all emit light that enters our eyes.

3. When you turn on the lights again, you can see all the objects in the room. Why?

   The objects reflect light to our eyes.

Activity 15 (b) (p.4)

Observe the objects around you. List 5 luminous objects and 5 non-luminous objects.

Luminous objects	Non-luminous objects
burning candle	the moon
torch	pencil
television	book
light bulb	table
the sun	glasses

Experiment 15.1 *Demonstration* (p.8)

To observe the path of a light beam

4. Describe how the light beam travels.

   The light beam travels in a straight line.

   Do you know why we need to put the tank in front of a piece of black paper?

   to give a better contrast for observation

5. Can you see the path of the light ray now? Try to explain your observation.

   No. The water is clear and cannot reflect light rays to our eyes.

6. Can you see the light beam travelling through air? Why?

   No. Because there is very little dust in air to reflect light rays to our eyes.

Activity 15 (c) (p.10)

1. Place the coin under the desk lamp. Observe the shadow of the coin and draw its shape in the box below.

2. Can you observe any changes in its shape? Draw the shape of the shadow in the box below.

3. Can you explain why the shapes of the shadows change when you rotate the objects?

As light travels in a straight line, the object will cast a different shadow when its orientation with respect to the lamp changes.

Activity 15 (d) (p.12)

Write down some of their similarities and differences.

The images are upside down. The images are of the same size as the objects.

Experiment 15.2 (p.12-13)

To observe the reflection of light

7. Complete the table below.

∠IAN	20°	30°	40°	50°	60°	70°	80°
∠RAN	20°	30°	40°	50°	60°	70°	80°

8. From the above table, can you find the relationship between the angle of incidence and the angle of reflection?

   The angle of incidence equals the angle of reflection.

9. What do you observe in each case?

   Why are they different from the reflection by a mirror?

Activity 15 (e) (p.16-17)

1. Which eye of your image is winking, the left eye or the right eye?

   left eye

2. Place a plane mirror on the dotted line below. Observe the image formed in the mirror.

IMAGE

IMAGE

(a) Which letter(s) in the image(s) are the same as the print? I, E

(b) Which letter(s) in the image(s) are different from the print? M, A, G

3. Place the mirror on the vertical dotted line below and observe the image again.

IMAGE | IMAGE

(a) Which letter(s) in the image(s) are the same as the print? I, M, A

(b) Which letter(s) in the image(s) are different from the print? G, E

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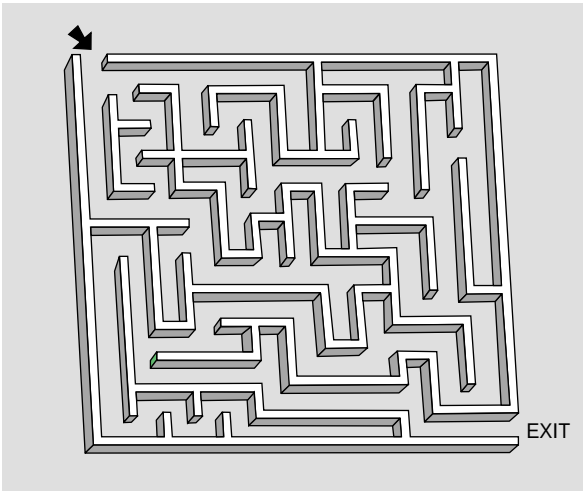
5. Try to find the ways out of the maze.



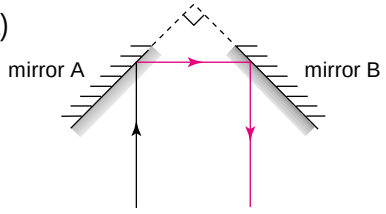
6. From the observations above, can you now write down some properties of plane mirror images?

laterally inverted

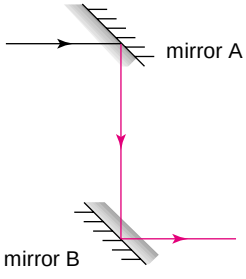
Activity 15 (f) (p.18-19)

1. Draw the light ray in the diagrams below.

(a)



(b)



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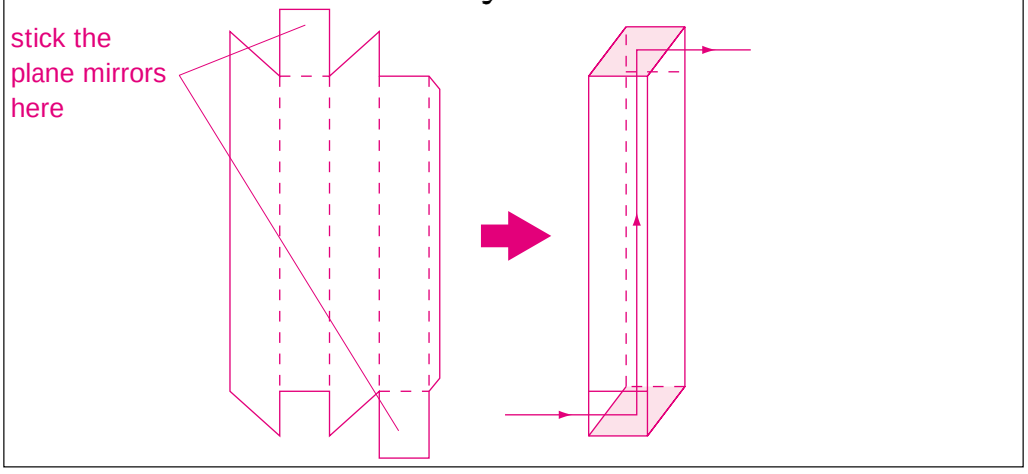
2. Place a coin in front of mirror A. Look into mirror B in each case. Check if the images formed in the mirrors are laterally inverted.

No, the images formed are not laterally inverted.

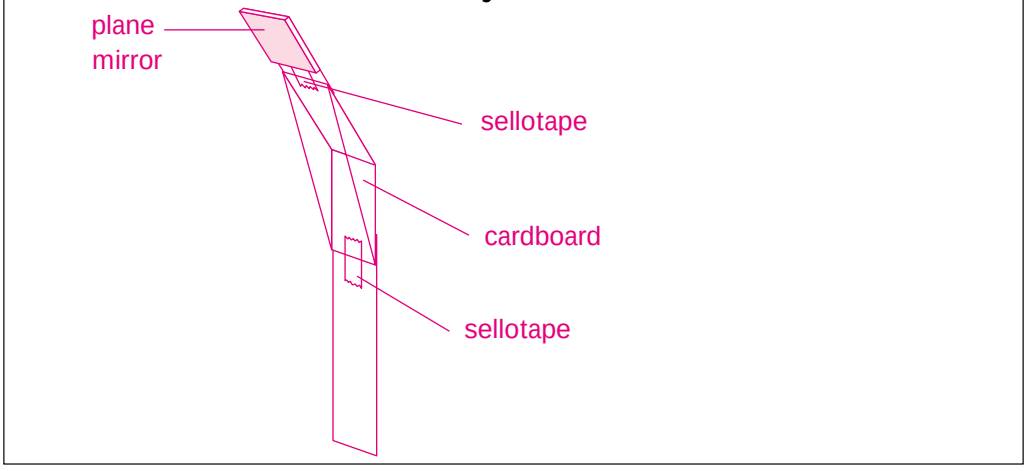
3. Sketch your design in the box below.

Your design



4. Draw your design in the box below.

Your design



Activity 15 (g) (p.21)

Draw a simple diagram to show how it reflects light.

Experiment 15.3 (p.23-24)

Dispersion of white light

2. What colours can you see when white light is dispersed?

   red, orange, yellow, green, violet, indigo and blue

5. (a) Rays of which colour are bent to the greatest extent?

   violet

   (b) Rays of which colour are bent to the smallest extent?

   red

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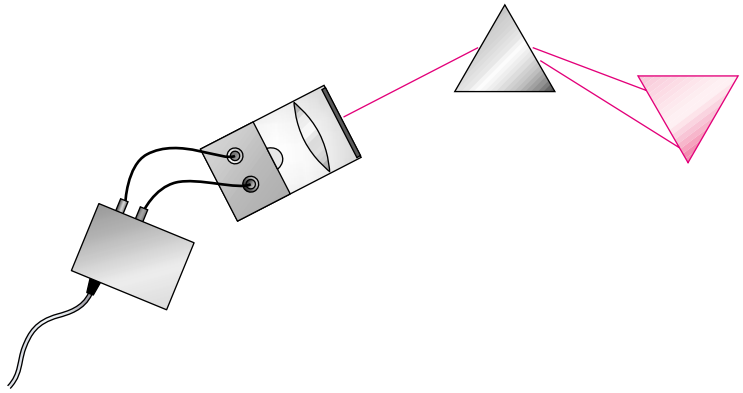
6. Draw your apparatus in the space below.



Experiment 15.4 (p.26-27)

Mixing light of the three primary colours

2. What is the colour of the light? red
3. What is the colour of the mixed light? magenta
4. Record the results obtained in the following table.

Colour of the light rays used	Colour of the mixed light
red and blue	magenta
red and yellow	orange
blue and green	cyan
blue and yellow	green
magenta and blue	violet
red and green	yellow
red, blue and green	white
yellow, magenta and cyan	white

Activity 15 (j) (p.30)

Try to explain why we cannot distinguish between different colours in a dark environment.

Cone cells, that are responsible for detection of colours, cannot function well in a dark environment.

Activity 15 (k) (p.30)

What can you see?

(a) 6 (b) red line & purple line (c) 74 (d) nothing

Activity 15 (l) (p.33)

What is the colour of light passing through the red colour filter and green colour filter?

No light can pass through.

Try to explain the above result.

Only green light can pass through the green colour filter. But the green light cannot pass through the red colour filter.

Experiment 15.5 (p.34-35)

To observe the colours of objects in light beams of different colours

6. Which of them appear black in colour?

pear and blue plastic cup

7. Complete the following table.

Colour of light	Objects that turn black	Colours of the other objects
red	pear, blue plastic cup	banana — red apple — red
blue	apple, pear, banana	blue plastic cup — blue
green	blue plastic cup, apple	banana — green pear — green
yellow	blue plastic cup	banana — yellow apple — red pear — green

Experiment 15.6 (p.37)

To detect radiations beyond the visible spectrum

6. In which position is the thermometer reading higher?

   beyond red light

7. What do you observe about the fluorescent paper in different positions?

   It becomes fluorescent in the region beyond the violet light.

Activity 15 (n) (p.46)

Try to find out what kinds of materials are microwave-safe. What will happen if we use inappropriate containers?

Activity 15 (o) (p.47)

How far away was the plane from the radar station? (Hint: the speed of microwaves in air is about 3×10^8 m s^{-1})

3 km

Experiment 15.7 (p.53-55)

To observe the refraction of light through a glass block

4. This light ray is the _____incident ray_____ .

7. The dotted line is the _____normal_____ .

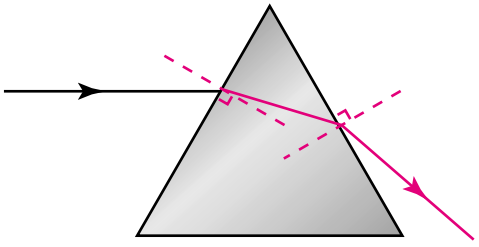
9. Complete the following table.

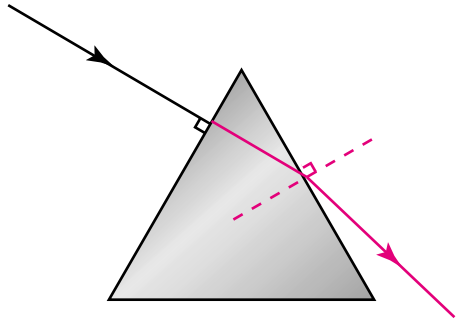
Light enters / leaves the glass block	Angle of incidence	Angle of refraction	Light bends towards / away from the normal
enters	0°		
leaves	0°		

10. From the above table, you will find that when light enters the glass, it bends _____towards_____ (towards / away from) the normal.

    On the other hand, when light leaves the glass and enters the air, it bends _____away from_____ (towards / away from) the normal.

11. Draw the paths of the light rays on the diagrams below.





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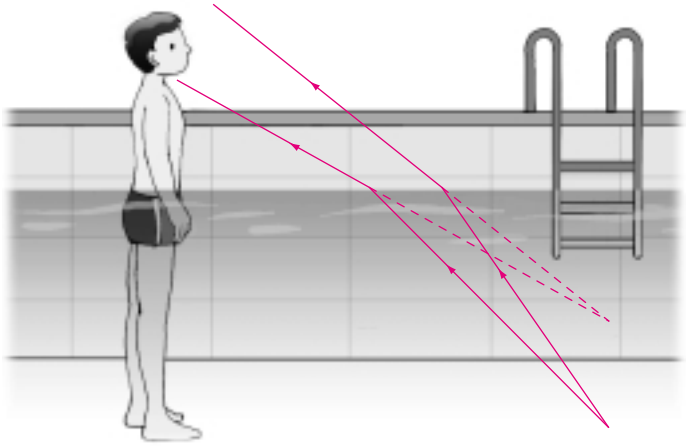
12. Draw the experimental results in the space below.

Activity 15 (p) (p.57)

1. Draw the path of light rays in the diagram below to illustrate your answer.



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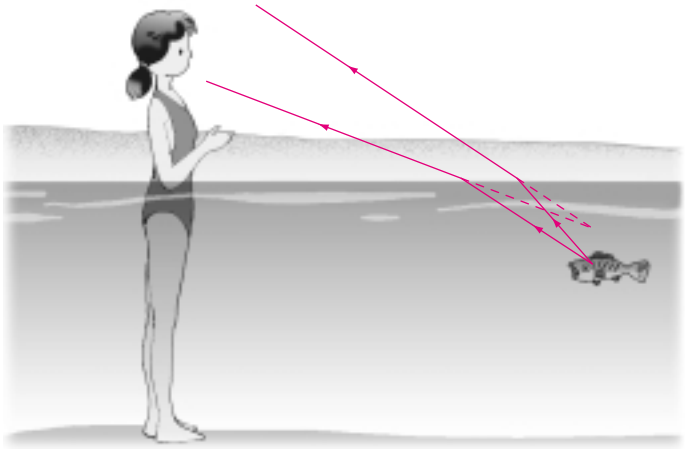
2. (a) Do you think she should aim at a higher or lower position? lower

(b) Use a ray diagram to explain your answer.



Experiment 15.8 (p.59)

To observe the bending of light through lenses

3. The light rays converge (converge / diverge).
4. The light rays will bend more (more / less).
5. The light rays diverge (converge / diverge).

Experiment 15.9 (p.60)

To observe the image formed by a convex lens

2. How does the image of the model look?

   diminished; inverted (magnified / diminished; erect / inverted)

4. When you are at a distance of 5 cm from the object, how does the model look?

   magnified; erect (magnified / diminished; erect / inverted)

Activity 15 (q) (p.61)

Your teacher will give you a beaker, a hand lens and a model.

1. The image of the model is _____larger_____ (larger / smaller) than the object.
2. The model looks _____bigger_____ (bigger / smaller).
3. How does your partner look?

   bigger/widened

Activity 15 (r) (p.62)

Try to list some things that use convex lenses.

hand lens, spectacles (long sight), telescope, microscope

Activity 15 (s) (p.63)

2. Is the image magnified? _____Yes_____

   Is the image inverted? _____Yes_____

A microscope is made up by 2 convex lenses. The image produced by a microscope is _____magnified_____ and _____inverted_____ .

Experiment 15.10 (p.65)

To observe total internal refraction

2. What do you observe?

The light ray passes through the glass block and bends away the normal.

3. What do you observe?

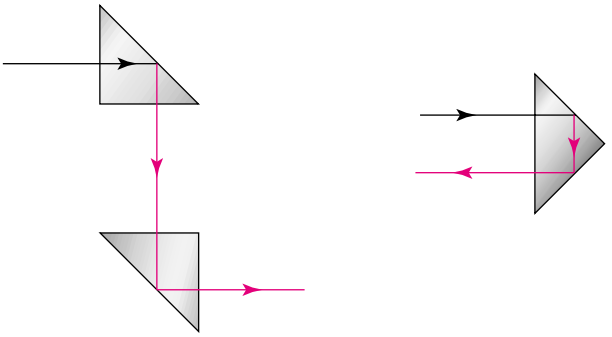
The light ray is reflected by the flat side of the semicircular glass block.

4. What do you observe?

The light ray passes through the semicircular glass block and bends towards the normal.

Activity 15 (t) (p.67)

2. Draw your observation in the diagram below.



Activity 15 (u) (p.70)

Can you think of anything at home which uses optical fibres for the transmission of signals? Try to find out.

Mini-disc player, computer, CD player

Experiment 15.11 *Demonstration* (p.71)

To demonstrate the transmission of radio signals through an optical fibre

2. What happens to the light spot while you speak?

   It flashes with changing frequency.

3. What happens to the loudspeaker?

   It sounds.

4. (a) Why is laser light used for transmission?

   Laser light has a very high frequency, thus the information-carrying capacity is increased.

   (b) What are the advantages of using optical fibres for transmission?

   low signal loss, high information-carrying capacity (high band width)