Islamic Primary School

Primary 5 STEM Activity Periscopes

Name: _____( )

Class: _____

1 Reflection of Light

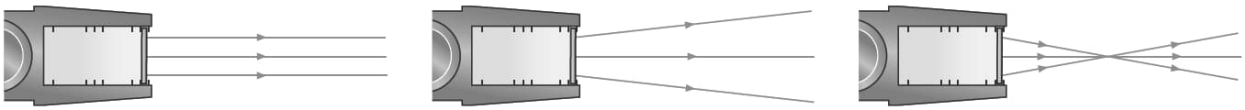
1.1 Light rays

- luminous object (發光體)
- non-luminous object (不發光體)
- ray (光線)
- parallel beam (平行光束)
- divergent beam (發散光束)
- convergent beam (會聚光束)
- cone of rays (光錐)

1 Objects that can give out light by themselves are called _____ objects. Objects do not give out light by themselves are called _____ objects.

2 Light consists of narrow rays travelling in _____ lines.

3 A light beam is a stream of light. Figure 1a shows three kinds of light beams.



a _____ beam a _____ beam a _____ beam

Fig 1a

4 A point gives out many rays but we usually draw _____ rays to mark out the cone of rays from the point of the object reaching the eye (Fig 1b). To indicate that the eye sees the whole object, two cones of rays are drawn from the two _____ of the object to the eye (Fig 1c).

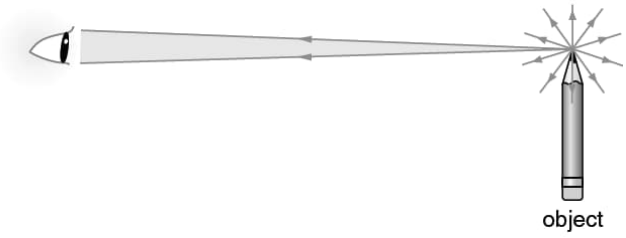


Fig 1b

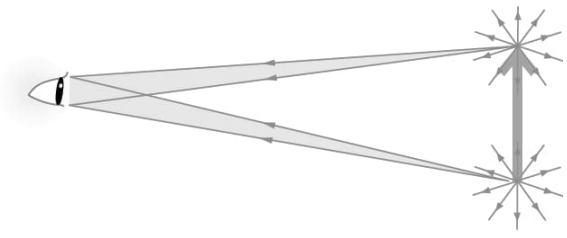


Fig 1c

1.2 The laws of reflection

- plane mirror (平面鏡)
- reflection (反射)
- laws of reflection (反射定律)
- regular reflection (單向反射)
- diffuse reflection (漫反射)

1 A ray of light bounces off a plane mirror. This is called _____.

2 Terms used to describe reflection:

_____ ray	The light ray that approaches the mirror
_____ ray	The light ray that leaves the mirror after reflection
Normal	An imaginary line _____ to the plane mirror at the point where the incident ray hits the mirror
Angle of _____	The angle between the incident ray and the normal
Angle of _____	The angle between the reflected ray and the normal

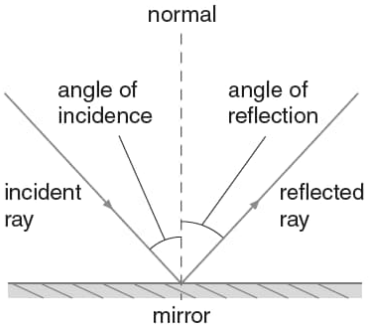


Fig 1g

Expt 1a Reflection of light

Objective

To investigate the relationship between the angle of incidence and the angle of reflection in reflection of light.

Set-up

Direct a light ray onto a plane mirror from different angles of incidence. Measure the corresponding angles of reflection (Fig a).

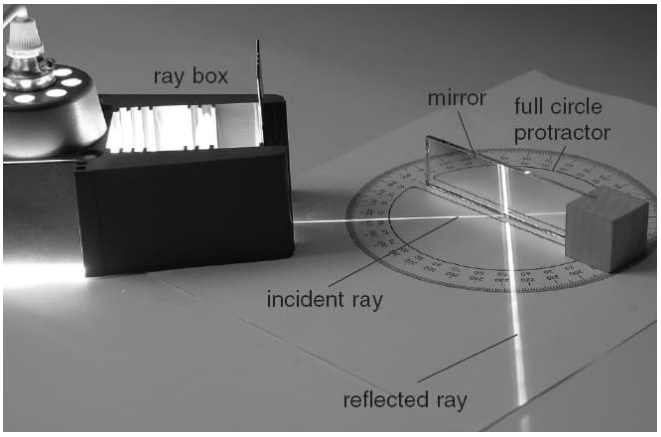


Fig a

3 Experiment 1a shows that the reflection of light follows the laws of reflection:

- The angle of reflection *r* is always _____ the angle of incidence *i*.
- The incident ray, the reflected ray and the normal all lie in the same _____.

Example 2

A ray of light hits a plane mirror as shown (Fig a).

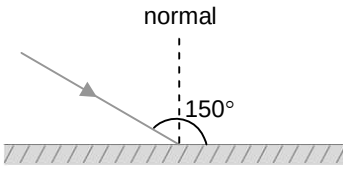


Fig a

The obtuse angle between the incident ray and the mirror is 150°.

(a) What is the angle of incidence?

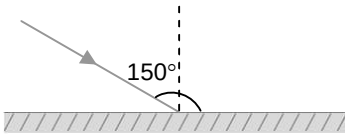
(b) What is the angle of reflection?

(c) Complete the ray diagram.

(a) Angle of incidence = 150° – _____ = _____

(b) Angle of reflection = _____

(c)



4 Parallel light rays are reflected in the same direction on flat and smooth surface. This is called _____ reflection (Fig 1i).

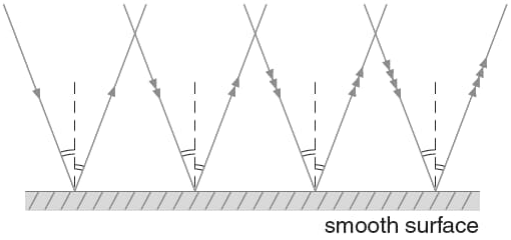


Fig 1i

5 Parallel light rays are reflected towards different directions on rough surface. This is called _____ reflection (Fig 1j).

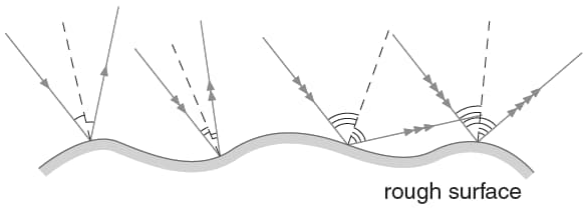


Fig 1j

6 _____ reflection enables a clear image to be formed (Fig 1k). However, _____ reflection produces a distorted image (Fig 1l).

Fig 1k

Fig 1l

1.3 Images formed by a plane mirror

Terms

- image (像)
- virtual image (虛像)
- laterally inverted (橫向倒置)

1 In Figure 1m, when light rays coming from *O* are reflected by a mirror into our eyes, we perceive the diverging rays as coming from point *I*. We call point *I* the _____ of *O*.

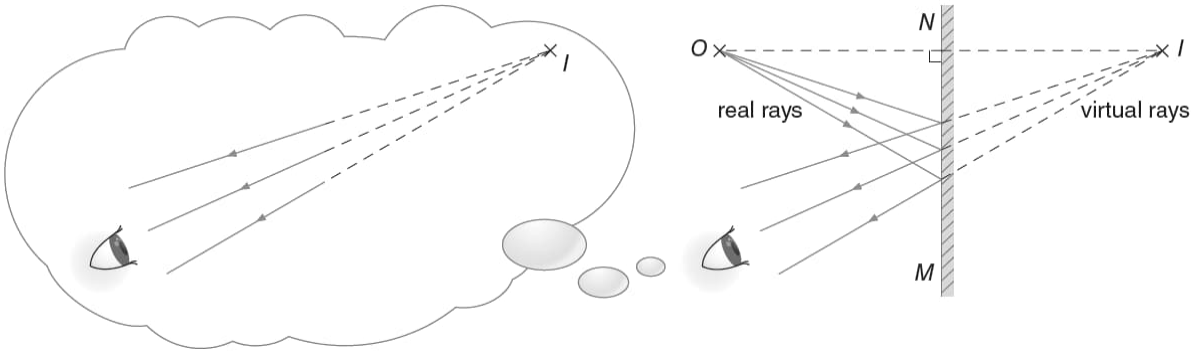


Fig 1m

2 The rays behind the mirror do not actually exist. They are called _____ rays.

Expt 1b Images formed by a plane mirror

Objective

To locate the image formed by a plane mirror.

Set up

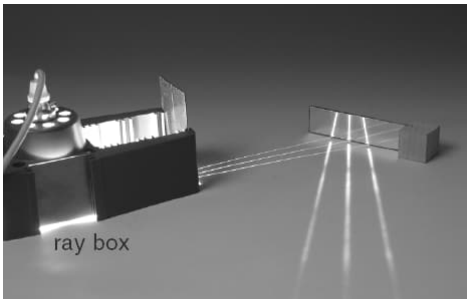
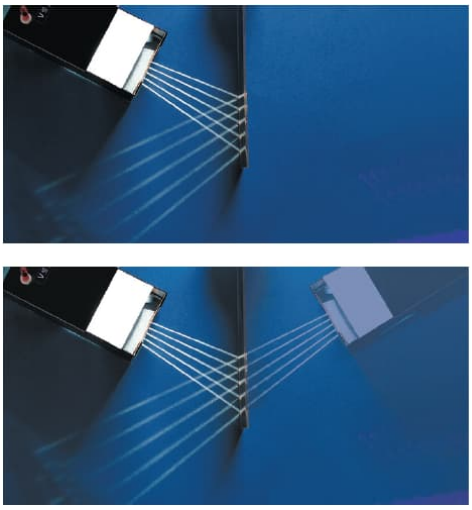


Fig a

Direct a set of divergent rays at a plane mirror on a piece of paper (Fig a). Draw the reflected rays on the paper. Trace the reflected rays back to meet at a point. This is where the image of the ray box is formed. **(Draw on P.12)**

3 In Experiment 1b, the reflected rays appear to come from a point behind the mirror. The image of the ray box is located at that point. However, the rays do not actually come from the image. Such an image _____ (can/cannot) be projected on a screen. It is called a _____ image (Fig 1n).



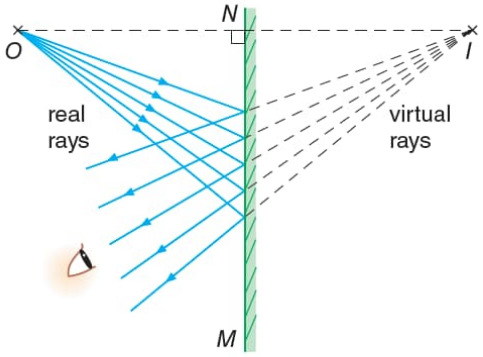


Fig 1n

Note that

The image formed by a plane mirror is as far behind the mirror as the object is in front (*ON = NI*)

Example 3

June and Gabriel are standing in front of a plane mirror. June is 5 m form the mirror and Gabriel is 4 m from the mirror (Fig a). What is the distance between June and the image of Gabriel?

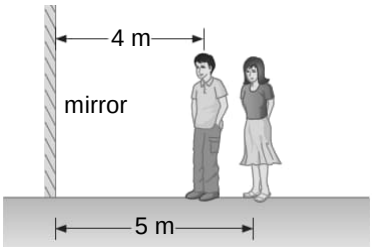


Fig a

Distance of the image of Gabriel from the mirror = _____

Distance between June and the image of Gabriel = _____

5 Any two points on the image are of the same distance as the corresponding points on the object (Fig 1p). Therefore the image formed by a plane mirror is of the same _____ as the object.

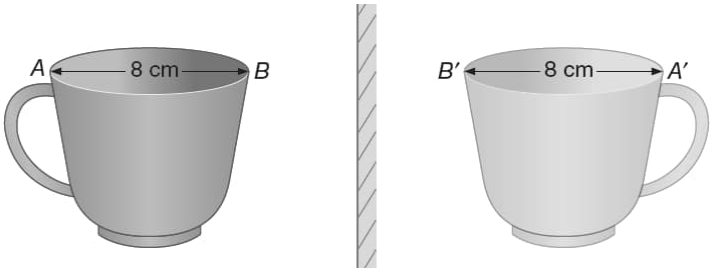


Fig 1p

Example 4 📖 p.14 Eg 3

A dog of 50 cm tall (Fig a) is 4 m in front of a plane mirror.

Fig a

(a) What is the height of its image?

(b) If the dog moves 2 m away from the mirror, how will the size of its image be affected?

💣 Hint: Size of the image = size of the object

(a) Height of the image =

(b) The size of the image will be (changed / unchanged).

6 The left hand will appear as the right hand in the mirror (Fig 1q). Mirror images are laterally _____. Beside, they are the right way up, or _____.

Fig 1q

7 To sum up, the image formed by a plane mirror has the following properties:

i	virtual,
ii	as _____ behind the mirror as the object is in front,
iii	of the _____as the object,
iv	erect but _____.

8 Figure 1r shows how the image formed by a plane mirror is constructed.

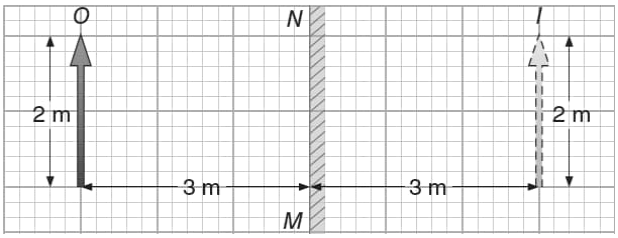


Fig 1r

Note that the image *I* must be

i of the same size as the object, i.e. _____ tall;

ii as far behind the mirror as the object is in front, i.e. _____ away from the mirror;

iii erect.

PERISCOPES

A periscope is a simple device that enables us to see over walls or round corners. Rays of light hitting the mirror of the periscope are reflected twice.

SCIENCE CONTEXT

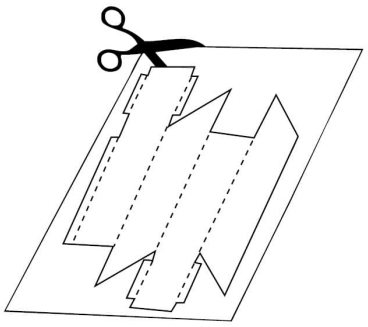
Light, that light travels from a source and is reflected from shiny surfaces e.g. mirrors, polished metals.

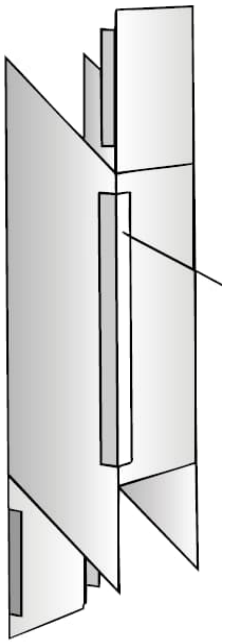
Application of periscopes

https://www.toppr.com/guides/physics/ray-optics-and-optical-instruments/periscope/

Let's make a periscopes

1. Attach the template to a piece of card with a paper clip and then cut it out.

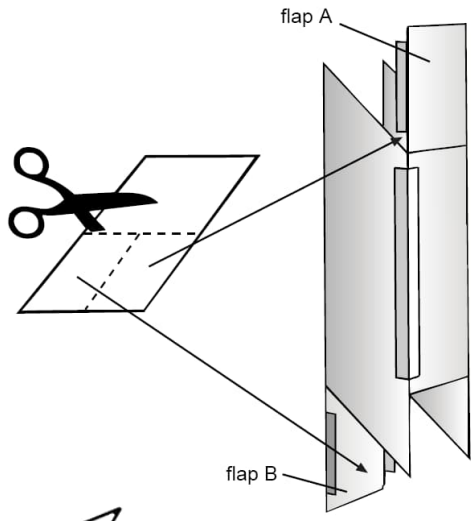




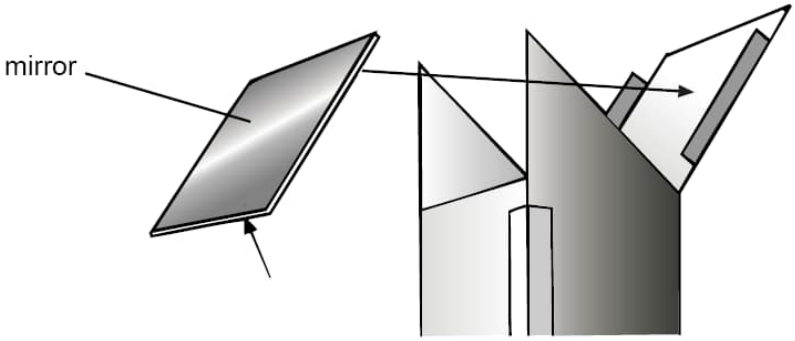
2. Fold along the dotted lines as shown on the template and strick together.

Tape

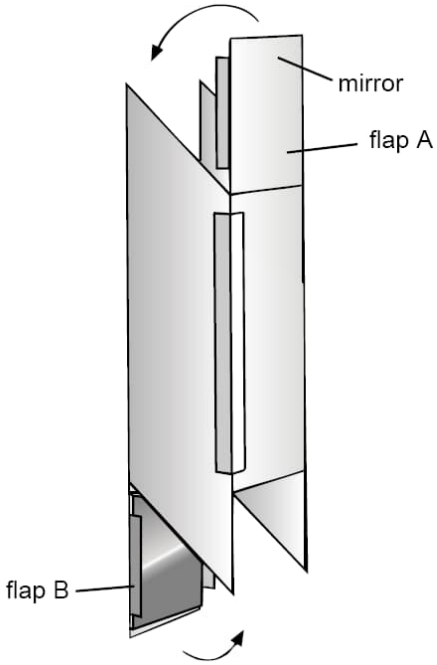
3. Cut two mirrors to fit flaps A and B, and peel off the protective plastic coating.

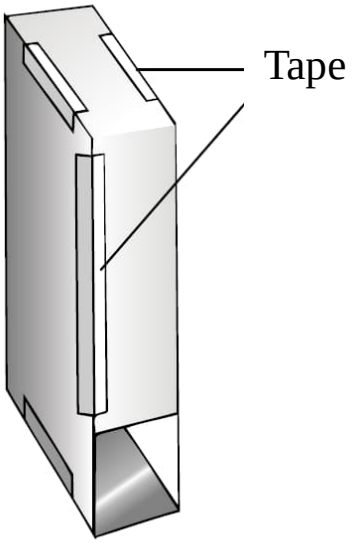


4. Glue the mirrors to the card.



5. Fix A and B to the supporting flaps.





Practical

Teacher will draw a letter “E” on the blackboard. Students use the periscope to observe.

Draw the image below.

Discussion

1. According to the observation, the image formed by a periscopes. (If the statement is correct put a ✓, if wrong put a ✖.)

   ☑ Virtual,

   ☐ As far behind the mirror as the object is in front,

   ☐ Same size as the object,

   ☐ Erect

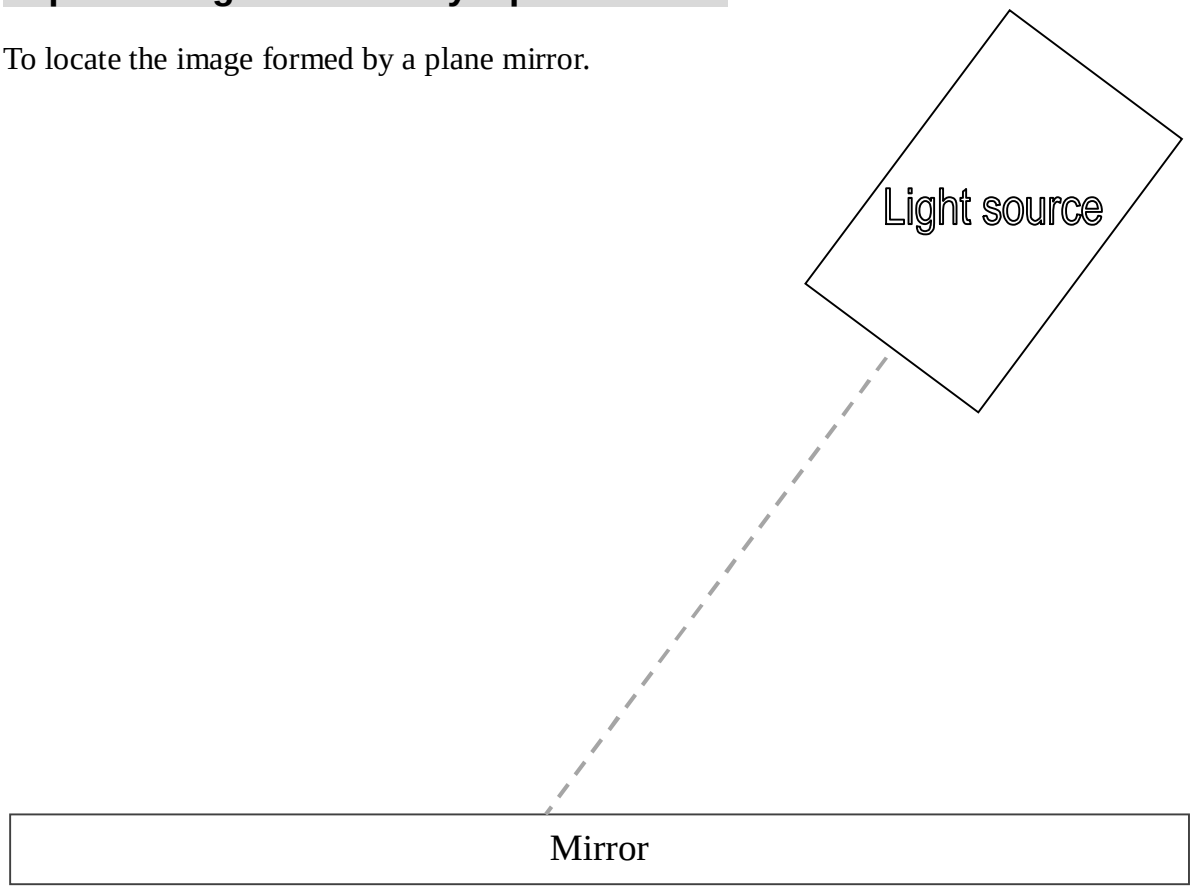
   ☐ Laterally inverted.

2.

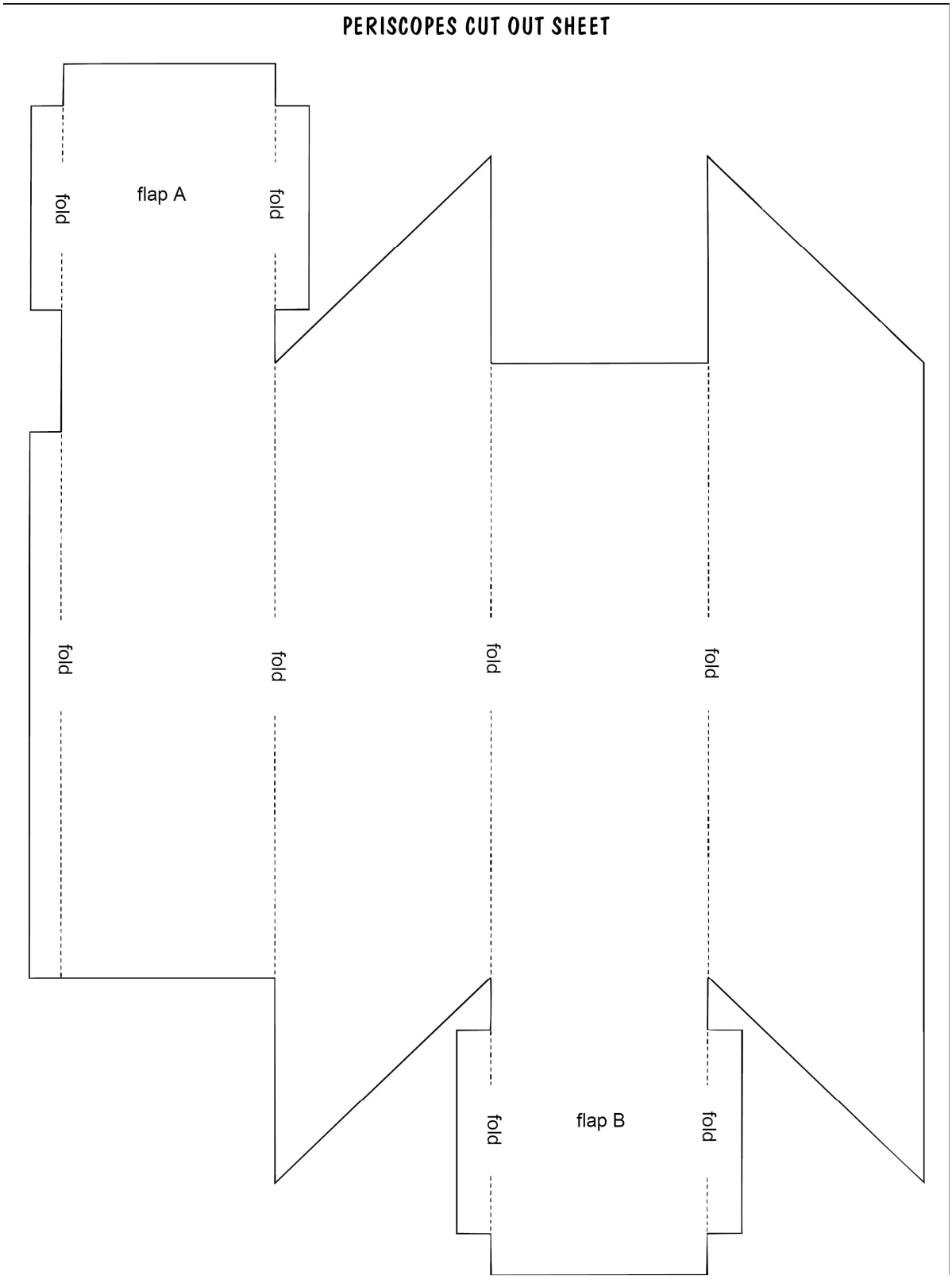
Appendix 1

Expt 1b Images formed by a plane mirror

To locate the image formed by a plane mirror.



Appendix 2


PERISCOPES CUT OUT SHEET
fold
flap A
fold
fold
fold
fold
fold
fold
flap B
fold