

6

Light

> 6.1 Reflection

Exercise 6.1A Making reflections

Focus

In this exercise, you will start to describe reflection.

- 1 Which of these means the same as ‘plane mirror’?

Tick (✓) one box.

curved mirror ☐

magnifying mirror ☐

flat mirror ☐

bathroom mirror ☐

- 2 A moving ball is an analogy for the movement of light. Which of these movements of the ball is an analogy for reflection of light?

Tick (✓) one box.

stopping ☐

bouncing ☐

slowing down ☐

speeding up ☐

- 3 A ray of light is reflected at a mirror.

Write the name given to:

- a the ray of light arriving at a mirror

.....

- b the ray of light that has been reflected

.....

- c the line in the ray diagram that is at to the mirror.

.....

Exercise 6.1B Ray diagrams

Practice

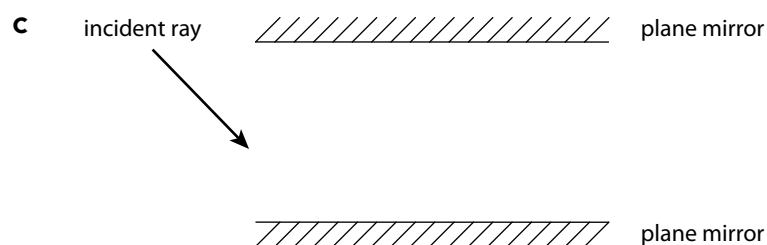
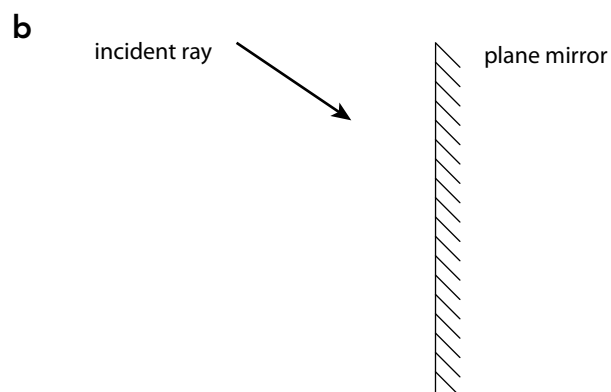
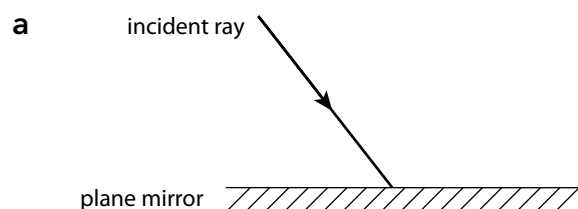
In this exercise, you will draw ray diagrams for reflection.

1 Complete these ray diagrams.

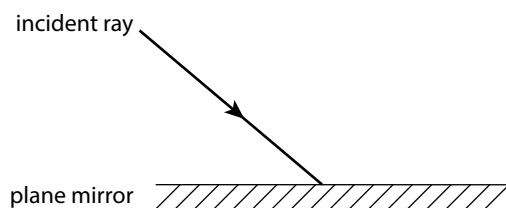
In each diagram, include:

- the normal
- the reflected ray
- the angle of incidence, i
- the angle of reflection, r .

You do **not** have to measure any angles.



- 2 a Use a protractor to draw the normal on this ray diagram.



- b Use a protractor to measure the angle of incidence.

angle of incidence =

Exercise 6.1C Accurate ray diagrams

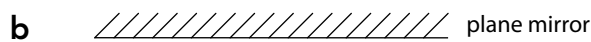
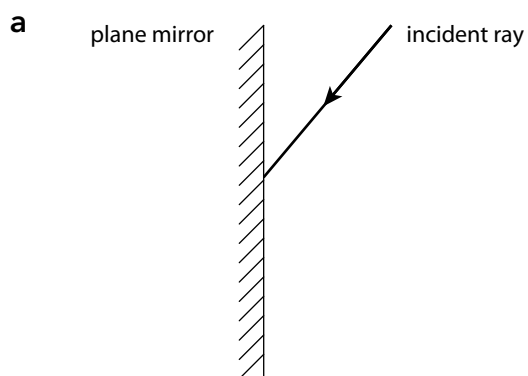
Challenge

In this exercise, you will use a protractor to draw accurate ray diagrams.

- 1 Complete these ray diagrams accurately. Use a protractor.

In each diagram:

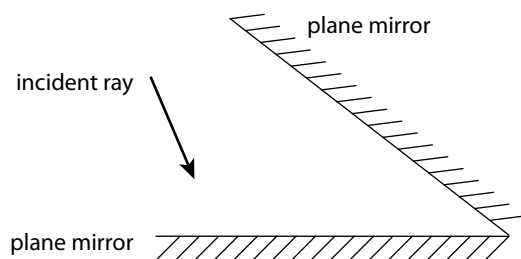
- draw the normal accurately
- draw the reflected ray accurately
- write the angle of incidence and the angle of reflection in the correct places.



- 2 Complete this ray diagram accurately.

Show **two** reflections.

Write the angles of incidence and angles of reflection in the spaces below the diagram.



first angle of incidence =

first angle of reflection =

second angle of incidence =

second angle of reflection =

> 6.2 Refraction

Exercise 6.2A Causes of refraction

Focus

In this exercise, you will think about what causes refraction.

- 1 Light can travel through transparent objects.

What name is given to any transparent object that light can pass through?

Choose one word from the list.

medium regular normal average

- 2 The table shows the speed of light in air, in water and in glass.

Transparent substance	Speed of light in km/s
air	300 000
water	225 000
glass	200 000

Complete these sentences using information from the table.

Use the words **speeds up** or the words **slows down** to complete each sentence.

- a When light passes from air into water, the light
.....
- b When light passes from glass into air, the light
.....
- c When light passes from water into glass, the light
.....

- 3 Use words from the list to complete the sentences.

shape speed distance refraction incident ray normal

When light changes direction, the change in direction can be caused
by a change in

When light changes direction passing from air into glass, this is
called

Exercise 6.2B Predicting refraction

Practice

In this exercise, you will predict what happens when light passes between different substances.

- 1 Explain what causes refraction.

.....

.....

.....

- 2 The table shows the speed of light in five different transparent substances.

Transparent substance	Speed of light in km/s
air	300 000
water	225 000
corn oil	204 000
diamond	124 000
glycerol	204 000

- a In which substance does light travel most slowly?

.....

- b Between which two substances would there be **most** refraction?

..... and

- c Between which two substances would there be **no** refraction?

..... and

- 3 Complete these sentences using either the word **towards** or the words **away from**.

When light passes into a medium where it slows down, the light bends the normal.

When light passes into a medium where it speeds up, the light bends the normal.

- 4 A window is covered in rain drops.

Explain why you cannot see clearly through the window when it is covered in rain drops.

.....

.....

.....

Exercise 6.2C Refraction ray diagrams

Challenge

In this exercise, you will draw ray diagrams to show how light is refracted.

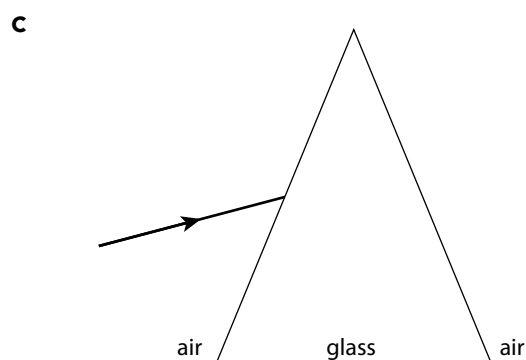
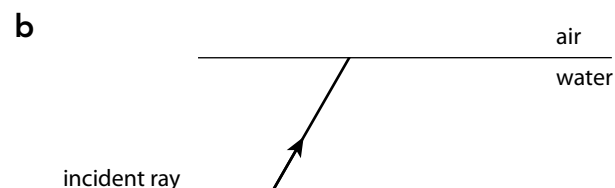
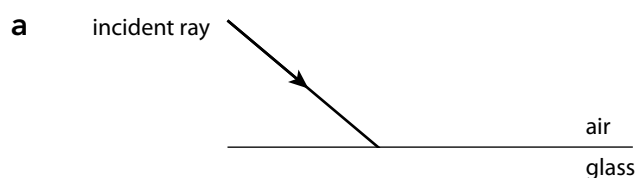
- 1 Complete the ray diagrams to show how light is refracted.

Where there are more than two surfaces, show the refraction at each surface.

In each diagram, include:

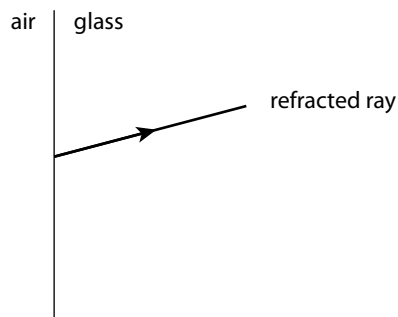
- the normal
- the refracted ray
- the angle of incidence, i
- the angle of refraction, r .

You do **not** have to measure any angles.



2 Complete the ray diagram to show:

- the normal
- the incident ray.



> 6.3 Making rainbows

Exercise 6.3A Colours of the rainbow

Focus

In this exercise, you will think about the different colours of the rainbow.

1 Which of these describes the range of colours in a rainbow?

Tick (✓) **one** box.

spectrum ☐

section ☐

vacuum ☐

reflection ☐

2 The list shows some of the colours of the rainbow in the correct order.

Complete the list so all the colours are in the correct order.

red,, yellow, green,,

indigo,

3 It is possible to make a rainbow effect in the laboratory by using a prism.

a State the colour of light that needs to shine on the prism to get a complete rainbow effect.

.....

b Give the name for splitting this colour of light into the colours of the rainbow.

.....

c Which of these describes how the colours appear on a white screen?

Tick (✓) **one** box.

Each colour is separated from the next one with a white space.

☐

Each colour is separated from the next one with a black space.

☐

Each colour merges into the next one with no space.

☐

Each colour forms a circle around the next one.

☐

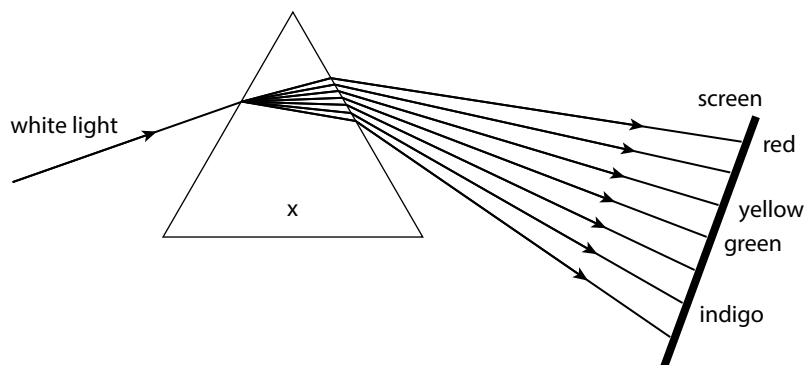
Exercise 6.3B Making a spectrum 1

Practice

In this exercise, you will think about how a spectrum of light is formed.

- 1 The ray diagram shows what happens when white light is separated into the colours of the rainbow, on a screen.

Only four of the colours of the rainbow are labelled.



- a Name the piece of equipment labelled X in the diagram.

.....

- b Which colour of light in the diagram is refracted the most when passing through X?

.....

Explain your answer.

.....

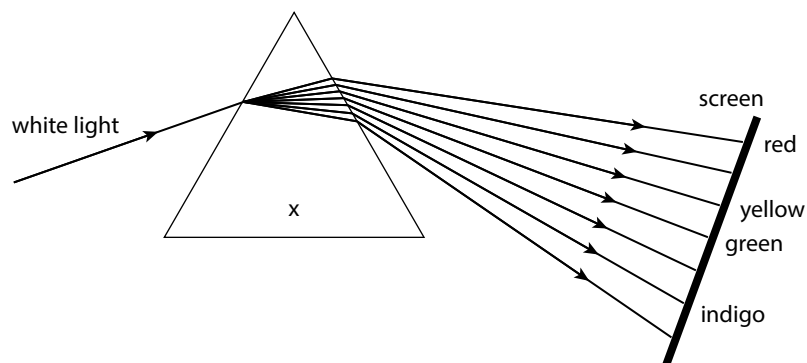
.....

Exercise 6.3C Making a spectrum 2

Challenge

In this exercise, you will think in more detail about how a spectrum is formed.

- 1 Look at the ray diagram.



The piece of equipment labelled X is made from a type of transparent plastic.

Use information in the ray diagram to explain how the speeds of the different colours of light compare when passing through this plastic.

.....

.....

.....

.....

.....

.....

> 6.4 Colours of light

Exercise 6.4A Adding primary colours

Focus

In this exercise, you will think about what happens when colours of light are added.

- 1 What is meant by the primary colours of light?

Tick (✓) **one** box.

colours of light that come first in the rainbow ☐

colours of light that cannot be made by adding other colours ☐

colours of light that can be made by adding any other colours ☐

colours of light that are brightest in a rainbow ☐

- 2 The primary colours of light are red, green and blue.

Complete the sentences.

a Adding red light and green light makes light.

b Adding green light and blue light makes light.

c Adding red light, green light and blue light makes light.

- 3 The Sun gives out seven colours of light.

Explain why the light from the Sun appears to be white.

.....

Exercise 6.4B Subtracting colours of light

Practice

In this exercise, you will think about what happens when light passes through coloured filters.

- 1 White light shines on a red filter.

Green light does **not** pass through the red filter.

- a Name **one other** colour of light that does **not** pass through the red filter.

.....

- b Complete the sentences using words from the list.

transmitted reflected absorbed refracted

The green light has been by the red filter.

Red light passes through the filter because red light is

..... by the filter.

- 2 White light shines on a blue filter.

- a State the colour which passes through the blue filter.

.....

Explain your answer in terms of subtraction of light.

.....

.....

.....

- b The light that passes through the blue filter is made to shine on a green filter.

Explain what will happen.

.....

.....

- 3 The sign above a shop gives out yellow light.
The sign uses white lamps.
Explain how white lamps can be used to produce yellow light.

.....

.....

.....

Exercise 6.4C Seeing colours

Challenge

In this exercise, you will think about why objects appear to be different colours.

- 1 a A green T-shirt appears green in white light.
Use the best words to complete these sentences.
- The green T-shirt only green light.
- The green T-shirt all
the other colours of light.
- b State how the green T-shirt would appear in red light.
-
- 2 State the colour, or colours, of light that should be used to produce each of these effects.
- a Make a red car look red.
..... light or light
- b Make white paper look blue.
..... light
- c Make a green apple appear black.
..... light or light

- 3 a Suggest why scientists do **not** consider black to be a colour.

.....

.....

- b Suggest why scientists do **not** consider white to be a colour.

.....

.....

Which of these shapes best describes the galaxy where we live?

Tick (✓) **one** box.