

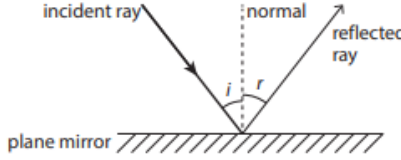
Unit 6 Light

Topic 6.1 Reflection

Exercise 6.1A Making reflections

- 1 flat mirror
- 2 bouncing
- 3
 - a incident ray
 - b reflected ray
 - c normal

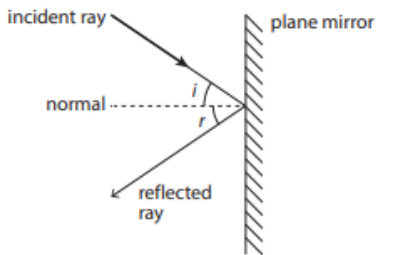
Exercise 6.1B Ray diagrams

- 1
 - a 

incident ray

normal

reflected ray

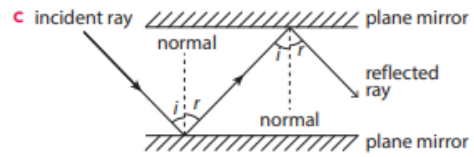
plane mirror
 - b 

incident ray

normal

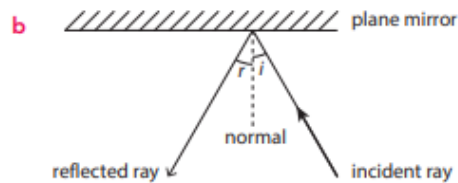
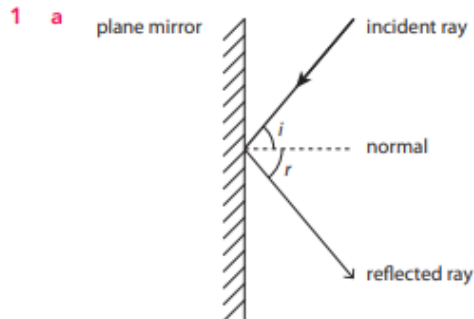
reflected ray

plane mirror

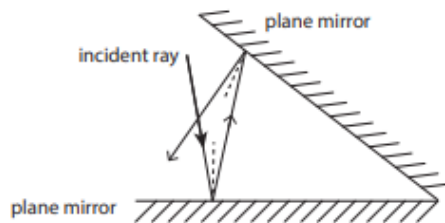


- 2
 - a line drawn at 90° to the mirror surface at the point where the light ray meets the surface; line can be dashed or solid and may pass through the mirror surface
 - b angle of incidence = 50°

Exercise 6.1C Accurate ray diagrams



- 2 First angle of incidence in range $20\text{--}23^\circ$. First angle of reflection should be equal to this. Second angle of incidence should be smaller than first. Second angle of reflection should be equal to second angle of incidence.



Topic 6.2 Refraction

Exercise 6.2A Causes of refraction

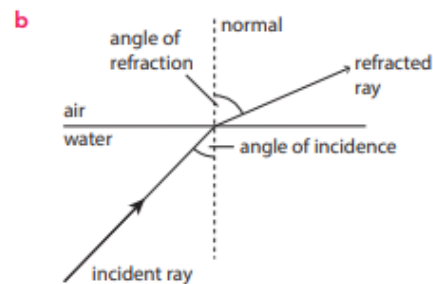
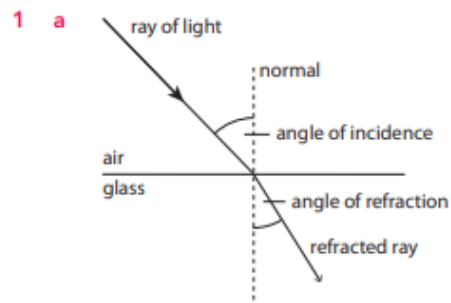
- 1 medium
- 2 a When light passes from air into water, the light **slows down**.
- b When light passes from glass into air, the light **speeds up**.
- c When light passes from water into glass, the light **slows down**.

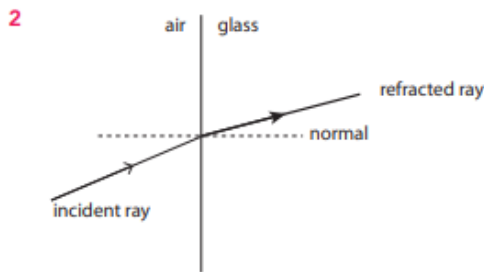
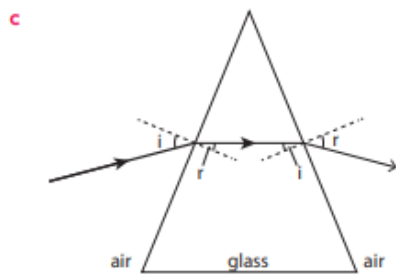
- 3 When light changes direction, the change in direction can be caused by a change in **speed**.
When light changes direction passing from air into glass, this is called **refraction**.

Exercise 6.2B Predicting refraction

- 1 When light changes speed (caused by) passing from one transparent substance/medium to another.
- 2 a diamond
b air and diamond
c corn oil and glycerol
- 3 When light passes into a medium where it slows down, the light bends **towards** the normal.
When light passes into a medium where it speeds up, the light bends **away from** the normal.
- 4 Raindrops refract light; raindrops are curved; raindrops refract light in different directions.

Exercise 6.2C Refraction ray diagrams





Topic 6.3 Making rainbows

Exercise 6.3A Colours of the rainbow

- spectrum
- red, **orange**, yellow, green, **blue**, indigo, **violet**
- white
 - dispersion
 - Each colour merges into the next one with no space.

Exercise 6.3B Making a spectrum 1

- triangular prism
 - violet; because violet bends through the largest angle
 - Move the screen closer to the prism.
 - The colours get closer together / merge together more.

Exercise 6.3C Making a spectrum 2

- Violet light slows the most when passing from air into plastic; violet is refracted the most; violet travels slowest in plastic; red light travels fastest in plastic and is refracted the least; other 5 colours listed in order of speed, either increasing or decreasing (increasing speed starts with violet, decreasing speed starts with red).

Topic 6.4 Colours of light

Exercise 6.4A Adding primary colours

- Colours of light that cannot be made by adding other colours.
- Adding red light and green light makes **yellow** light.
 - Adding green light and blue light makes **cyan** light.
 - Adding red light, green light and blue light makes **white** light.
- All seven colours are given out together; all seven colours are of (approximately) equal brightness; all seven colours mix to give white light.

Exercise 6.4B Subtracting colours of light

- any one from orange, yellow, blue, indigo, violet
 - The green light has been **absorbed** by the red filter. Red light passes through the filter because red light is **transmitted** by the filter.
- blue
All other colours except blue are subtracted/absorbed/removed from the white light, so only blue remains.
 - The remaining blue light will be absorbed by the green filter.
- A yellow filter is used; all other colours except yellow are subtracted/absorbed/removed from the white light, so only yellow is transmitted.

Exercise 6.4C Seeing colours

- The green T-shirt **reflects** only green light. The green T-shirt **absorbs** all the other colours of light.
 - black
- red or white
 - blue
 - red or blue
- Black does not reflect light of any colour / black is the absence of light.
 - White reflects all colours equally / white light contains all colours.

Topic 6.5 Galaxies

Exercise 6.5A Our own galaxy

- Milky Way
 - tick under first picture (spiral)
- the Sun
 - more than 1 000 000
- There is a small quantity of dust between the stars in our galaxy; **true**.

There is a small quantity of gas between the stars in our galaxy; **true**.

Exercise 6.5B Galaxies in space 1

- Universe
 - They contain stars; stars give out their own light.
- spiral, elliptical, irregular
- Scientists have made an estimate of how many galaxies there are in total. This number may not be accurate/exact.

Exercise 6.5C Galaxies in space 2

- gas, stars, planets/solar systems
 - Each particle of dust causes a small force of gravity; there are very many particles of dust; the gravity from all of them adds up to a large force.
- stars
 - Any two from: they do not reflect light; they absorb light; they do not give out light.
- Any two from: fewer will be seen; they will be dimmer; they will appear smaller.
- Count the number of grains in a small volume / volume given, for example 0.1 cubic centimetre; then estimate the volume of sand on the whole beach by multiplying length \times width \times depth; convert both volumes to the same unit; divide the volume of the sand on the whole beach by the volume of the small sample; multiply the counted number of grains by the result of this calculation.
 - The total number cannot be counted accurately; the method for both estimates is the same; both methods assume the spacing of objects is uniform.

Topic 6.6 Rocks in space

Exercise 6.6A Describing asteroids

- Asteroids are made from rock. Asteroids can have irregular shapes.
- Between the orbits of Mars and Jupiter.
- orbit

Exercise 6.6B Asteroids and planets

- Any two from: asteroids are smaller than Earth; asteroids have no atmosphere; asteroids have no oceans; (many) asteroids have an irregular shape.
- There are too many asteroids/not all have been discovered/difficulty telling them apart by appearance.
- $\frac{5000}{10} = 500$ km

Exercise 6.6C Asteroids and planets

- Any two from: both orbit the Sun; both are part of the Solar System; both contain rock.
- Asteroids are too small/gravity from asteroids is too low to attract/hold a moon.
- There was not enough gravity between them to form a planet; there were not enough of them to form a planet.
- Answer can refer to: poor quality/low resolution of the photograph; lack of evidence that aliens exist; desire to attract attention to the website/make a sensational claim; light reflecting off a crater is more likely/more realistic; alien building is exciting but not realistic explanation; universities will have experts looking at the picture; independent website may not have experts contributing; opinions can vary on interpreting photographs; reference to opinion or fact.