

# Light, the Human Eye and the Colourful World

Science · Class 10 · Topic-wise Practice Worksheet

|                    |                 |                   |                        |
|--------------------|-----------------|-------------------|------------------------|
| TIME<br>45 minutes | QUESTIONS<br>18 | TOTAL MARKS<br>24 | MAX. SCORE<br>___ / 24 |
|--------------------|-----------------|-------------------|------------------------|

Name: \_\_\_\_\_ Class/Sec: \_\_\_\_\_ Date: \_\_\_\_\_

## INSTRUCTIONS

- There are **18 questions** in this worksheet. All questions are compulsory.
- Each question has four options (A), (B), (C) and (D). Exactly **one** option is correct.
- Questions 1–15 carry **1 mark** each. Questions 16–18 (Achievers Section) carry **3 marks** each.
- There is no negative marking. Study every ray diagram and table carefully.

## Section A — Scientific Reasoning

Q1–Q8 · 1 mark each

- According to the laws of reflection, the angle of incidence is \_\_\_\_\_ the angle of reflection.
 

(A) Greater than
(B) Less than

(C) Equal to
(D) Twice
- The image formed by a plane mirror is \_\_\_\_\_.
 

(A) Real and inverted
(B) Virtual and diminished

(C) Real and magnified
(D) Virtual, erect and of the same size as the object
- A concave mirror is used by a dentist to examine teeth because it can form \_\_\_\_\_.
 

(A) A diminished image always
(B) A magnified, erect image when the object is close to it

(C) No image at all
(D) Only real images
- A convex mirror is used as a rear-view mirror in vehicles because it \_\_\_\_\_.
 

(A) Magnifies distant vehicles
(B) Forms real images

(C) Gives a wider field of view
(D) Absorbs light
- Light bends on passing from one transparent medium into another because its \_\_\_\_\_ changes.
 

(A) Colour
(B) Amplitude

(C) Frequency
(D) Speed
- The refractive index of a medium is defined as \_\_\_\_\_.
 

(A)  $\frac{\text{speed of light in vacuum}}{\text{speed of light in the medium}}$ 
(B)  $\frac{\text{speed of light in the medium}}{\text{speed of light in vacuum}}$

(C) speed of light in vacuum  $\times$  speed in the medium
(D) The thickness of the medium
- The power of a lens is \_\_\_\_\_.
 

(A) The reciprocal of its focal length in metres
(B) The square of its focal length

(C) Its focal length in centimetres
(D) Its diameter

8. In the human eye, a sharp image of the object being viewed is formed on the \_\_\_\_\_.

(A) Cornea

(B) Retina

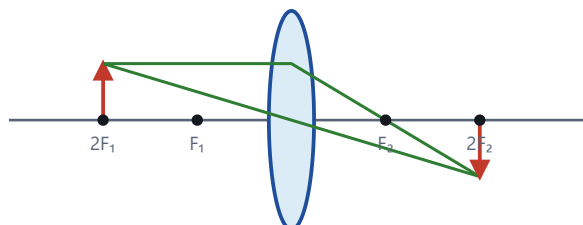
(C) Iris

(D) Pupil

### Section B — Applying What You Know

Q9–Q15 · 1 mark each

9. In the ray diagram, an object is placed at  $2F_1$  in front of a converging lens. The image formed is \_\_\_\_\_.



*An object at  $2F_1$  in front of a converging lens*

(A) Real, inverted and magnified

(B) Virtual, erect and magnified

(C) Real, inverted and of the same size, at  $2F_2$

(D) Virtual, inverted and diminished

10. The focal length of a convex lens is 50 cm. Its power is \_\_\_\_\_.

(A) +0.5 D

(B) +50 D

(C) –2 D

(D) +2 D

11. One row of the table below is **incorrectly** matched. Which row is it?

| Row | Defect of vision                 | Corrective lens                  |
|-----|----------------------------------|----------------------------------|
| (A) | Myopia (short-sightedness)       | Concave lens                     |
| (B) | Hypermetropia (long-sightedness) | Concave lens                     |
| (C) | Presbyopia                       | Bifocal lens                     |
| (D) | Cataract                         | Surgical replacement of the lens |

*Table 5.1 — Defects of vision and their correction*

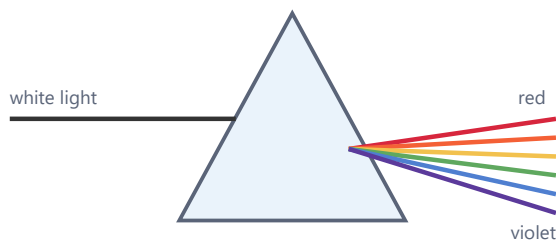
(A) (A)

(B) (B)

(C) (C)

(D) (D)

12. When white light passes through a glass prism, the colour that bends the **least** is \_\_\_\_\_.



*Dispersion of white light by a glass prism*

- (A) Red (B) Green  
(C) Blue (D) Violet
13. Stars appear to twinkle at night mainly because of \_\_\_\_\_.  
(A) The stars actually changing brightness (B) Atmospheric refraction, which keeps changing slightly  
(C) Total internal reflection in the eye (D) Dispersion inside the star
14. The sky appears blue because the molecules of air \_\_\_\_\_.  
(A) Emit blue light of their own (B) Absorb all colours except blue  
(C) Scatter shorter wavelengths such as blue more strongly (D) Reflect the blue of the oceans
15. A student cannot see distant objects clearly but reads comfortably from a book held close. The defect and its correction are \_\_\_\_\_.  
(A) Hypermetropia, corrected with a convex lens (B) Myopia, corrected with a convex lens  
(C) Hypermetropia, corrected with a concave lens (D) Myopia, corrected with a concave lens

### Achievers Section

Q16–Q18 · 3 marks each

16. **Assertion (A):** The sun appears reddish at sunrise and sunset.  
**Reason (R):** Near the horizon sunlight travels through a much greater thickness of atmosphere, so most of the blue light is scattered away before it reaches us.  
(A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true but R is not the correct explanation of A  
(C) A is true but R is false (D) A is false but R is true
17. An object is placed 15 cm in front of a convex lens of focal length 10 cm. The image formed is \_\_\_\_\_.  
(A) At 30 cm from the lens, real, inverted and twice the size of the object (B) At 30 cm from the lens, virtual and erect  
(C) At 6 cm from the lens, real and diminished (D) At infinity
18. An elderly person finds that they can read only when the book is held more than 50 cm away, though their distance vision is fine. The most suitable correction is \_\_\_\_\_.  
(A) A concave lens, because the near point has moved further away (B) A convex lens, because the near point has moved further away  
(C) A convex lens, because the far point has moved closer (D) No lens is needed

# Answer Key

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|    |   |    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|----|---|
| 1  | C | 2  | D | 3  | B | 4  | C | 5  | D |
| 6  | A | 7  | A | 8  | B | 9  | C | 10 | D |
| 11 | B | 12 | A | 13 | B | 14 | C | 15 | D |
| 16 | A | 17 | A | 18 | B |    |   |    |   |

## Solutions

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**1. Answer: (C)** Equal to

The angle of incidence is always **equal to** the angle of reflection, and the incident ray, the reflected ray and the normal all lie in one plane.

**2. Answer: (D)** Virtual, erect and of the same size as the object

A plane mirror gives an image that is **virtual, erect and the same size as the object**, at the same distance behind the mirror. It is also laterally inverted, which is why writing appears reversed.

**3. Answer: (B)** A magnified, erect image when the object is close to it

When the object lies between the pole and the focus, a concave mirror forms **a magnified, erect, virtual image**, which is what makes the tooth easier to see. The same property is used in shaving mirrors.

**4. Answer: (C)** Gives a wider field of view

A convex mirror always gives an erect, diminished, virtual image, so it packs a **wider field of view** into the same area of glass, letting the driver see more of the road behind.

**5. Answer: (D)** Speed

Refraction happens because the **speed** of light differs from one medium to another. The frequency, and hence the colour, stays unchanged.

**6. Answer: (A)**  $\frac{\text{speed of light in vacuum}}{\text{speed of light in the medium}}$

The refractive index is  $\frac{\text{speed of light in vacuum}}{\text{speed of light in the medium}}$ . Since light always slows down in a medium, this ratio is greater than 1.

**7. Answer: (A)** The reciprocal of its focal length in metres

Power  $P = \frac{1}{f}$ , with  $f$  in metres, and it is measured in dioptres (D). A converging lens has positive power and a diverging lens negative power.

**8. Answer: (B)** Retina

The **retina**, the light-sensitive layer at the back of the eye, receives the image, and its cells send signals to the brain along the optic nerve. The iris merely controls how much light enters.

**9. Answer: (C)** Real, inverted and of the same size, at  $2F_2$

The two rays meet on the far side of the lens at  $2F_2$ , so the image is **real, inverted and the same size as the object**. This is the one position at which a converging lens neither magnifies nor diminishes.

**10. Answer: (D)** +2 D

Convert the focal length to metres: 50 cm = 0.5 m. Then  $P = \frac{1}{0.5} = +2 \text{ D}$ , positive because the lens is converging.

**11. Answer: (B)** (B)

In hypermetropia the image falls behind the retina, so extra converging power is needed — the correction is a *convex* lens, not a concave one. So row **(B)** is wrong; the other three are correct.

**12. Answer: (A)** Red

A prism bends longer wavelengths least, and **red** has the longest wavelength in the visible spectrum, so it emerges nearest the original direction. Violet, with the shortest wavelength, is bent most, which is why it lies at the other end of the spectrum.

**13. Answer: (B)** Atmospheric refraction, which keeps changing slightly

Starlight passes through layers of air of varying density and temperature, and this **continually changing atmospheric refraction** makes the star's apparent position and brightness flicker. Planets, being nearer and appearing as small discs rather than points, twinkle much less.

14. **Answer: (C)** Scatter shorter wavelengths such as blue more strongly

Very fine particles scatter short wavelengths far more effectively than long ones, so the blue in sunlight is **scattered in all directions** and reaches us from every part of the sky. Above the atmosphere, with no molecules to scatter light, the sky looks black.

15. **Answer: (D)** Myopia, corrected with a concave lens

Difficulty with distant objects means the image is being formed in front of the retina, which is **myopia**. A diverging **concave lens** spreads the rays slightly before they enter the eye, pushing the image back on to the retina.

16. **Answer: (A)** Both A and R are true and R is the correct explanation of A

At sunrise and sunset the light takes a long slanting path through the air. The short blue wavelengths are scattered out of that beam, leaving mainly the long red ones to reach the eye. Both statements are true and the second is exactly **why** the first happens, so R explains A.

17. **Answer: (A)** At 30 cm from the lens, real, inverted and twice the size of the object

Working with magnitudes,  $\frac{1}{v} = \frac{1}{f} - \frac{1}{u}$  gives  $\frac{1}{v} = \frac{1}{10} - \frac{1}{15} = \frac{1}{30}$ , so  $v = 30$  cm on the far side of the lens. The

magnification is  $\frac{v}{u} = \frac{30}{15} = 2$ , and the image is inverted. So it is **real, inverted, twice the size and 30 cm from the lens** — as expected for an object placed between F and 2F.

18. **Answer: (B)** A convex lens, because the near point has moved further away

A near point beyond the normal 25 cm, with clear distance vision, is hypermetropia caused by the eye lens losing flexibility with age. Extra converging power is needed to focus nearby objects on the retina, so the correction is a **convex lens**.