Class 10 · Science · Chapter 10

The Human Eye and the Colourful World

Answer key — every question, the correct option and model answers

The green option is the correct answer. Board questions show their own exam year and page.

Lesson check questions

Parts of the eye and the power of accommodation

1 **Where does the human eye form the image of an object?**

Check

a On the cornea

b On the iris

c On the pupil

d **On the retina**

💡 **Hint:** The light-sensitive screen.

Explanation:

The lens forms an inverted real image on the retina.

2 **The near point of a normal young eye is about**

Check

a 25 m

b 2.5 cm

c **25 cm**

d 2.5 m

💡 **Hint:** The least distance of distinct vision.

Explanation:

For a normal young eye the near point is about 25 cm.

3 **The ciliary muscles change the focal length of the eye lens.**

Check

✓ **True**

✗ False

Explanation:

True — with relaxed muscles the lens is thin and the focal length increases.

4 **The ability of the eye to change its focal length is called _____ .**

Check

Answer: समंजन

💡 **Hint:** The English word is accommodation.

Explanation:

It is called accommodation, or the power of accommodation.

5 **Write one difference between the job of the cornea and the job of the eye lens.**

Check · 2 marks

Model answer (board format)

Most of the refraction of the rays takes place at the cornea. The eye lens makes the fine adjustment of focal length so that the image falls on the retina.

6 **For a distant object take the distance from the lens to the retina as 2.3 cm. Find the power of the eye in dioptres.**

Check · 2 marks

Model answer (board format)

For a distant object u is infinite, so f = v = 2.3 cm = 0.023 m. Formula P = 1/f. P = 1/0.023 = about 43.5 D. The unit is the dioptre.

Myopia and hypermetropia — which lens

1 **Which lens corrects myopia?**

Check

- **a** A convex lens
- **b** **A concave lens**
- **c** The lower part of a bifocal
- **d** A plane mirror

💡 **Hint:** The image is forming in front of the retina and must be shifted back.

Explanation:

Myopia is corrected with a concave lens.

2 **In hypermetropia, where does the image of a nearby object form?**

Check

a On the retina

b In front of the retina

c **Behind the retina**

d On the cornea

💡 **Hint:** The eyeball is too small, or the focal length is too long.

Explanation:

In hypermetropia the image forms behind the retina. A convex lens brings it onto the retina.

3 **The far point of a myopic eye is at infinity.**

Check

✓ True

✗ **False**

Explanation:

False — the far point comes closer than infinity. The person sees clearly only up to a few metres.

4 **Hypermetropia is corrected by a _____ lens.**

Check

Answer: उत्तल

💡 **Hint:** Extra focusing power is needed.

Explanation:

Hypermetropia is corrected by a convex (converging) lens.

5 **A person has a far point of 40 cm. Find the power of the correcting lens. Write the formula, the substitution and the unit.**

Check · 3 marks

Model answer (board format)

$1/f = 1/v - 1/u$. $u = -\infty$, $v = -0.40$ m. $1/f = 1/(-0.40) = -2.5$ m^{-1}. $P = -2.5$ D. The lens is concave.

Presbyopia, bifocal lenses and eye donation

1 **The upper part of a bifocal lens is**

Check

a Convex, for near vision

b **Concave, for distant vision**

c Concave, for near vision

d Plane

💡 **Hint:** The part for distant vision sits on top.

Explanation:

The upper concave lens is for distant vision. The lower convex lens is for near vision.

2 **In cataract the eye lens becomes milky and cloudy.**

Check

✓ **True**

✗ False

Explanation:

True — surgery can restore the vision.

3 **The main cause of presbyopia is —**

Check

a The eyeball suddenly becoming long

b Weakening of the ciliary muscles and loss of flexibility of the lens

c The cornea becoming opaque

d The optic nerve being cut

💡 **Hint:** It comes with age.

Explanation:

In presbyopia the ciliary muscles weaken and the lens becomes less flexible.

4 **Within what time must eyes be removed for donation? Name one illness in which donation is not possible.**

Check 2 marks

Model answer (board format)

Within 4 to 6 hours of death. Donation is not possible in AIDS, hepatitis B or C, rabies, acute leukaemia, tetanus, cholera, meningitis or encephalitis.

5 **The upper part of a bifocal lens has power −2.0 D. Find the focal length in cm and state which kind of vision this part is for.**

Check 3 marks

Model answer (board format)

f = 1/P = 1/(−2.0) = −0.50 m = −50 cm. A negative focal length is a concave lens. The upper part is for distant vision.

Refraction through a prism — Activity 10.1

1 **How does the ray leaving a glass prism stand relative to the incident ray?**

Check

- a Always parallel
- b Always perpendicular
- c **Bent at an angle**
- d It stops inside the prism

💡 **Hint:** That angle is called the angle of deviation.

Explanation:

Because the faces are inclined, the emergent ray bends from the incident ray by the angle of deviation.

2 **At the first face of a prism, a ray entering from air into glass bends towards the normal.**

Check

- ✓ **True**
- ✗ False

Explanation:

True — from a rarer to a denser medium the ray bends towards the normal.

3 **The angle between the incident ray and the emergent ray is called the angle of _____.**

Check

Answer: विचलन

💡 **Hint:** The English word is deviation.

Explanation:

This is the angle of deviation ∠D. The angle of the prism ∠A is a different thing.

4 **In Activity 10.1, why are the pins R and S fixed?**

Check

a To stick the prism to the paper

b So that they lie on one straight line with the images of P and Q

c To measure the angle of the prism

d To bring in sunlight

💡 **Hint:** The alignment, while looking through the second face.

Explanation:

R and S fix the path of the emergent ray. They lie on one line with the images of P and Q.

5 **In Activity 10.1, which way does the ray bend at the first face and at the second face?**

Check 2 marks

Model answer (board format)

At face AB the ray goes from air into glass and bends towards the normal. At face AC it goes from glass into air and bends away from the normal.

6 **The refractive index of glass is 1.50. Find the speed of light in glass. Take c = 3.0 × 10^8 m/s.**

Check 2 marks

Model answer (board format)

$v = c/n = (3.0 \times 10^8) / 1.50 = 2.0 \times 10^8$ m/s.

Dispersion and recombination — Activity 10.2

1 **Which colour bends the most through a prism?**

Check

- a Red
- b Yellow
- c Green
- d **Violet**

💡 **Hint:** The end of the spectrum with the larger deviation.

Explanation:

Violet bends the most and red the least.

2 **The splitting of white light into its component colours is called —**

Check

- a Scattering
- b **Dispersion**
- c Angle of deviation
- d Accommodation

💡 **Hint:** The coloured band of Activity 10.2.

Explanation:

This splitting is dispersion. The band of colours is the spectrum.

3 **A second prism placed inverted relative to the first joins the spectrum back into white light.**

Check

- ✓ **True**
- ✗ False

Explanation:

True — this is the recombination Newton observed.

4 **The colour that bends the least in the spectrum is _____.**

Check

Answer: लाल

💡 **Hint:** The last colour of VIBGYOR.

Explanation:

Red bends the least. Violet bends the most.

5 **In which direction does a rainbow appear in the sky?**

Check

a Towards the sun

b **Opposite the sun**

c Towards the moon

d Always straight overhead

💡 **Hint:** The sun should be behind you.

Explanation:

A rainbow forms opposite the sun. The drops act as tiny prisms.

6 **The wavelength of blue light is 400 nm. The wavelength of red is about 1.8 times this. Find the wavelength of red in nm. In one sentence, say what a second inverted prism shows.**

Check 3 marks

Model answer (board format)

Wavelength of red = 1.8 × 400 = 720 nm. An inverted second prism joins the colours back into white light, so sunlight is made of seven colours. Violet has a greater deviation than red.

Atmospheric refraction — twinkling and advanced sunrise

1 **The twinkling of stars is caused by —**

Check

a Scattering

b **Atmospheric refraction**

c Dispersion

d Accommodation of the eye

💡 **Hint:** Air whose refractive index keeps changing.

Explanation:

Twinkling of stars is due to atmospheric refraction.

2 **Planets twinkle just as stars do.**

Check

✓ True

✗ **False**

Explanation:

False — planets are extended sources and the variations in their light average out to zero.

3 **Because of atmospheric refraction, the sun is seen about how long before the actual sunrise?**

Check

a 2 seconds

b **2 minutes**

c 2 hours

d 20 minutes

💡 **Hint:** Sunset is seen about this much later as well.

Explanation:

The sun is seen about 2 minutes early at sunrise and about 2 minutes late at sunset.

4 **Why do planets not twinkle? Write it in two lines.**

Check · 2 marks

Model answer (board format)

Planets are nearer the earth and look like extended sources. The variation in light from a large number of points averages out to zero, so no twinkling is seen.

5 **Sunrise is seen about 2 minutes early and sunset about 2 minutes late. Find the total extra viewing time over 15 days, in minutes and in hours.**

Check · 2 marks

Model answer (board format)

Extra time in one day = 2 + 2 = 4 minutes. Over 15 days, 15 × 4 = 60 minutes = 1 hour.

Scattering — blue sky, red sunset and the Tyndall effect

1 **The Tyndall effect is seen in which of these?**

Check

- **a** In a true solution
- **b** **In a colloidal solution**
- **c** In a vacuum
- **d** On a plane mirror

💡 **Hint:** The particles are large enough for the path of the beam to show.

Explanation:

Colloidal particles scatter light and the path of the beam becomes visible. In a true solution the path is not seen.

2 **The clear sky looks blue because —**

Check

a Red light scatters more than blue

b Fine particles scatter shorter wavelengths more

c The sun sends only blue light

d The retina sees only blue

💡 **Hint:** The wavelength of red is about 1.8 times that of blue.

Explanation:

Fine particles in air scatter blue light more than red.

3 **Danger signals are red because red light is scattered the least by fog.**

Check

✓ **True**

✗ False

Explanation:

True — red keeps its colour over a long distance.

4 **At sunset the light that mainly reaches the eye is _____.**

Check

Answer: लाल

💡 **Hint:** The colour with the least scattering.

Explanation:

Along the long path blue is scattered away and red light reaches the eye.

5 **Why does the sun look red at sunset? Why is a danger signal made red?**

Check · 3 marks

Model answer (board format)

At sunset the light travels a long path through the atmosphere. Blue light of shorter wavelength is scattered away on the way, and the less-scattered red light reaches the eye. Fog or smoke also scatters red the least, so the signal stays red at a distance.

6 **The wavelength of red light is 720 nm. Write it in metres in standard form.**

Check · 2 marks

Model answer (board format)

1 nm = 10^{-9} m. 720 nm = 720 × 10^{-9} m = 7.2 × 10^{-7} m.

(a) Board questions · Annual Secondary Exam 2025 (Science, subject code 112)

Source: BSEB Annual Secondary Exam 2025, Science (112) — the paper released on the board's official site; question numbers and pages are from that paper. Answers are by Study With Me.

1 **Which phenomena is responsible for the blue colour of the sky?**

BSEB 2025 · board paper · Q9 · page 6 · 1 mark

- a Refraction
- **b Scattering**
- c Reflection
- d None of these

Explanation:

Tiny air particles **scatter** blue (short-wavelength) light the most (lesson 7).

2 **The primary colour of light is—**

BSEB 2025 · board paper · Q10 · page 6 · 1 mark

- a Red
- b Blue
- c Green
- **d All of these**

Explanation:

The three primary colours of light are **red, green and blue** — so «all of these».

3 **Where are large numbers of light-sensitive cells present?**

BSEB 2025 · board paper · Q11 · page 7 · 1 mark

- a In Cornea
- b In Pupil
- **c In Retina**
- d None of these

Explanation:

The **retina** has huge numbers of light-sensitive cells (rods and cones) (lesson 1).

4 **Which lens is used for the treatment of farsightedness?**

BSEB 2025 · board paper · Q12 · page 7 | 1 mark

- **a** **Convex lens**
- **b** Concave lens
- **c** Cylindrical lens
- **d** None of these

Explanation:

In farsightedness (hypermetropia) the image forms behind the retina; a **convex lens** brings it onto the retina (lesson 2).

5 **Why is red colour used in railway signals?**

BSEB 2025 · board paper · Q1 · page 26 | 2 marks

Model answer (board format)

- Red light has the **longest wavelength**.
- So it is **scattered the least** by fog, mist and smoke particles.
- Red light travels far without spreading and is **clearly seen from a distance** — so danger signals are red (lesson 7).

(a) Board questions · BSEB Model Question Paper 2026 (Science, 112) — not an annual-exam question

Source: the Bihar Board's official model question paper 2026 (Science, 112). It is not the annual exam, but it is the board's own set.

1 **On which of the following parts is the image of an object formed in the human eye?**

BSEB model paper 2026 (not the annual exam) · Q11 · page 6 · 1 mark

- a Cornea
- b Iris
- c Pupil
- d **Retina**

Explanation:

The eye lens forms an inverted real image on the **retina** (lesson 1).

2 **The transparent front part of the eye is—**

BSEB model paper 2026 (not the annual exam) · Q12 · page 6 · 1 mark

- a Iris
- b **Cornea**
- c Lens
- d Retina

Explanation:

The clear bulge at the front of the eye is the **cornea**; most of the bending of light happens there (lesson 1).

3 **Which defect is corrected by bifocal lens is—**

BSEB model paper 2026 (not the annual exam) · Q13 · page 6 · 1 mark

- a Myopia
- b Hypermetropia
- c **Presbyopia**
- d None of these

Explanation:

When both near and far defects come together — usually in **presbyopia** — a bifocal lens is used (lesson 3).

4 **Rods cells are sensitive to—**

BSEB model paper 2026 (not the annual exam) · Q14 · page 7 · 1 mark

- a Colour
- b Bright light
- c **Dim light**
- d None of these

Explanation:

Rod cells respond to the intensity of **dim light**; cone cells respond to colour (lesson 1).

5 **The blind spot has no—**

BSEB model paper 2026 (not the annual exam) · Q15 · page 7 · 1 mark

- a Cornea
- b **Rods and cones**
- c Pupil
- d Lens

Explanation:

Where the optic nerve leaves the retina there are no **rods and cones**, so that spot cannot see (lesson 1).

(b) Important book-based questions · multiple choice

Questions made from important lines of the book. Each shows the book section (10.x) and topic.

1 **What controls the amount of light entering the eye?**

Book-based · 10.1 · pupil · 1 mark

- a cornea
- **b pupil** ✓
- c retina
- d optic nerve

Explanation:
The iris changes the size of the **pupil** to control the light.

2 **What controls the size of the pupil?**

Book-based · 10.1 · iris · 1 mark

- **a iris** ✓
- b eye lens
- c cornea
- d retina

Explanation:
The **iris** — a dark muscular diaphragm.

3 **The image formed on the retina is—**

Book-based · 10.1 · image · 1 mark

- a virtual and erect
- **b real and inverted** ✓
- c virtual and inverted
- d real and erect

Explanation:
The eye lens forms a **real and inverted** image on the retina; the brain reads it as upright.

4 **Most of the refraction of light entering the eye happens at—**

Book-based · 10.1 · refraction | 1 mark

- a the eye lens
- **b the outer surface of the cornea**
- c the retina
- d the pupil

Explanation:

Most refraction is at the **outer surface of the cornea**; the lens only fine-tunes the focal length.

5 **While looking at a far object the ciliary muscles—**

Book-based · 10.1 · far object | 1 mark

- a contract, lens thick
- **b relax, lens thin**
- c contract, lens thin
- d relax, lens thick

Explanation:

Relaxed muscles → **thin** lens → longer focal length.

6 **One cause of myopia is—**

Book-based · 10.2 · myopia | 1 mark

- a a shortened eyeball
- **b an elongated eyeball**
- c too long a focal length of the lens
- d weak muscles

Explanation:

An **elongated eyeball** or too much curvature of the lens (focal length too short).

7 In hypermetropia the near point is—

Book-based · 10.2 · hypermetropia · 1 mark

- a closer than 25 cm
- **b farther than 25 cm**
- c at infinity
- d on the retina

Explanation:

The near point moves **farther than 25 cm**; near objects look blurred.

8 Accommodation falls with age because of—

Book-based · 10.2 · presbyopia · 1 mark

- **a weak ciliary muscles and a less flexible lens**
- b a thicker cornea
- c a bigger pupil
- d a shifted retina

Explanation:

Weaker muscles and a **less flexible lens** — this is presbyopia.

9 The ray coming out of a glass prism bends—

Book-based · 10.3 · prism · 1 mark

- a towards the apex
- **b towards the base**
- c without bending
- d backwards

Explanation:

The emergent ray bends **towards the base** of the prism.

10 The angle between the incident ray and the emergent ray is called—

Book-based · 10.3 · angle of deviation | 1 mark

a angle of the prism

b angle of incidence

c **angle of deviation**

d angle of refraction

Explanation:

The **angle of deviation (∠D)**.

11 The colour bent the least by a prism is—

Book-based · 10.4 · dispersion | 1 mark

a violet

b blue

c green

d **red**

Explanation:

Red bends the least, violet the most.

12 In forming a rainbow, raindrops cause—

Book-based · 10.4 · rainbow | 1 mark

a only reflection

b **refraction, dispersion and internal reflection**

c only scattering

d only refraction

Explanation:

Refraction + dispersion in the drop, then **internal reflection**, then refraction again on leaving.

13 **Atmospheric refraction makes sunrise appear about how much earlier?**

Book-based · 10.5 · advance sunrise | 1 mark

- a 2 seconds
- **b 2 minutes**
- c 20 minutes
- d 2 hours

Explanation:

About **2 minutes** earlier; sunset is about 2 minutes late too.

14 **When very large particles (like clouds) scatter light, it looks—**

Book-based · 10.6 · scattering | 1 mark

- a blue
- b red
- **c white**
- d violet

Explanation:

Large particles scatter all colours almost equally — **white**.

(b) Book-based · fill in the blanks

1 The image in the eye forms on the _____.

Book-based · 10.1 · retina | 1 mark

Answer: retina

> **Explanation:**
> Retina.

2 The curvature of the eye lens is changed by the _____ muscles.

Book-based · 10.1 · ciliary | 1 mark

Answer: ciliary

> **Explanation:**
> Ciliary.

3 For a normal eye the least distance of distinct vision is _____ cm.

Book-based · 10.1 · near point | 1 mark

Answer: 25

> **Explanation:**
> 25 cm.

4 Electrical signals go from the retina to the brain through the _____ nerve.

Book-based · 10.1 · optic nerve | 1 mark

Answer: optic

> **Explanation:**
> Optic.

5 Myopia is corrected with a _____ lens.

Book-based · 10.2 · concave | 1 mark

Answer: concave

> **Explanation:**
> Concave.

6 The eye lens turning milky and cloudy is called _____.

Book-based · 10.2 · cataract | 1 mark

Answer: cataract

> **Explanation:**
> Cataract.

7 The band of seven colours of white light is called a _____.

Book-based · 10.4 · spectrum | 1 mark

Answer: spectrum

> **Explanation:**
> Spectrum.

8 _____ was the first to use a glass prism to obtain the spectrum of sunlight.

Book-based · 10.4 · Newton | 1 mark

Answer: newton

> **Explanation:**
> Isaac Newton.

9 Scattering of light by colloidal particles is called the _____ effect.

Book-based · 10.6 · Tyndall | 1 mark

Answer: tyndall

> **Explanation:**
> Tyndall.

10 Danger signals are _____ in colour.

Book-based · 10.6 · red | 1 mark

Answer: red

> **Explanation:**
> Red.

(b) Book-based · true or false

1 **In dim light the pupil becomes smaller.**

Book-based · 10.1 · pupil · 1 mark

✓ True

✗ **False**

Explanation:

False — in dim light the pupil **widens** to let in more light.

2 **Cone cells detect colours.**

Book-based · 10.1 · cones · 1 mark

✓ **True**

✗ False

Explanation:

True.

3 **In hypermetropia the image forms behind the retina.**

Book-based · 10.2 · hypermetropia · 1 mark

✓ **True**

✗ False

Explanation:

True — a convex lens corrects it.

4 **Only people below 40 can donate eyes.**

Book-based · 10.2 · eye donation · 1 mark

✓ True

✗ **False**

Explanation:

False — people of **any age** or sex can donate eyes.

5 The ray emerging from a rectangular glass slab is parallel to the incident ray.

Book-based · 10.3 · slab | 1 mark

✓ **True**

✗ False

Explanation:

True — the faces of the slab are parallel.

6 Violet light bends the least through a prism.

Book-based · 10.4 · violet | 1 mark

✓ True

✗ **False**

Explanation:

False — violet bends the **most**.

7 A rainbow always forms opposite the Sun.

Book-based · 10.4 · rainbow | 1 mark

✓ **True**

✗ False

Explanation:

True.

8 Planets twinkle because they are point sources.

Book-based · 10.5 · planets | 1 mark

✓ True

✗ **False**

Explanation:

False — planets are **extended sources**, so they **do not** twinkle.

9 If the Earth had no atmosphere the sky would look dark.

Book-based · 10.6 · blue sky | 1 mark

✓ **True**

✗ False

Explanation:

True — there would be no scattering.

10 At noon the Sun looks white because its light travels a shorter path then.

Book-based · 10.6 · noon | 1 mark

✓ **True**

✗ False

Explanation:

True — less air to cross, less scattering.

(b) Book-based · one-line answers (1 mark)

1 What is the clear bulge at the front of the eye called?

Book-based · 10.1 · cornea | 1 mark

Model answer (board format)

The cornea.

2 About how big is the diameter of the eyeball?

Book-based · 10.1 · diameter | 1 mark

Model answer (board format)

About 2.3 cm.

3 Which cells respond to the intensity of dim light?

Book-based · 10.1 · rods | 1 mark

Model answer (board format)

Rod cells.

4 What is the SI unit of the power of a lens?

Book-based · 10.2 · power | 1 mark

Model answer (board format)

Dioptre (D); P = 1/f (f in metres).

5 Which lens is in the upper part of a bifocal lens?

Book-based · 10.2 · bifocal | 1 mark

Model answer (board format)

A concave lens (for far vision).

6 Name two ways other than spectacles to correct vision defects today.

Book-based · 10.2 · contact lens | 1 mark

Model answer (board format)

Contact lenses and surgery.

7 What is the angle between the two lateral faces of a prism called?

Book-based · 10.3 · angle of prism | 1 mark

Model answer (board format)

The angle of the prism (∠A).

8 Write the order of the colours of the spectrum.

Book-based · 10.4 · VIBGYOR | 1 mark

Model answer (board format)

Violet, indigo, blue, green, yellow, orange, red (VIBGYOR).

9 How is the refractive index of hot air compared with cold air?

Book-based · 10.5 · refractive index | 1 mark

Model answer (board format)

Lower (hot air is less dense).

10 About how many times the wavelength of blue light is that of red light?

Book-based · 10.6 · wavelength | 1 mark

Model answer (board format)

About 1.8 times.

(b) Book-based · short answers (3 marks)

1 **Name any four parts of the human eye and give their functions.**

Book-based · 10.1 · parts of the eye | 3 marks

Model answer (board format)

- **Cornea:** light enters here; most of the refraction
- **Iris:** controls the size of the pupil
- **Eye lens:** forms a real, inverted image on the retina; adjusts the focal length
- **Retina:** light-sensitive cells; signals go to the brain through the optic nerve

2 **Give two causes of myopia and its correction.**

Book-based · 10.2 · myopia | 3 marks

Model answer (board format)

- **Cause 1:** too much curvature of the eye lens (focal length too short)
- **Cause 2:** elongation of the eyeball
- The image of a far object forms **in front of** the retina
- **Correction:** a **concave lens** of suitable power — the rays spread a little and meet on the retina

3 **Give two causes of hypermetropia and its correction.**

Book-based · 10.2 · hypermetropia | 3 marks

Model answer (board format)

- **Cause 1:** the focal length of the eye lens is too long
- **Cause 2:** the eyeball has become too short
- The image of a near object forms **behind** the retina; the near point is beyond 25 cm
- **Correction:** a **convex lens** of suitable power — extra converging brings the image onto the retina

4 **Write three main points about eye donation.**

Book-based · 10.2 · eye donation | 3 marks

Model answer (board format)

- Eyes must be removed **within 4–6 hours** of death; inform the nearest eye bank at once
- People of **any age** can donate, including those who wear glasses or had cataract surgery
- One pair of eyes can give vision to up to **four** people with corneal blindness

5 **What is dispersion? Give the reason for the dispersion of white light by a prism.**

Book-based · 10.4 · spectrum | 3 marks

Model answer (board format)

- The **splitting of white light into its colours** is dispersion
- Different colours bend through **different angles** in the prism
- Red bends the least and violet the most — so the colours separate into the **VIBGYOR** spectrum

6 **Write any three effects of atmospheric refraction.**

Book-based · 10.5 · atmospheric refraction | 3 marks

Model answer (board format)

- **Twinkling of stars** — the apparent position and brightness keep changing
- **Advance sunrise and delayed sunset** — about 2 minutes each
- **Objects seem to waver above a fire or hot road** — hot air has a lower refractive index

7 **Why does the sky look blue?**

Book-based · 10.6 · blue sky | 3 marks

Model answer (board format)

- Air molecules and tiny particles are **smaller** than the wavelength of visible light
- They scatter **short-wavelength (blue)** light much more; red has about 1.8 times the wavelength
- The scattered blue light reaches our eyes — the sky looks **blue**

(b) Book-based · long answers (5 marks)

1 **Describe the structure of the human eye. What is the power of accommodation and how does it work?**

Book-based · 10.1 · eye and accommodation | 5 marks

Model answer (board format)

- **Structure:** a ball about 2.3 cm across; at the front the **cornea** (most refraction), behind it the **iris** and **pupil**, then the **eye lens** (fibrous, jelly-like), at the back the **retina** (rod and cone cells), and the **optic nerve** to the brain
- **Image:** the lens forms a real, inverted image on the retina; the brain reads it as upright
- **Accommodation:** the lens changes its focal length
- Far object: ciliary muscles **relax** → lens **thin** → longer focal length
- Near object: muscles **contract** → lens **thick** → shorter focal length
- Limits: near point 25 cm, far point infinity

2 **Compare myopia, hypermetropia and presbyopia — symptoms, causes and correction.**

Book-based · 10.2 · vision defects | 5 marks

Model answer (board format)

Defect	Symptom	Cause	Correction
Myopia	far objects blurred; image in front of the retina	too much lens curvature, long eyeball	concave lens
Hypermetropia	near objects blurred; image behind the retina	focal length too long, short eyeball	convex lens
Presbyopia	reading close becomes hard with age	weak muscles, less flexible lens	convex lens; bifocal if both defects

- In both figures of lesson 2 the rays meet **on the retina** once the lens is added

3 **Describe Activity 10.1 — refraction of light through a glass prism. What is the angle of deviation?**

Book-based · 10.3 · refraction through a prism | 5 marks

Model answer (board format)

- Place a prism on white paper and draw its outline PQR
- Draw a slanting line EF towards face PQ and fix two pins P and Q on it
- Looking from the other side, fix pins R and S so that all four look in one line
- Remove the pins; draw the incident ray, the refracted ray and the **emergent ray**, and the normals at both faces
- **Result:** the ray bends at both faces and the emergent ray tilts **towards the base**
- The angle between the extended incident ray and the emergent ray is the **angle of deviation ∠D**; the angle between the faces is the angle of the prism ∠A

4 **What is scattering of light? Use it to explain the blue sky, the red Sun at sunrise and sunset, and the Tyndall effect.**

Book-based · 10.6 · scattering | 5 marks

Model answer (board format)

- Light **spreading out in all directions** after hitting particles is scattering; the colour of the scattered light depends on the particle size
- **Tyndall effect:** colloidal particles (smoke, dust, mist) make the path of a beam visible — like sunlight through a dense forest
- **Blue sky:** tiny air particles scatter blue (short-wavelength) light the most
- **Red sunrise and sunset:** near the horizon light travels a long path; blue is scattered away and **red** reaches the eye
- **White Sun at noon:** shorter path, less scattering
- **White clouds:** large particles scatter all colours equally

(c) NCERT in-text questions — all 4

All questions inside the NCERT chapter (after section 10.2). Write first, then compare with the model answer.

1 **What is meant by power of accommodation of the eye?**

NCERT in-text question · after 10.2 · Q1

Model answer (board format)

The ability of the eye lens to **adjust its focal length** is called the **power of accommodation**.

- The ciliary muscles make the lens thicker or thinner, so both near and far objects are focused sharply on the retina.

2 **A person with a myopic eye cannot see objects beyond 1.2 m distinctly. What should be the type of the corrective lens used to restore proper vision?**

NCERT in-text question · after 10.2 · Q2

Model answer (board format)

- This is **myopia**; the far point has come to 1.2 m.
- A **concave (diverging) lens** of suitable power is needed.

$f = -1.2$ m $\Rightarrow P = 1/f \approx$ **−0.83 D**

3 **What is the far point and near point of the human eye with normal vision?**

NCERT in-text question · after 10.2 · Q3

Model answer (board format)

- **Near point:** about **25 cm** (least distance of distinct vision)
- **Far point: infinity**

4 **A student has difficulty reading the blackboard while sitting in the last row. What could be the defect the child is suffering from? How can it be corrected?**

NCERT in-text question · after 10.2 · Q4

Model answer (board format)

- The student cannot see far objects clearly — **myopia** (near-sightedness).
- It is corrected with spectacles having a **concave lens** of suitable power.

(c) NCERT exercises — all 13 questions

All end-of-chapter exercise questions with full answers.

1 **The human eye can focus on objects at different distances by adjusting the focal length of the eye lens. This is due to—**

NCERT exercise · Q1 | 1 mark

a presbyopia	**b accommodation**
c near-sightedness	d far-sightedness

Explanation:

(b) accommodation.

2 **The human eye forms the image of an object at its—**

NCERT exercise · Q2 | 1 mark

a cornea	b iris
c pupil	**d retina**

Explanation:

(d) retina.

3 **The least distance of distinct vision for a young adult with normal vision is about —**

NCERT exercise · Q3 | 1 mark

a 25 m	b 2.5 cm
c 25 cm	d 2.5 m

Explanation:

(c) 25 cm.

4 The change in focal length of an eye lens is caused by the action of the—

NCERT exercise · Q4 | 1 mark

a pupil

b retina

c **ciliary muscles**

d iris

Explanation:

(c) ciliary muscles.

5 A person needs a lens of power −5.5 dioptres for correcting his distant vision. For correcting his near vision he needs a lens of power +1.5 dioptre. What is the focal length of the lens required for correcting (i) distant vision, and (ii) near vision?

NCERT exercise · Q5

Model answer (board format)

f = 1/P (in metres)

(i) f = 1/(−5.5) m = −0.182 m = **−18.2 cm** (concave lens)

(ii) f = 1/(+1.5) m = +0.667 m = **+66.7 cm** (convex lens)

6 The far point of a myopic person is 80 cm in front of the eye. What is the nature and power of the lens required to correct the problem?

NCERT exercise · Q6

Model answer (board format)

- An object at infinity must form its image at the far point, 80 cm: u = ∞, v = −80 cm

1/f = 1/v − 1/u = −1/80 ⇒ f = −80 cm = −0.8 m

P = 1/f = 1/(−0.8) = **−1.25 D**

- A **concave lens** of power −1.25 D.

7 **Make a diagram to show how hypermetropia is corrected. The near point of a hypermetropic eye is 1 m. What is the power of the lens required to correct this defect? Assume that the near point of the normal eye is 25 cm.**

NCERT exercise · Q7

Model answer (board format)

- **Diagram:** rays from an object at 25 cm pass through a convex lens and then travel as if they came from 1 m (the new near point); the image then forms on the retina (figure in lesson 2).
- u = −25 cm, v = −100 cm

$1/f = 1/v - 1/u = -1/100 + 1/25 = 3/100 \Rightarrow f = +33.3 \text{ cm} = +0.333 \text{ m}$

$P = 1/f =$ **+3 D**

- A **convex lens** of power +3 D.

8 **Why is a normal eye not able to see clearly the objects placed closer than 25 cm?**

NCERT exercise · Q8

Model answer (board format)

- The focal length of the eye lens cannot drop below a **certain minimum**.
- For an object closer than 25 cm the ciliary muscles cannot make the lens any thicker, so the image does not form on the retina and the object looks **blurred**.

9 **What happens to the image distance in the eye when we increase the distance of an object from the eye?**

NCERT exercise · Q9

Model answer (board format)

- The image distance **stays the same** — the image always forms on the retina (the lens-to-retina distance is fixed).
- As the object moves away, the ciliary muscles relax and the lens gets thinner, so its **focal length increases**.

10 **Why do stars twinkle?**

NCERT exercise · Q10

Model answer (board format)

- Starlight is **refracted again and again** as it enters the Earth's atmosphere (atmospheric refraction).
- The temperature and density of the air layers keep changing, so the **apparent position** of the star keeps shifting slightly.
- A star is a point source, so the light reaching the eye is sometimes more and sometimes less — the star **twinkles**.

11 **Explain why the planets do not twinkle.**

NCERT exercise · Q11

Model answer (board format)

- Planets are much closer to the Earth, so they are **extended sources** — a collection of many point sources.
- The changes in light from the different points **cancel one another out**.
- The total light stays nearly steady, so planets **do not twinkle**.

12 **Why does the Sun appear reddish early in the morning?**

NCERT exercise · Q12

Model answer (board format)

- At sunrise the Sun is near the horizon, so its light travels a long way through **thick layers** of the atmosphere.
- On the way, blue and other short-wavelength light is **scattered away**.
- Mostly **red (longer-wavelength)** light reaches the eye — the Sun looks reddish.

13 **Why does the sky appear dark instead of blue to an astronaut?**

NCERT exercise · Q13

Model answer (board format)

- At very great heights there is **no atmosphere**, so there is **no scattering** of light.
- No scattered light reaches the eye, so the sky looks **dark**.

Multiple choice

Pick one option. A wrong try brings a hint.

1 **The focal length of the eye lens is changed by the**

NCERT-style · practice · 1 mark

- **a** pupil
- **b** retina
- **c** **ciliary muscles**
- **d** iris

💡 **Hint:** The muscles that make the lens thin or thick.

Explanation:

The ciliary muscles change the curvature of the lens and so its focal length.

2 **Where does most of the refraction in the human eye take place?**

Board-style (practice) · 1 mark

- **a** At the retina
- **b** **At the outer surface of the cornea**
- **c** In the optic nerve
- **d** At the centre of the pupil

💡 **Hint:** The lens only makes the fine adjustment.

Explanation:

Most of the refraction occurs at the outer surface of the cornea.

3 The least distance of distinct vision is —

NCERT-style · practice | 1 mark

- **a** **25 cm**
- **b** 25 m
- **c** 2.5 cm
- **d** Infinity

💡 **Hint:** The near point of a normal young eye.

Explanation:

For a normal young eye it is about 25 cm. The far point is infinity.

4 An image of a distant object forming in front of the retina is called —

Board-style (practice) | 1 mark

- **a** Hypermetropia
- **b** **Myopia**
- **c** Presbyopia
- **d** Cataract

💡 **Hint:** Near is clear, far is blurred.

Explanation:

This is myopia and it is corrected by a concave lens.

5 Hypermetropia is corrected by —

Board-style (practice) | 1 mark

- **a** a concave lens
- **b** **a convex lens**
- **c** a prism
- **d** a plane mirror

💡 **Hint:** The image forms behind the retina.

Explanation:

A convex lens provides the extra focusing power.

6 **In presbyopia the lower part of a bifocal lens is —**

Board-style (practice) · 1 mark

- a concave
- **b convex**
- c opaque
- d cylindrical, only for distance

💡 **Hint:** The lower part is used for reading.

Explanation:

The lower convex lens is for near vision. The upper concave lens is for distant vision.

7 **At the first face of a prism the ray bends —**

Board-style (practice) · 1 mark

- a away from the normal, because it goes from glass into air
- **b towards the normal, because it goes from air into glass**
- c not at all
- d only for red light

💡 **Hint:** Rarer to denser.

Explanation:

At the first face the ray goes from air into glass and bends towards the normal.

8 **Which colour has the greatest deviation in the spectrum?**

NCERT-style · practice · 1 mark

- a Red
- b Yellow
- **c Violet**
- d Green

💡 **Hint:** The first colour of VIBGYOR.

Explanation:

Violet bends the most and red the least.

9 **To turn the spectrum of sunlight back into white, Newton placed the second prism —**

Board-style (practice) · 1 mark

- a the same way as the first
- **b inverted relative to the first**
- c behind the screen
- d inside the eye

💡 **Hint:** A second prism the same way up neither splits the colours further nor joins them.

Explanation:

An inverted second prism recombines the colours and gives white light.

10 **In the formation of a rainbow a water drop does not —**

Board-style (practice) · 1 mark

- a refraction
- b dispersion
- c internal reflection
- **d absorb the light and make darkness**

💡 **Hint:** The drop works like a tiny prism.

Explanation:

The drop refracts, disperses, reflects internally and refracts again.

11 **Stars twinkle because of —**

NCERT-style · practice · 1 mark

- a scattering
- **b atmospheric refraction**
- c dispersion
- d accommodation

💡 **Hint:** A point source and changing air.

Explanation:

Starlight bends continuously in the atmosphere and the light reaching the eye flickers.

12 **About how long after the actual sunset is the sun still seen?**

Board-style (practice) · 1 mark

- a 2 seconds
- **b 2 minutes**
- c 20 minutes
- d 2 hours

💡 **Hint:** Sunrise is also seen about this much earlier.

Explanation:

Atmospheric refraction keeps the sun visible for about 2 minutes more.

13 **The clear sky is blue because fine particles —**

Board-style (practice) · 1 mark

- a scatter red more
- **b scatter blue more**
- c leave only green
- d absorb all the light

💡 **Hint:** The shorter wavelength scatters more.

Explanation:

Fine particles scatter blue light more than red light.

14 **A danger signal is made red because —**

Board-style (practice) · 1 mark

- a red scatters the most
- **b red scatters the least in fog or smoke**
- c red does not harm the eye
- d red travels the fastest

💡 **Hint:** The same colour should be seen from far away.

Explanation:

Red is scattered the least, so the signal stays red at a distance.

15 **An example of the Tyndall effect is —**

Board-style (practice) | 1 mark

a the invisible path of a beam in a pure sugar solution

b **a sunbeam entering a smoky room through a hole**

c the image in a plane mirror

d the angle of deviation of a prism

💡 **Hint:** Colloidal particles make the path visible.

Explanation:

Smoke particles scatter the light and the path of the beam becomes visible.

True or false

1 **The diameter of the eyeball is about 2.3 cm.**

Board-style (practice) · 1 mark

✓ **True**

✗ False

Explanation:

True — the book gives this size.

2 **The far point of a normal eye is 25 cm.**

Board-style (practice) · 1 mark

✓ True

✗ **False**

Explanation:

False — 25 cm is the near point. The far point is infinity.

3 **Myopia is corrected by a convex lens.**

Board-style (practice) · 1 mark

✓ True

✗ **False**

Explanation:

False — myopia uses a concave lens. A convex lens is for hypermetropia.

4 **In cataract the lens becomes milky and cloudy.**

Board-style (practice) · 1 mark

✓ **True**

✗ False

Explanation:

True — surgery can restore vision.

5 **The ray leaving a glass slab is parallel to the incident ray.**

Board-style (practice) 1 mark

✓ **True**

✗ False

Explanation:

True — this is not so for a prism. There an angle of deviation remains.

6 **Red light bends more than violet light.**

Board-style (practice) 1 mark

✓ True

✗ **False**

Explanation:

False — violet bends the most and red the least.

7 **A rainbow forms in the direction of the sun.**

Board-style (practice) 1 mark

✓ True

✗ **False**

Explanation:

False — a rainbow forms in the direction opposite the sun.

8 **If there were no atmosphere the sky would look dark.**

Board-style (practice) 1 mark

✓ **True**

✗ False

Explanation:

True — the blue colour comes from scattering.

Fill in the blanks

1 **The size of the pupil is controlled by the _____.**

Board-style (practice) · 1 mark

Answer: परितारिका

💡 **Hint:** The iris controls the amount of light through the pupil.

Explanation:

It is a dark muscular diaphragm.

2 **The near point of the eye is about _____ cm.**

Board-style (practice) · 1 mark

Answer: 25

💡 **Hint:** For a normal young eye the near point is about 25 cm.

Explanation:

The least distance of distinct vision.

3 **A _____ lens is used for myopia.**

Board-style (practice) · 1 mark

Answer: अवतल

💡 **Hint:** A concave lens brings the image of a distant object onto the retina.

Explanation:

The image has to be brought onto the retina.

4 **The angle of the prism is the angle between the two _____ faces.**

Board-style (practice) 1 mark

Answer: अपवर्तक

💡 **Hint:** The angle of the prism is between the two refracting lateral faces.

Explanation:

Not the triangular base.

5 **The band of colours is called the _____.**

Board-style (practice) 1 mark

Answer: स्पेक्ट्रम

💡 **Hint:** The band of component colours is called the spectrum.

Explanation:

Dispersion produces this band.

6 **The wavelength of red light is about _____ times that of blue light.**

Board-style (practice) 1 mark

Answer: 1.8

💡 **Hint:** The wavelength of red is about 1.8 times that of blue.

Explanation:

That is why blue scatters more.

7 **For eye donation the eyes must be removed within _____ hours of death.**

Board-style (practice) 1 mark

Answer: 4-6

💡 **Hint:** The eyes must be removed within 4 to 6 hours.

Explanation:

Inform the eye bank at once.

8 **Planets do not twinkle because they are _____ sources.**

Board-style (practice) 1 mark

Answer: फैले

💡 **Hint:** Planets are extended sources and the variations average out.

Explanation:

A star is a point source.

Match

1 **Match the part with its job.**

Board-style (practice) · 2 marks

1. Cornea → **B. Most of the refraction**

2. Iris → **A. Size of the pupil**

3. Retina → **C. Screen for the image**

4. Optic nerve → **D. Signals to the brain**

> **Explanation:**
> Cornea refracts, the iris controls the pupil, the retina is the screen, the optic nerve carries signals.

2 **Match the effect with its cause.**

NCERT-style · practice · 2 marks

1. Twinkling of stars → **D. Atmospheric refraction of a point source**

2. Blue sky → **A. Scattering**

3. Spectrum → **C. Dispersion**

4. Advanced sunrise → **B. Atmospheric refraction**

> **Explanation:**
> Twinkling and advanced sunrise are refraction. The blue sky is scattering. The spectrum is dispersion.

3 **Match each part with its job.**

NCERT 10.1 · parts of the eye | 2 marks

1. Cornea → **A. most of the refraction**

2. Iris → **B. controls the pupil size**

3. Ciliary muscles → **C. change the focal length of the lens**

4. Retina → **D. the image forms here**

4 **Match each phenomenon with its cause.**

NCERT 10.2–10.6 · phenomena | 2 marks

1. Twinkling of stars → **A. atmospheric refraction**

2. Rainbow → **B. dispersion and internal reflection in drops**

3. Blue sky → **C. scattering of light**

4. Cataract → **D. the eye lens turning cloudy**

Assertion–reason

Check both statements, then see whether the reason explains the assertion.

1 **Assertion (A): Myopia is corrected by a concave lens.**

Reason (R): In this defect the image of a distant object forms in front of the retina.

Board-style (practice) · 1 mark

- **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.

Explanation:
Both are true and R is the correct explanation of A.

2 **Assertion (A): The clear sky looks blue.**

Reason (R): Red light is scattered more than blue light.

Board-style (practice) · 1 mark

- **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.

Explanation:
A is true. R is false — blue is scattered more, red less.

3 **Assertion (A): In a prism violet light bends the least.**

Reason (R): Different colours have different deviations.

Competency-based (not a PYQ) · 1 mark

- 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.**

Explanation:

A is false — violet bends the most. R is true.

4 **Assertion (A): Planets do not twinkle.**

Reason (R): Sunrise appears about 2 minutes early because of atmospheric refraction.

Board-style (practice) · 1 mark

- 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.

Explanation:

Both are true, but R does not explain A. They are separate facts.

5 **Assertion (A): Danger signals are red.**

Reason (R): Red light is scattered the least by fog or smoke.

NCERT-style · practice · 1 mark

- **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.

Explanation:

Both are true and R is the correct reason.

6 **Assertion (A): Danger signals are red.**

Reason (R): Red light is scattered the least by fog and smoke.

Book-based · assertion–reason · 1 mark

- **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.

Explanation:

Both true, and R explains A.

7 **Assertion (A): Planets do not twinkle.**

Reason (R): Planets are much farther from the Earth than stars.

Book-based · assertion–reason · 1 mark

- **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.

Explanation:

A true, R false — planets are **closer** and are extended sources.

8 **Assertion (A): A prism splits white light into seven colours.**

Reason (R): Different colours bend through different angles in a prism.

Book-based · assertion–reason · 1 mark

- **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.

Explanation:

Both true, and R explains A.

9 **Assertion (A):** Myopia is corrected with a convex lens.

Reason (R): In myopia the image forms in front of the retina.

Book-based · assertion–reason | 1 mark

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.**

Explanation:

A false (it needs a **concave** lens), R true.

Coefficient practice

These equations are not results of this chapter. They are only practice in filling coefficients.

1 **This is coefficient practice. This equation is not a result of this chapter. Balance it by filling the coefficients.**

Board-style (practice) · 1 mark

$H_2 + O_2 \rightarrow H_2O$

Explanation: $2H_2 + O_2 \rightarrow 2H_2O$

2 **This is coefficient practice. This equation is not a result of this chapter. Balance it by filling the coefficients.**

Board-style (practice) · 1 mark

$N_2 + H_2 \rightarrow NH_3$

Explanation: $N_2 + 3H_2 \rightarrow 2NH_3$

3 **This is coefficient practice. This equation is not a result of this chapter. Balance it by filling the coefficients.**

Board-style (practice) · 1 mark

$CH_4 + O_2 \rightarrow CO_2 + H_2O$

Explanation: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

4 **This is coefficient practice. This equation is not a result of this chapter. Balance it by filling the coefficients.**

Board-style (practice) | 2 marks

$Fe + O_2 \rightarrow Fe_2O_3$

Explanation: $4Fe + 3O_2 \rightarrow 2Fe_2O_3$

Classify

1 **Place each defect with the right lens.**

Board-style (practice) · 2 marks

Myopia

Hypermetropia

Near vision in presbyopia

Normal eye, a book at 25 cm

> **Explanation:**
> Myopia is concave. Hypermetropia, and the near part of presbyopia, are convex. A normal eye needs no lens.

2 **Place each effect in its class.**

NCERT-style · practice · 2 marks

The coloured band from a prism

Blue sky

Twinkling of stars

A beam visible in smoke

> **Explanation:**
> The band is dispersion. The blue sky and Tyndall are scattering. Twinkling is atmospheric refraction.

Very short answer

1 **Define the power of accommodation in one line.**

Board-style (practice) · 1 mark

Model answer (board format)

Accommodation is the ability to focus near and distant objects on the retina by changing the focal length of the eye lens.

2 **Write the near point and the far point for normal vision.**

NCERT-style · practice · 1 mark

Model answer (board format)

The near point is about 25 cm. The far point is infinity.

3 **What is dispersion?**

Board-style (practice) · 2 marks

Model answer (board format)

Dispersion is the splitting of white light into its component colours. The band of those colours is called the spectrum.

4 **What is the Tyndall effect?**

Board-style (practice) · 2 marks

Model answer (board format)

Scattering of light by colloidal particles makes the path of a beam visible. This is the Tyndall effect.

5 **What is the angle of deviation?**

Board-style (practice) 2 marks

Model answer (board format)

The angle of deviation is the angle between the ray leaving the prism and the direction of the incident ray.

Short answer

1 **Write two causes of myopia and its correction.**

Board-style (practice) · 3 marks

Model answer (board format)

The lens may be too curved, or the eyeball may be too long. The image of a distant object forms in front of the retina. A concave lens of suitable power brings the image onto the retina.

2 **Write the difference between hypermetropia and presbyopia.**

NCERT-style · practice · 3 marks

Model answer (board format)

In hypermetropia the near image forms behind the retina because the focal length is too long or the eyeball is too small. A convex lens is used. Presbyopia comes with age, when the ciliary muscles weaken and the lens is less flexible. If both defects occur together, a bifocal lens is used.

3 **In Activity 10.2, what appears on the screen and what is the order of colours?**

Board-style (practice) · 3 marks

Model answer (board format)

A narrow beam of white light leaves the prism as a band of colours. The order is VIBGYOR — violet, indigo, blue, green, yellow, orange and red. Violet bends the most and red the least.

4 **Why is sunrise seen before the actual time?**

Board-style (practice) · 3 marks

Model answer (board format)

Actual sunrise is the moment the sun crosses the horizon. The atmosphere bends the rays so that the sun is seen even while it is still below the horizon. The difference is about 2 minutes. Sunset is also seen about 2 minutes late.

Long answer

1 **Trace the path of light through the human eye. Explain the power of accommodation.**

Board-style (practice) · 5 marks

Model answer (board format)

Light enters through the cornea, where most of the refraction occurs. The iris controls the amount of light through the pupil. The lens fine-focuses and forms an inverted real image on the retina. Signals go to the brain along the optic nerve. In accommodation the ciliary muscles make the lens thin or thick. With relaxed muscles the focal length increases and a distant object is clear. With contracted muscles the focal length decreases and a nearby object is clear. The near point is about 25 cm.

2 **The far point of a myopic person is 2 m. Find the power of the lens. Show the formula, the substitution and the unit. What does this lens do?**

NCERT-style · practice · 5 marks

Model answer (board format)

The formula is $1/f = 1/v - 1/u$ and $P = 1/f$. For a distant object $u = -\infty$ and $v = -2$ m. $1/f = 1/(-2) - 0 = -0.5\ m^{-1}$. $P = -0.5$ D. The unit is the dioptre. The concave lens forms the image of a distant object at the far point, so that it falls on the retina.

3 **Explain the blue sky, the red sunset and the red danger signal with one rule.**

Board-style (practice) · 5 marks

Model answer (board format)

Fine particles scatter a shorter wavelength more. The wavelength of red is about 1.8 times that of blue, so blue scatters more and the sky looks blue. At sunset the long path scatters blue away and red reaches the eye. Fog also scatters red the least, so a danger signal stays red at a distance. With no atmosphere the sky would look dark.

Board-pattern practice set (ours, not a board question)

This model set is for practice. It is **not** an annual examination paper of any year.

1 **A student in the last row sees the board blurred. The defect and the lens are —**

BSEB model · practice (not an annual paper) · 1 mark

- a Hypermetropia, convex
- **b Myopia, concave**
- c Presbyopia, convex only
- d Cataract, no lens

💡 **Hint:** A distant object is not clear.

Explanation:

This is myopia. A concave lens is used.

2 **In hypermetropia the near point is —**

BSEB model · practice (not an annual paper) · 1 mark

- a closer than 25 cm
- **b farther than 25 cm**
- c always at infinity
- d on the retina

💡 **Hint:** Reading matter has to be held farther than 25 cm.

Explanation:

The near point shifts farther than the normal 25 cm.

3 **The short form used to remember the spectrum is _____.**

BSEB model · practice (not an annual paper) · 1 mark

Answer: VIBGYOR

💡 **Hint:** VIBGYOR — from violet to red.

Explanation:

The first letters of the seven English colour names.

4 **Can a person who wears spectacles still donate eyes? Write it in one sentence with the reason.**

BSEB model · practice (not an annual paper) 2 marks

Model answer (board format)

Yes. Spectacles, cataract surgery, diabetes or hypertension do not stop eye donation, unless the person is on the excluded list of communicable diseases.

5 **The near point of a hypermetropic eye is 50 cm. Taking the normal near point as 25 cm, find the power of the lens.**

BSEB model · practice (not an annual paper) 3 marks

Model answer (board format)

u = −0.25 m, v = −0.50 m. $1/f = 1/v - 1/u = 1/(-0.50) - 1/(-0.25) = -2 + 4 = +2\ m^{-1}$. P = +2 D. The lens is convex.

6 **Write the two different observations of a prism in Activities 10.1 and 10.2. Make the difference between deviation and dispersion clear.**

BSEB model · practice (not an annual paper) 5 marks

Model answer (board format)

In 10.1 a ray passes through the prism and bends from its direction by the angle of deviation. It bends towards the normal at the first face and away from the normal at the second. In 10.2 white light splits into a band of colours. Deviation is the angle by which the whole beam bends. Dispersion is the splitting of colours through different angles, violet bending the most and red the least.

Competency-based questions

These are competency-based practice questions. They are **not** a past paper and not a copy of a CBSE paper.

1 **A student is given two lenses, −0.5 D and +2.0 D. The lens that clears a distant object for a myopic eye is —**

Competency-based (not a PYQ) · 1 mark

- a +2.0 D
- **b −0.5 D**
- c Both together
- d Neither, because both are convex

💡 **Hint:** A negative power is a concave lens.

Explanation:

Myopia needs a concave lens. −0.5 D is concave.

2 **After rain the sun is behind you and a coloured arc is in the sky ahead. The correct account is —**

Competency-based (not a PYQ) · 1 mark

- a The arc twinkles like a star by atmospheric refraction
- **b Drops refract, disperse, internally reflect and again refract the light**
- c The arc is blue only because of scattering
- d The arc forms towards the sun

💡 **Hint:** A rainbow forms opposite the sun.

Explanation:

A water drop, like a tiny prism, refracts, disperses and reflects the light internally.

3 **Assertion (A): A student in the last row cannot read the board.**

Reason (R): The student has myopia and a concave lens can correct the defect.

Competency-based (not a PYQ) · 1 mark

- **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.

Explanation:

Both are true and R is the correct reason.

4 **Assertion (A): At a very great height the sky looks dark.**

Reason (R): At that height dispersion stops because there is no prism.

Competency-based (not a PYQ) · 1 mark

- **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.

Explanation:

A is true. R is false — the reason is that scattering becomes weak, not dispersion.

5 **A person cannot read a book at 25 cm, but sees a distant bus clearly. Name the defect, where the image forms, and the lens.**

Competency-based (not a PYQ) · 3 marks

Model answer (board format)

This is hypermetropia. The image of a nearby object forms behind the retina. A convex lens of suitable power is used.

6 **An experiment with two prisms returns white light. What does the experiment show, and why had violet bent more?**

Competency-based (not a PYQ) | 3 marks

Model answer (board format)

The first prism splits white light into a spectrum and the inverted second prism joins the colours. This shows that white light is made of seven colours. Violet has a larger deviation than red, so it separates to the other end of the band.

Get daily important questions on WhatsApp

Join our WhatsApp channel — free, new questions every day:

https://whatsapp.com/channel/0029VbDbQlmJP20z0t5FjS2e

Full chapters, videos and questions online:

studyswm.in

Made with ❤️ by Appu