

CBSE CLASS X
Science (086)

QUESTION PAPER

AI-generated question paper

Code: HK1NWI

Questions: 74

Maximum Marks: 203

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SELECTIONS USED

Subject	Science
Lessons	9 Light – Reflection and Refraction
Level of understanding	Thorough understanding
Question selection	Curated chapter coverage (~5 questions per section + 8 synthesis)
Model	claude-sonnet-4-6

Composition – Difficulty: 5 straightforward · 46 medium · 23 deep | Types: 59 Short · 6 Long · 5 Very short · 4 MCQ

Q1. medium thorough-understanding § Introduction**[3]**

A small opaque ball is held in the path of a parallel beam of light and casts a shadow on a screen. When the ball is replaced by one that is much smaller (comparable in size to the wavelength of light), a bright spot is observed at the centre of the shadow instead of a dark region. (i) What does the formation of a sharp shadow by the larger ball tell us about the nature of light? (ii) How does the appearance of a bright spot in the centre of the shadow of the very small ball challenge this model?

◆ Light – Reflection and Refraction

Q2. medium thorough-understanding § Introduction**[1]**

In which of the following situations does the straight-line (ray) model of light fail to give an accurate description?

- (A) Light passing through a large window and casting a sharp-edged shadow on the floor.
- (B) Light reflecting off a plane mirror to form an image.
- (C) Light bending around the edge of a very thin razor blade.
- (D) Light travelling through a glass slab and emerging on the other side.

A Light passing through a large window and casting a sharp-edged shadow on the floor.

B Light reflecting off a plane mirror to form an image.

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◆ Light – Reflection and Refraction

Q3. medium thorough-understanding § 9.1 REFLECTION OF LIGHT**[3]**

A candle placed in front of a plane mirror produces a virtual, erect image of the same size as the object. If the same candle is now placed between the pole and the principal focus of a concave mirror, compare the image formed with that in the plane mirror. State any TWO properties of the image that differ and explain the optical reason behind each difference.

◆ Light – Reflection and Refraction

Q4. medium thorough-understanding § 9.1 REFLECTION OF LIGHT [1]

A student claims: 'The laws of reflection only apply to flat mirrors; curved mirrors follow different rules.' Is this claim correct? Justify your answer.

◆ Light – Reflection and Refraction

Q5. deep thorough-understanding § 9.1 REFLECTION OF LIGHT [3]

You hold the inner (concave) surface of a shining spoon close to your face and observe your reflection. As you slowly move the spoon farther away from your face, the image undergoes a noticeable change at one particular distance and then changes again beyond it. (i) Describe the nature, size, and orientation of the image at each stage of this sequence. (ii) Explain why the image changes at that particular distance.

◆ Light – Reflection and Refraction

Q6. medium thorough-understanding § 9.2 SPHERICAL MIRRORS [3]

A concave mirror is placed facing the Sun, and a piece of paper is held at its focus. After some time, the paper catches fire. Using the properties of reflection of parallel rays by a concave mirror and the concept of the principal focus, explain why this happens.

◆ Light – Reflection and Refraction

Q7. medium thorough-understanding § 9.2 SPHERICAL MIRRORS [3]

A concave mirror has a radius of curvature of 40 cm. An object 5 cm tall is placed 20 cm in front of it. Using the mirror formula, find the position and size of the image. State its nature (real/virtual) and orientation (erect/inverted).

◆ Light – Reflection and Refraction

Q8. medium thorough-understanding § 9.2 SPHERICAL MIRRORS [2]

Drivers prefer a convex mirror over a plane mirror as a rear-view mirror even though a plane mirror gives undistorted sizes. Give TWO distinct optical reasons, based on the properties of image formation by a convex mirror, that justify this preference.

◆ Light – Reflection and Refraction

Q9. medium thorough-understanding § 9.2 SPHERICAL MIRRORS [3]

Using the New Cartesian Sign Convention, an object is placed 20 cm in front of a concave mirror of focal length 15 cm. Calculate the image distance and magnification. State whether the image is real or virtual, and erect or inverted.

◆ Light – Reflection and Refraction

Q10. deep thorough-understanding § 9.2 SPHERICAL MIRRORS [3]

A spherical mirror produces a magnification of -3 for an object placed 10 cm from the pole. What type of mirror is it? Where is the image formed, and what does the negative sign of magnification tell you about the image?

◆ Light – Reflection and Refraction

Q11. deep thorough-understanding § 9.2 SPHERICAL MIRRORS [3]

A student claims that a concave mirror can produce an image that is simultaneously virtual, erect and diminished – just like a convex mirror always does. Is the student correct? Justify your answer by analysing all possible object positions for a concave mirror and the nature of images formed in each case.

◆ Light – Reflection and Refraction

Q12. medium thorough-understanding § 9.2.1 Image Formation by Spherical Mirrors [3]

A concave mirror produces a virtual, erect and enlarged image of an object. What does this tell you about the position of the object relative to the mirror's focal point? Explain why the image cannot be captured on a screen in this case.

◆ Light – Reflection and Refraction

Q13. medium thorough-understanding § 9.2.1 Image Formation by Spherical Mirrors [3]

An object is moved steadily from a very large distance towards the pole of a concave mirror. How does the position of the real image change as the object moves from beyond C to exactly at F? Describe the trend clearly.

◆ Light – Reflection and Refraction

Q14. medium thorough-understanding § 9.2.1 Image Formation by Spherical Mirrors [2]

At which single position of the object in front of a concave mirror does the image form at the same location as the object? Justify your answer.

◆ Light – Reflection and Refraction

Q15. deep thorough-understanding § 9.2.1 Image Formation by Spherical Mirrors [3]

A concave mirror is used in a solar furnace. (a) State the property of image formation by a concave mirror that makes it suitable for this application. (b) What must be true about the position of the Sun relative to the mirror for this property to be utilized? Explain.

◆ Light – Reflection and Refraction

Q16. medium thorough-understanding § 9.2.2 Representation of Images Formed by Spherical Mirrors Using Ray Diagrams [2]

When constructing a ray diagram for a spherical mirror, why is it sufficient to use only two rays from an object point, even though an infinite number of rays originate from that point?

◆ Light – Reflection and Refraction

Q17. medium thorough-understanding § 9.2.2 Representation of Images Formed by Spherical Mirrors Using Ray Diagrams [3]

A ray of light travelling parallel to the principal axis strikes a convex mirror. Describe the path of the reflected ray and explain, with reference to the law of reflection and the geometry of a spherical mirror, why its behaviour differs from what happens when the same ray strikes a concave mirror.

◆ Light – Reflection and Refraction

Q18. medium thorough-understanding § 9.2.2 Representation of Images Formed by Spherical Mirrors Using Ray Diagrams [3]

An object is placed between the pole P and the principal focus F of a concave mirror. Using ray diagram rules, explain why the image formed cannot be caught on a screen.

◆ Light – Reflection and Refraction

Q19. straightforward thorough-understanding § 9.2.2 Representation of Images Formed by Spherical Mirrors Using Ray Diagrams [1]

Which of the following correctly describes what happens to a ray passing through the centre of curvature C of a concave mirror after reflection?

- (A) It passes through the principal focus F.
- (B) It emerges parallel to the principal axis.
- (C) It reflects back along the same path.
- (D) It reflects at an angle equal to twice the angle of incidence.

A It passes through the principal focus F.

B It emerges parallel to the principal axis.

C It reflects back along the same path.

D It reflects at an angle equal to twice the angle of incidence.

◆ Light – Reflection and Refraction

Q20. medium thorough-understanding § 9.2.2 Representation of Images Formed by Spherical Mirrors Using Ray Diagrams [3]

A student draws a ray from the tip of an object directed towards the centre of curvature of a convex mirror. The ray does not actually reach C because C lies behind the mirror. How should the student correctly draw this reflected ray, and what principle justifies it?

◆ Light – Reflection and Refraction

Q21. medium thorough-understanding § 9.2.2 Representation of Images Formed by Spherical Mirrors Using Ray Diagrams [2]

A ray strikes the pole of a concave mirror making an angle θ with the principal axis. Using the law of reflection and the fact that the principal axis is the normal at the pole, determine the angle the reflected ray makes with the principal axis. Would your answer change if the mirror were convex? Justify your reasoning.

◆ Light – Reflection and Refraction

Q22. medium thorough-understanding § 9.2.2 Representation of Images Formed by Spherical Mirrors Using Ray Diagrams [2]

In a ray diagram for a concave mirror, two reflected rays appear to diverge (they do not meet in front of the mirror). What does this tell you about the nature of the image, and how would you locate it on the diagram?

◆ Light – Reflection and Refraction

Q23. deep thorough-understanding § 9.2.2 Representation of Images Formed by Spherical Mirrors Using Ray Diagrams [3]

A concave mirror is used as a shaving mirror. A person positions their face close to the mirror and observes a magnified image. Using ray diagram rules for a concave mirror, identify the position of the face relative to the focal point F, and explain – with reference to the behaviour of the reflected rays – the nature and position of the image formed.

◆ Light – Reflection and Refraction

Q24. deep thorough-understanding § 9.2.2 Representation of Images Formed by Spherical Mirrors Using Ray Diagrams [2]

When locating the image of an object placed beyond C in a concave mirror, a student uses only two specific rays and finds their point of convergence. A classmate argues that using a third ray from the same object point would give a different image point, making the diagram inconsistent. How would you refute this argument? What fundamental principle of optics underpins your response?

◆ Light – Reflection and Refraction

- Q25.** medium thorough-understanding § 9.2.3 Sign Convention for Reflection by Spherical Mirrors [3]
A student sets up an experiment with a concave mirror. She measures the object distance as 20 cm and the image distance as 30 cm, and writes both values as positive in the mirror formula. Her teacher marks this as incorrect. Explain what the student did wrong and write the correct signs for both distances, justifying your answer using the New Cartesian Sign Convention.
- ◆ Light – Reflection and Refraction
- Q26.** deep thorough-understanding § 9.2.3 Sign Convention for Reflection by Spherical Mirrors [3]
A concave mirror has a focal length of -10 cm. Using the mirror formula, find the object distance if the image is formed at -30 cm. What does the negative sign of the image distance tell you about the nature of the image? Justify your answer using the New Cartesian Sign Convention.
- ◆ Light – Reflection and Refraction
- Q27.** medium thorough-understanding § 9.2.4 Mirror Formula and Magnification [2]
While solving a problem using the mirror formula for a concave mirror, a student obtains a positive value for the image distance v . (i) What does the sign of v indicate about the position of the image relative to the mirror? (ii) State the nature (real/virtual, erect/inverted) of this image. (iii) Under what condition of object placement does a concave mirror produce such an image?
- ◆ Light – Reflection and Refraction
- Q28.** medium thorough-understanding § 9.2.4 Mirror Formula and Magnification [3]
An object is placed 20 cm in front of a concave mirror of focal length 20 cm. Using the mirror formula, determine where the image is formed and explain what this result means physically.
- ◆ Light – Reflection and Refraction
- Q29.** medium thorough-understanding § 9.2.4 Mirror Formula and Magnification [3]
The magnification produced by a spherical mirror is -3 . What does the negative sign tell you, and what does the magnitude 3 tell you? In what region in front of the mirror must the object be placed to produce this image?
- ◆ Light – Reflection and Refraction
- Q30.** deep thorough-understanding § 9.2.4 Mirror Formula and Magnification [3]
The magnification for a spherical mirror is given by $m = -v/u$, while for a lens it is $m = v/u$. A student argues that both formulae should give the same sign for magnification when the image is real and inverted. Evaluate the student's claim: using the sign convention, show what sign m takes in each case when a real, inverted image is formed, and explain why the formulae are actually consistent with each other despite the apparent difference in form.
- ◆ Light – Reflection and Refraction
- Q31.** deep thorough-understanding § 9.2.4 Mirror Formula and Magnification [3]
A convex mirror always produces a magnification between 0 and $+1$ for any real object. Using the mirror formula and the sign convention, justify why the magnification for a convex mirror can never be negative or greater than 1.
- ◆ Light – Reflection and Refraction
- Q32.** medium thorough-understanding § 9.3 REFRACTION OF LIGHT [3]
A ray of light travels from glass (refractive index ≈ 1.5) into water (refractive index ≈ 1.33). (i) State whether the ray bends towards or away from the normal at the interface. (ii) Using the relationship between the speed of light and optical density, explain why it bends in that direction.
- ◆ Light – Reflection and Refraction

- Q33.** medium thorough-understanding § 9.3 REFRACTION OF LIGHT [3]
When a light ray passes through a rectangular glass slab at an angle, the emergent ray is parallel to the incident ray but shifted sideways. What causes this lateral shift, and why does the shift vanish when the ray hits the slab perpendicularly?
- ◆ Light – Reflection and Refraction
- Q34.** medium thorough-understanding § 9.3 REFRACTION OF LIGHT [3]
The speed of light in medium A is $2.0 \times 10^8 \text{ m s}^{-1}$ and in medium B is $2.5 \times 10^8 \text{ m s}^{-1}$. A ray travels from medium A into medium B. (i) Which medium is optically denser? (ii) Calculate the refractive index of medium A with respect to medium B. (iii) State the direction in which the ray bends at the interface.
- ◆ Light – Reflection and Refraction
- Q35.** deep thorough-understanding § 9.3 REFRACTION OF LIGHT [2]
Kerosene floats on water, showing that its mass density is less than that of water. Yet a light ray bends more when entering kerosene from air than when entering water from air. How do you account for this apparent contradiction?
- ◆ Light – Reflection and Refraction
- Q36.** deep thorough-understanding § 9.3 REFRACTION OF LIGHT [5]
A coin lying at the bottom of a water tank appears to be closer to the surface than it actually is. (i) Using the concept of refraction of light, explain why the coin appears raised. Draw a ray diagram to support your answer. (ii) The actual depth of the water is 40 cm and the refractive index of water is 1.33. Calculate the apparent depth of the coin. (iii) If water is replaced by a liquid of refractive index 1.5 (same actual depth), how does the apparent depth change? What does this tell you about the relationship between refractive index and apparent depth?
- ◆ Light – Reflection and Refraction
- Q37.** medium thorough-understanding § 9.3.1 Refraction through a Rectangular Glass Slab [3]
A ray of light enters one face of a rectangular glass slab obliquely and exits through the opposite parallel face. What happens to the direction of the emergent ray compared to the incident ray? Explain, with reference to refraction at each surface, why this outcome occurs.
- ◆ Light – Reflection and Refraction
- Q38.** medium thorough-understanding § 9.3.1 Refraction through a Rectangular Glass Slab [2]
A light ray strikes the flat surface of a rectangular glass slab at exactly 90° (i.e., along the normal). Will it be refracted as it enters the glass? Justify your answer using the laws of refraction.
- ◆ Light – Reflection and Refraction
- Q39.** deep thorough-understanding § 9.3.1 Refraction through a Rectangular Glass Slab [2]
A ray of light emerges from a rectangular glass slab parallel to the incident ray but shifted sideways. (i) What is the name given to this shift? (ii) State any two factors on which the magnitude of this shift depends, and explain how each factor affects it.
- ◆ Light – Reflection and Refraction
- Q40.** deep thorough-understanding § 9.3.1 Refraction through a Rectangular Glass Slab [5]
A student places a rectangular glass slab over a straight line drawn on paper, with one edge of the slab at an angle to the line. Viewing from the side, the line appears bent at the edges of the slab. However, when the slab is placed with its edge exactly perpendicular to the line and the student looks from directly above, the line appears raised but not bent sideways. Why is there a difference between these two observations?
- ◆ Light – Reflection and Refraction

Q41. medium thorough-understanding § 9.3.2 The Refractive Index [3]

Light travels from water (refractive index 1.33) into carbon disulphide (refractive index 1.63). In which direction does the refracted ray bend at the interface – towards the normal or away from it? Justify your answer in terms of the speeds of light in the two media.

◆ Light – Reflection and Refraction

Q42. straightforward thorough-understanding § 9.3.2 The Refractive Index [1]

The absolute refractive index of diamond is 2.42. What is the speed of light inside diamond? (Speed of light in air = $3 \times 10^8 \text{ m s}^{-1}$)

◆ Light – Reflection and Refraction

Q43. medium thorough-understanding § 9.3.2 The Refractive Index [3]

Kerosene has a higher refractive index than water, yet kerosene is less dense than water. What does this tell you about the relationship between optical density and mass density? Explain why these two properties are independent of each other.

◆ Light – Reflection and Refraction

Q44. straightforward thorough-understanding § 9.3.2 The Refractive Index [1]

[mcq] Light travels at speed v_w in water and at speed v_g in glass, where $v_g < v_w$. Which expression correctly gives the refractive index of glass with respect to water?

- (A) v_g / v_w
 (B) v_w / v_g
 (C) $(v_w + v_g) / 2$
 (D) $v_g \times v_w$
- A v_g / v_w
 B v_w / v_g
 C $(v_w + v_g) / 2$
 D $v_g \times v_w$

◆ Light – Reflection and Refraction

Q45. medium thorough-understanding § 9.3.2 The Refractive Index [2]

[short_answer] The refractive indices of air, ice, and ruby are approximately 1.0003, 1.31, and 1.71 respectively. Rank these three media in increasing order of the speed of light passing through them. Explain your reasoning using the relationship between refractive index and speed of light.

◆ Light – Reflection and Refraction

Q46. deep thorough-understanding § 9.3.2 The Refractive Index [5]

[long_answer] A glass sample is found to allow light to travel through it at a speed of $2.0 \times 10^8 \text{ m s}^{-1}$. (Speed of light in air = $3 \times 10^8 \text{ m s}^{-1}$.)

- (i) Calculate the refractive index of this glass sample.
 (ii) Crown glass has a refractive index of 1.52. Is this glass sample optically denser or rarer than crown glass? Justify your answer.
 (iii) If a ray of light passes from air into each of these two glass types at the same angle of incidence, in which glass will the refracted ray make a smaller angle with the normal? Explain why.

◆ Light – Reflection and Refraction

Q47. medium thorough-understanding § 9.3.3 Refraction by Spherical Lenses [3]

A convex lens is called a 'converging lens' while a concave lens is called a 'diverging lens'. What physical feature of each lens shape causes this difference in behaviour when parallel rays of light pass through them?

◆ Light – Reflection and Refraction

Q48. medium thorough-understanding § 9.3.3 Refraction by Spherical Lenses [3]

A lens has two principal foci, F_1 and F_2 , one on each side. Explain why a lens must have two principal foci rather than just one. A student argues that both foci are always equidistant from the optical centre – under what condition is this true, and what does this tell us about the medium surrounding the lens?

◆ Light – Reflection and Refraction

Q49. medium thorough-understanding § 9.3.3 Refraction by Spherical Lenses [2]

You are given two convex lenses: Lens P has a short focal length and Lens Q has a long focal length. Both are held in sunlight. For which lens will the sharp image of the Sun form closer to the lens, and why?

◆ Light – Reflection and Refraction

Q50. deep thorough-understanding § 9.3.3 Refraction by Spherical Lenses [3]

A transparent object can function as a lens only if at least one of its surfaces is spherical. A flat glass slab, however, also refracts light. Why can a flat glass slab not be used as a lens to converge or diverge light rays?

◆ Light – Reflection and Refraction

Q51. deep thorough-understanding § 9.3.3 Refraction by Spherical Lenses [5]

A concave lens and a concave mirror both diverge a parallel beam of light, yet a concave mirror can form a real image of a distant object while a concave lens cannot. (a) Describe what each does to a parallel beam incident on it, clearly distinguishing between the two. (b) Explain the fundamental physical reason why a concave mirror converges reflected rays to a real focus, whereas a concave lens diverges refracted rays to a virtual focus.

◆ Light – Reflection and Refraction

Q52. deep thorough-understanding § 9.3.3 Refraction by Spherical Lenses [3]

The principal focus of a convex lens is defined using rays parallel to the principal axis. What would you observe if, instead of parallel rays, you directed rays from a point source placed exactly at the principal focus F_1 through the convex lens? Justify your answer using the principle involved.

◆ Light – Reflection and Refraction

Q53. medium thorough-understanding § 9.3.4 Image Formation by Lenses [3]

A student places a candle at various positions in front of a convex lens and tries to catch the image on a screen. At one particular position of the candle, no image can be formed on the screen, yet an image does exist. Where is the candle, and why can the image not be caught on a screen?

◆ Light – Reflection and Refraction

Q54. medium thorough-understanding § 9.3.4 Image Formation by Lenses [3]

A concave lens is described as a 'diverging lens'. Explain, using the concept of ray behaviour, why a concave lens cannot form a real image of a real object regardless of where the object is placed.

◆ Light – Reflection and Refraction

Q55. straightforward thorough-understanding § 9.3.4 Image Formation by Lenses [1]

A convex lens of focal length 20 cm is used as a simple magnifier. State the range of object distances for which this lens acts as a magnifier, and explain why the image formed in this case cannot be caught on a screen.

◆ Light – Reflection and Refraction

Q56. deep thorough-understanding § 9.3.4 Image Formation by Lenses [5]

An object is moved steadily from a very large distance towards a convex lens along its principal axis. Describe how the position of the real image changes as the object moves from far beyond $2F_1$ to just outside F_1 . What happens to the size of the image during this journey? Justify your answer using the image formation data for a convex lens.

◆ Light – Reflection and Refraction

Q57. deep thorough-understanding § 9.3.4 Image Formation by Lenses [3]

A convex lens and a concave lens both have a magnitude of focal length 15 cm. An object is placed 30 cm to the left of each lens separately. For which lens is the image real, and for which is it virtual? Give a reason for each.

◆ Light – Reflection and Refraction

Q58. medium thorough-understanding § 9.3.5 Image Formation in Lenses Using Ray Diagrams [3]

A ray of light travelling parallel to the principal axis strikes (i) a concave mirror and (ii) a convex lens. Describe the path of the reflected/refracted ray in each case and draw the corresponding ray diagrams. Using the concepts of reflection and refraction, explain why the behaviour of the ray differs in the two cases.

◆ Light – Reflection and Refraction

Q59. medium thorough-understanding § 9.3.5 Image Formation in Lenses Using Ray Diagrams [1]

A ray of light is directed towards the principal focus F_1 on the left side of a convex lens but strikes the lens before actually reaching F_1 . Draw the path of this ray after refraction through the lens and explain, using the principle of reversibility of light, why it travels in that direction.

◆ Light – Reflection and Refraction

Q60. medium thorough-understanding § 9.3.6 Sign Convention for Spherical Lenses [3]

A lens forms a virtual, erect image of an object placed 8 cm in front of it. The image is located 4.8 cm from the lens on the same side as the object. (a) Using the lens formula, calculate the focal length of this lens and state what type of lens it is. (b) With the help of sign convention, explain why the focal length carries the sign you obtained.

◆ Light – Reflection and Refraction

Q61. deep thorough-understanding § 9.3.7 Lens Formula and Magnification [3]

The lens formula for a spherical lens is written as $1/v - 1/u = 1/f$, while the mirror formula is written as $1/v + 1/u = 1/f$. Why can the same formula not be used for both, even though both involve a curved optical surface forming an image?

◆ Light – Reflection and Refraction

Q62. medium thorough-understanding § 9.3.7 Lens Formula and Magnification [2]

A concave lens always produces a magnification that is positive and has a magnitude less than 1, regardless of where the object is placed. Justify both of these statements using the lens formula and the definition of magnification, and describe what they together tell us about the image formed.

◆ Light – Reflection and Refraction

- Q63.** medium thorough-understanding § 9.3.7 Lens Formula and Magnification [3]
An object 3 cm tall is placed 12 cm from a convex lens of focal length 8 cm. Find the height of the image and determine whether it is erect or inverted.
◆ Light – Reflection and Refraction
- Q64.** deep thorough-understanding § 9.3.7 Lens Formula and Magnification [3]
When an object is placed exactly at the focus of a convex lens, what does the lens formula predict about the position of the image? Explain physically why this result makes sense, and identify one practical application that exploits exactly this condition.
◆ Light – Reflection and Refraction
- Q65.** straightforward thorough-understanding § 9.3.8 Power of a Lens [1]
A lens has a power of -2.5 D. (a) Calculate its focal length. (b) What type of lens is it? (c) Where should an object be placed in front of this lens so that the image is formed at the focus?
◆ Light – Reflection and Refraction
- Q66.** medium thorough-understanding § 9.3.8 Power of a Lens [3]
An optician tests a patient's eye and places two corrective lenses of power $+1.5$ D and $+0.75$ D in contact inside the trial frame. (a) What is the equivalent power of this combination? (b) What focal length single lens could replace the combination? (c) Why is it more practical for opticians to work with powers rather than focal lengths when combining lenses?
◆ Light – Reflection and Refraction
- Q67.** medium thorough-understanding § 9.3.8 Power of a Lens [3]
Two convex lenses P and Q have focal lengths 10 cm and 40 cm respectively. (a) Calculate the power of each lens. (b) A parallel beam of light falls on each lens separately. For which lens will the refracted rays converge closer to the lens, and why? (c) If these two lenses are placed in contact, what is the power of the combination? What type of lens does this combination behave like?
◆ Light – Reflection and Refraction
- Q68.** deep thorough-understanding § 9.3.8 Power of a Lens [3]
A student claims: 'A concave lens of power -4 D and a convex lens of power $+4$ D placed in contact will act as a flat glass plate — light will pass through without any bending.' Evaluate this claim. Is the student correct? Justify your answer using the concept of power of a lens, and state what assumption must hold for this to be true.
◆ Light – Reflection and Refraction
- Q69.** medium thorough-understanding § (whole-chapter synthesis) [3]
A concave mirror and a convex lens are often said to behave analogously. Under what conditions does a concave mirror produce a virtual image, and under what conditions does a convex lens produce a virtual image? Identify the single common geometric condition that triggers a virtual image in both devices and explain why that condition causes the reflected/refracted rays to diverge rather than converge.
◆ Light – Reflection and Refraction
- Q70.** medium thorough-understanding § (whole-chapter synthesis) [3]
A ray of light travelling in air strikes a concave mirror and separately strikes a glass slab, in both cases hitting the surface obliquely. Compare what happens to the direction of the ray at the surface in each case, and explain the different physical reason behind each change in direction.
◆ Light – Reflection and Refraction

Q71. medium thorough-understanding § (whole-chapter synthesis) [3]

An object is placed at the centre of curvature C of a concave mirror of focal length f . A separate but identical object is placed at a distance $2f$ in front of a convex lens of the same focal length f . Predict and compare the position, size, and nature of the image in each case. Explain the underlying reason why the two results are similar in character.

◆ Light – Reflection and Refraction

Q72. medium thorough-understanding § (whole-chapter synthesis) [1]

Assertion (A): A convex mirror is preferred as a rear-view mirror in vehicles even though it produces a diminished image, whereas a concave mirror of the same size would give a larger image of the same object.

Reason (R): A convex mirror has a wider field of view than a plane or concave mirror of the same aperture because its reflecting surface curves outward.

Choose the correct option:

- (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.

- 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.

◆ Light – Reflection and Refraction

Q73. deep thorough-understanding § (whole-chapter synthesis) [3]

Light travels from water (refractive index 1.33) into glass (refractive index 1.52). (a) In which medium does light travel faster, and how does the difference in speed determine the direction in which the ray bends at the interface? (b) If this piece of glass is shaped into a concave lens and a ray parallel to the principal axis enters it from air, describe the complete path of the ray after it exits the lens and explain where an observer on the transmission side would perceive the ray to have originated.

◆ Light – Reflection and Refraction

Q74. medium thorough-understanding § (whole-chapter synthesis) [5]

A 4 cm tall object is placed 30 cm in front of a concave mirror of focal length 10 cm. Using the mirror formula and magnification formula, find: (i) the image distance, (ii) the height of the image, and (iii) whether the same object placed 30 cm in front of a convex lens of focal length 10 cm would give an image on the same side or the opposite side of the device compared to the object. Justify your answer for part (iii) without calculation.

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