QB365 Question Paper Software
12th Standard - Physics
Ray Optics and Optical Instruments Assertion and reason

Exam Time: 00:20 Hrs | Date: 2025-09-30

Total Marks: 10

Questions:

1. **Assertion (A)** : A convex lens of glass (μ = 1.5) behave as a diverging lens when immersed in carbon disulphide of higher refractive index (μ = 1.65).
Reason (R) : A diverging lens is thinner in the middle and thicker at the edges.
Codes:
(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 and R is also false

2. **Assertion (A)** : The diamond shines due to multiple total internal reflections.
Reason (R) : The critical angle for diamond is 24.4°.
Codes:
(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 and R is also false

3. **Assertion (A)** : Convergent lens property of converging remains same in all media.
Reason (R) : Property of lens whether the ray is diverging or converging is independent of the surrounding medium.
Codes:
(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 and R is also false

4. **Assertion (A)** : A double convex lens (μ = 1.5) has focal length 10 cm. When the lens is immersed in water (μ = 4/3) its focal length becomes 75.24 cm
Reason (R) : $\frac{1}{f} = \frac{\mu_g - \mu_m}{\mu_m}\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$
Codes:
(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 and R is also false

5. Assertion (A) : Propagation of light through an optical fibre is due to total internal reflection taking place at the core-clade interface,
Reason (R) : Refractive index of the material of the core of the optical fibre is greater than that of air.
(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(b) Both Assertion and Reason are true but Reason is not the correct explanation of

Assertion.
(c) Assertion is true but Reason is false.
(d) Assertion is false but Reason is true.

6. **Assertion :** The image formed by a concave mirror is certainly real if the object is virtual.
Reason : The image formed by a concave mirror is certainly virtual if the object is real.
Codes:
(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

7. **Assertion (A) :** Higher is the refractive index of a medium or denser the medium, lesser is the velocity of light in that medium.
Reason (R) : Refractive index is inversely proportional to velocity.
Codes:
(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 and R is also false.

8. **Assertion :** Plane mirror may form real image.
Reason : Plane mirror forms virtual image, if object is real.
Codes:
(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 and R is also false.

9. **Assertion:** The focal length of an equiconvex lens of radius of curvature R made of material of refractive index $\mu = 1.5$, is R.
Reason : The focal length of the lens will be R/2.
Codes:
(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 and R is also false.

10. **Assertion (A):** A real image formed by a convex lens is always inverted.
Reason (R): A real image is formed when light rays actually converge at a point, and this convergence results in an inverted image
Codes:
(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 and R is also false.

Answers Key:

1.

(b) : $\mu = \frac{\mu_g}{\mu_c} = \frac{1.5}{1.65} < 1$

From $\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

f becomes negative.

Therefore, the lens behaves as a diverging lens.

2. **(b)**: The brilliance of diamond is due to total internal reflection of light. μ for diamond is 2.42, so that critical angle for diamond air interface is C = 24.40 (from sinC = $1/\mu$). The diamond is cut suitable so that light entering the diamond from any face suffers multiple total internal reflections at the various faces and remains within the diamond. Hence the diamond sparkles.
3. **(d)**: A convex lens made of glass behaves as a convergent lens when placed in air or water. However when the same lens is immersed in carbon disulphide (μ = 1.63), it behaves as a divergent lens. Therefore when a convergent lens is placed inside a transparent medium of refractive index greater than that of material of the lens, it behaves as a divergent lens. Behaviour of a lens depends on the refractive index of a surrounding medium.
4. **(a):** $\frac{1}{f} = ({}^{w}\mu_g - 1)\left[\frac{1}{R_1} - \frac{1}{R_2}\right] = \left(\frac{\mu_g}{\mu_w} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

   $\frac{1}{f} = \left(\frac{\mu_g - \mu_w}{\mu_w}\right) \cdot \left[\frac{1}{R_1} - \frac{1}{R_2}\right] = \left(\frac{1.5 - 1.33}{1.33}\right) \cdot \left[\frac{1}{20} + \frac{1}{20}\right]$

   $\therefore \quad f = 78.24 \text{ cm}$
5. (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

   Optical fibre communication is based on the phenomenon of total internal reflection at core-clad interface.

   The refractive index of the material of the cladding, hence light striking at core-cladding interface gets totally internally reflected. The light undergoes and reaches the other end of the fibre.
6. (c) If the Assertion is correct but Reason is incorrect.

   Explanation:

   The image of real object may be real in case of concave mirror.
7. (a) Both A and R are true and R is the correct explanation of A.
8. (b) Both A and R are true but R is not the correct explanation of A.
9. (c) A is true but R is false.
10. (a) Both A and R are true and R is the correct explanation of A.