

STUDENT NAME _____

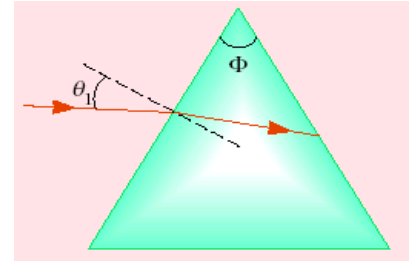
STUDENT #. _____

PART I (48%) In the scantron sheet clearly indicate your answers to all question below.

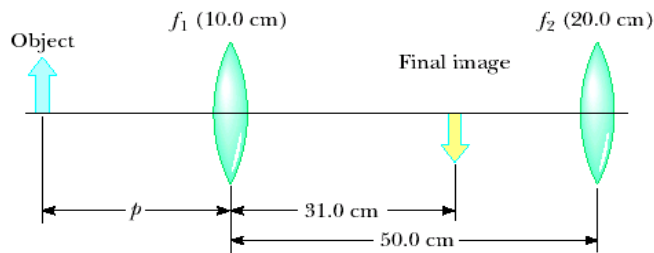
- 1 A light ray whose frequency is 6×10^{14} Hz in vacuum is incident on water ($n = 1.33$). The wavelength of the light after it enters the water is (in nm)
a) 798 b) 500 c) 665 d) 376 e) 266
- 2 A person looks horizontally at the edge of a swimming pool. If its length is 5 m, and the pool is filled to the surface, to what depth (in m) could the observer see? (n for water is 1.33)
a) 3.2 b) 4.4 c) 2.1 d) 1.0 e) 0.3
- 3 A concave mirror has a focal length of 20 cm. What is the magnification if the object and image distances are 10 cm and -20 cm respectively?
a) 1 b) 2 c) $\frac{1}{2}$ d) $\frac{1}{4}$ e) $-\frac{1}{2}$
- 4 If a convex lens were made out of very thin clear plastic filled with air, and were then placed underwater where $n = 1.33$ and where the lens would have an effective index of refraction $n = 1$, the lens would act in the same way
a) as a concave mirror in air.
b) as a concave lens in air.
c) as a convex lens in air.
d) as a flat refracting surface between water and air as seen from the water side.
e) as the glasses worn by a farsighted person.
5. In a double slit experiment, the distance between the slits is 0.2 mm and the distance to the screen is 150 cm. What is the phase difference (in degrees) between the waves from the two slits arriving at a point P when the angular distance of P is 10° relative to the central peak, and the wavelength is 500 nm? (Convert your result so the angle is between 0 and 360° .)
a) 145° b) 155° c) 165° d) 135° e) none of the above
- 6 In a Newton's rings apparatus, find the phase difference (in radians) when an air wedge of 500 nm thickness is illuminated with red light ($wavelength = 640$ nm).
a) 13 b) 11 c) 9 d) 7 e) none of the above
- 7 Unpolarized light is passed through three successive Polaroid filters, each with its transmission axis at 45° to the preceding filter. What percentage of light gets through?
a) 0% b) 12.5% c) 25% d) 50% e) 33%

PART II In exam booklet solve 4 out of 5 problems below:

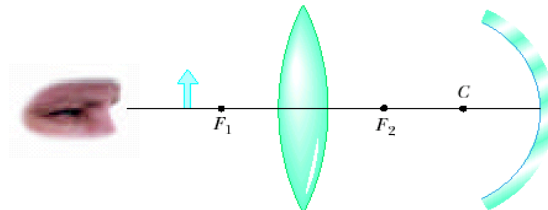
33 A triangular glass prism with apex angle $\Phi = 60.0^\circ$ has an index of refraction $n = 1.50$. What is the smallest angle of incidence θ_1 for which a light ray can emerge from the other side?



74. Two converging lenses having focal lengths of 10.0 cm and 20.0 cm are located 50.0 cm apart, as shown in. The final image is to be located between the lenses at the position indicated. (a) How far to the left of the first lens should the object be? (b) What is the overall magnification? (c) Is the final image upright or inverted?



72. Figure below shows a thin converging lens for which the radii of curvature are $R_1 = 9.00$ cm and $R_2 = -11.0$ cm. The lens is in front of a concave spherical mirror with the radius of curvature $R = 8.00$ cm. (a) Assume its focal points F_1 and F_2 are 5.00 cm from the center of the lens. Determine its index of refraction. (b) The lens and mirror are 20.0 cm apart, and an object is placed 8.00 cm to the left of the lens. Determine the position of the final image and its magnification as seen by the eye in the figure. (c) Is the final image inverted or upright? Explain.



39. An air wedge is formed between two glass plates separated at one edge by a very fine wire, as shown. When the wedge is illuminated from above by 600-nm light and viewed from above, 30 dark fringes are observed. Calculate the diameter of the wire.



50. A certain crude oil has an index of refraction of 1.25. A ship dumps 1.00 m^3 of this oil into the ocean, and the oil spreads into a thin uniform slick. If the film produces a first-order maximum of light of wavelength 500 nm normally incident on it, how much surface area of the ocean does the oil slick cover? Assume that the index of refraction of the ocean water is 1.34. State your answer to the nearest meter squared.

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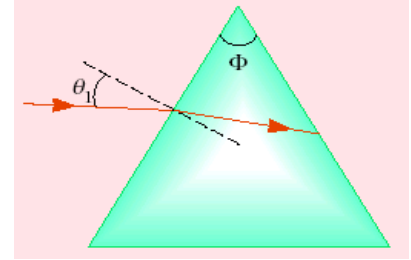
STUDENT NO. _____

PART I (48%) In the scantron sheet clearly indicate your answers to all question below.

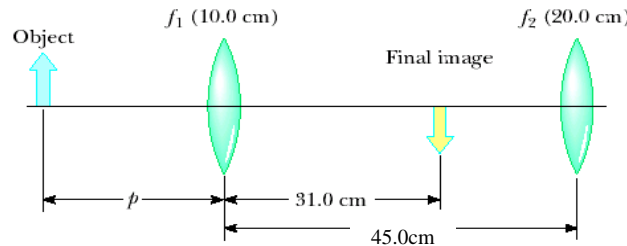
- 1 A light ray whose frequency is 8.48×10^{14} Hz in vacuum is incident on water ($n = 1.33$). The wavelength of the light after it enters the water is (in nm)
a) 797 b) 500 c) 665 d) 376 e) 266
- 2 A person looks horizontally at the edge of a swimming pool. If its length is 4.0 m, and the pool is filled to the surface, to what depth (in m) could the observer see? (n for pool water is 1.30)
a) 3.3 b) 4.4 c) 5.4 d) 1.0 e) 0.3
- 3 A concave mirror has a focal length of 10 cm. What is the magnification if the object and image distances are 20 cm and 20 cm respectively?
a) -1 b) 2 c) $\frac{1}{2}$ d) $\frac{1}{4}$ e) $-\frac{1}{2}$
- 4 If a concave lens were made out of very thin clear plastic filled with air, and were then placed underwater where $n = 1.33$ and where the lens would have an effective index of refraction $n = 1$, the lens would act in the same way
a) as a convex mirror in air.
b) as a concave lens in air.
c) as a convex lens in air.
d) as a flat refracting surface between water and air as seen from the water side.
e) as the glasses worn by a farsighted person.
5. In a double slit experiment, the distance between the slits is 0.3 mm and the distance to the screen is 150 cm. What is the phase difference (in degrees) between the waves from the two slits arriving at a point P when the angular distance of P is 15° relative to the central peak, and the wavelength is 400 nm? (Convert your result so the angle is between 0 and 360° .)
a) 41° b) 155° c) 165° d) 132° e) none of the above
- 6 In a Newton's rings apparatus, find the phase difference (in radians) when an air wedge of 300 nm thickness is illuminated with blue light ($wavelength = 480$ nm).
a) 13 b) 11 c) 9 d) 7 e) none of these answers
- 7 Unpolarized light is passed through three successive Polaroid filters, each with its transmission axis at 33° to the preceding filter. What percentage of light gets through?
a) 0% b) 12.5% c) 25% d) 50% e) 33%

PART II In exam booklet solve 4 out of 5 problems below:

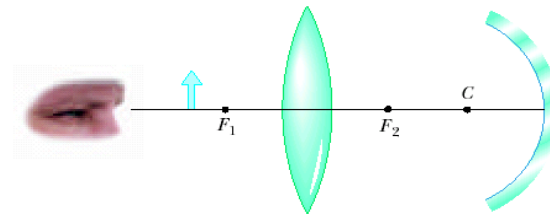
- 1 A triangular glass prism with apex angle $\Phi = 65.0^\circ$ has an index of refraction $n = 1.55$. What is the smallest angle of incidence θ_1 for which a light ray can emerge from the other side?



- 2 Two converging lenses having focal lengths of 10.0 cm and 20.0 cm are located 45.0 cm apart, as shown in. The final image is to be located between the lenses at the position indicated. (a) How far to the left of the first lens should the object be? (b) What is the overall magnification? (c) Is the final image upright or inverted?



- 3 Figure below shows a thin converging lens for which the radii of curvature are $R_1 = 9.00$ cm and $R_2 = -11.0$ cm. The lens is in front of a concave spherical mirror with the radius of curvature $R = 8.00$ cm. (a) Assume its focal points F_1 and F_2 are 5.00 cm from the center of the lens. Determine its index of refraction. (b) The lens and mirror are 20.0 cm apart, and an object is placed 8.00 cm to the left of the lens. Determine the position of the final image and its magnification as seen by the eye in the figure. (c) Is the final image inverted or upright? Explain.



- 4 An air wedge is formed between two glass plates separated at one edge by a very fine wire, as shown. When the wedge is illuminated from above by 500-nm light and viewed from above, 30 dark fringes are observed. Calculate the diameter of the wire.



5. A certain crude oil has an index of refraction of 1.26. A ship dumps 1.20 m^3 of this oil into the ocean, and the oil spreads into a thin uniform slick. If the film produces a first-order maximum of light of wavelength 500 nm normally incident on it, how much surface area of the ocean does the oil slick cover? Assume that the index of refraction of the ocean water is 1.35. State your answer to the nearest meter squared.

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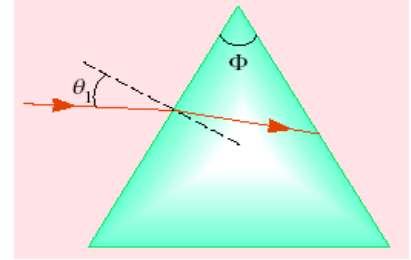
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PART I (48%) In the scantron sheet clearly indicate your answers to all question below.

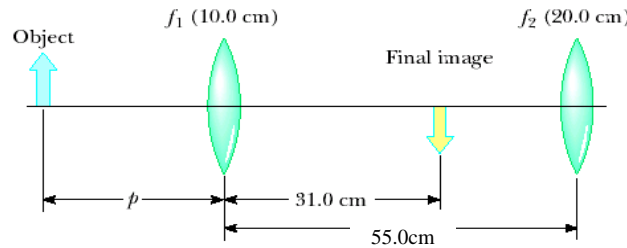
- 1 A light ray whose frequency is 2.83×10^{14} Hz in vacuum is incident on water ($n = 1.33$). The wavelength of the light after it enters the water is (in nm).
a) 797 b) 500 c) 665 d) 376 e) 266
- 2 A person looks horizontally at the edge of a swimming pool. If its length is 6 m, and the pool is filled to the surface, to what depth (in m) could the observer see? (n for pool water is 1.35)
a) 3.3 b) 4.4 c) 5.4 d) 1.0 e) none of the above
- 3 A concave mirror has a focal length of 10 cm. What is the magnification if the object and image distances are +20 cm and 20 cm respectively?
a) -1 b) 2 c) $\frac{1}{2}$ d) $\frac{1}{4}$ e) $-\frac{1}{2}$
- 4 If a concave lens were made out of very thin clear plastic filled with air, and were then placed underwater where $n = 1.33$ and where the lens would have an effective index of refraction $n = 1$, the lens would act in the same way
a) as a convex lens in air.
b) as a concave lens in air.
c) as a convex mirror in air.
d) as a flat refracting surface between water and air as seen from the water side.
e) as the glasses worn by a farsighted person.
- 5 In a double slit experiment, the distance between the slits is 0.3 mm and the distance to the screen is 150 cm. What is the phase difference (in degrees) between the waves from the two slits arriving at a point P when the angular distance of P is 23° relative to the central peak, and the wavelength is 400 nm? (Convert your result so the angle is between 0 and 360° .)
a) 41° b) 155° c) 165° d) 132° e) none of the above
- 6 In a Newton's rings apparatus, find the phase difference (in radians) when an air wedge of 200 nm thickness is illuminated with red light ($wavelength = 650$ nm).
a) 13 b) 11 c) 9 d) 7 e) none of these answers
- 7 Unpolarized light is passed through three successive Polaroid filters, each with its transmission axis at 26° to the preceding filter. What percentage of light gets through?
a) 0% b) 12.5% c) 25% d) 50% e) 33%

PART II In exam booklet solve 4 out of 5 problems below:

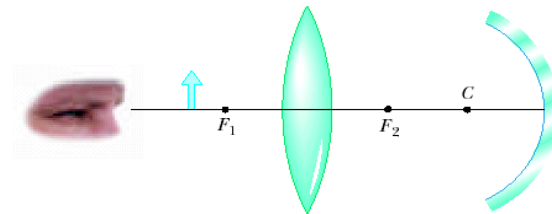
- 1 A triangular glass prism with apex angle $\Phi = 60.0^\circ$ has an index of refraction $n = 1.50$. What is the smallest angle of incidence θ_1 for which a light ray can emerge from the other side?



- 2 Two converging lenses having focal lengths of 10.0 cm and 20.0 cm are located 55.0 cm apart, as shown in. The final image is to be located between the lenses at the position indicated. (a) How far to the left of the first lens should the object be? (b) What is the overall magnification? (c) Is the final image upright or inverted?



- 3 Figure below shows a thin converging lens for which the radii of curvature are $R_1 = 9.00$ cm and $R_2 = -11.0$ cm. The lens is in front of a concave spherical mirror with the radius of curvature $R = 9.00$ cm. (a) Assume its focal points F_1 and F_2 are 5.00 cm from the center of the lens. Determine its index of refraction. (b) The lens and mirror are 20.0 cm apart, and an object is placed 8.00 cm to the left of the lens. Determine the position of the final image and its magnification as seen by the eye in the figure. (c) Is the final image inverted or upright? Explain.



- 4 An air wedge is formed between two glass plates separated at one edge by a very fine wire, as shown. When the wedge is illuminated from above by 600-nm light and viewed from above, 20 dark fringes are observed. Calculate the diameter of the wire.



5. A certain crude oil has an index of refraction of 1.27. A ship dumps 1.10 m^3 of this oil into the ocean, and the oil spreads into a thin uniform slick. If the film produces a first-order maximum of light of wavelength 400 nm normally incident on it, how much surface area of the ocean does the oil slick cover? Assume that the index of refraction of the ocean water is 1.34. State your answer to the nearest meter squared.