

Optics B Answer Key

Science Olympiad North Regional Tournament at the
University of Florida



Numbers 1-10: +3 points each

*Each correct response is worth 3 points. There is no partial credit for incorrect responses.
Responses with multiple answers do not receive any points.*

1. E
2. C
3. D
4. D
5. E
6. A
7. A
8. B
9. C
10. C

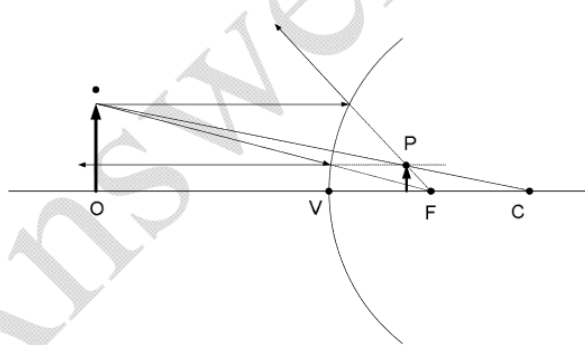
Numbers 11-20:

Points for correct responses are listed in parenthesis next to the correct response. There is no partial credit for calculation and fill-in-the-blank unless otherwise stated. For open-response questions, reference to the underlined portions in correct responses must be in the student answer. Partial credit may be given to responses which make reference to (some of) the underlined portions but do not provide an adequate response or do not demonstrate full understanding of the material. Additionally, responses which are correct, relevant, and demonstrate understanding may also receive full credit (no partial credit). For calculation problems, the +/- 2% range is included in parentheses next to the correct answer. Incorrect significant figures or units on responses which are otherwise correct are deducted 1 point.

11.

- Glass (+1)
- “dispersion is the phenomenon in which the phase velocity of a wave depends on its frequency” (+1; accept something to this effect)
- “Red, Orange, Yellow, Green, Blue, Indigo, Violet” (+1; accept indigo omission)
- “The second prism disperses light less” (+2; accept something to this effect)

12.



- (+1; location, upright, smaller)
- $i = 18 \text{ mm}$ (+3; 17.6 — 18.4)
- $m = -0.0144$ (+1; -0.0141 — -0.147; do not accept if negative missing)

13.

- total internal reflection **OR** refraction **OR** reflection (+1)
- delay = 83 ms (+1; 81 — 85)
- $\phi_{\text{air}} = 51.98^\circ$ (+3; 50.93 — 53.02) **OR** $\phi_{\text{air}} = 59.60^\circ$ (+1; 58.41 — 60.80)

14.

- a. “The scattering of light off air molecules produces linearly polarized light in the plane perpendicular to the incident light” (+2)
- b. Blue (+1)
- c. Look for concentric circles around sun (+2)

15.

- a. $f = 0.125$ cm (+2; 0.123 — 0.128)
- b. $d = 0.250$ cm (+3; 0.245 — 0.255) **OR** 0.125 cm (+2; 0.123 — 0.128)

16.

- a. rods (+1) **AND** cones (+1)
- b. “Additive color is a method to create color by mixing a number of different light colors, with shades of red, green, and blue being the most common primary colors used in additive color system.” (+1; accept something to this effect) **OR** “when we speak of white light, we are referring to ROYGBIV - the presence of the entire spectrum of visible light... Any three colors (or frequencies) of light that produce white light when combined with the correct intensity are called primary colors of light” (+1; accept something to this effect)
- c. “Yellow-blue” (+2)

17.

- a. $d = 4.36$ m (+2; 4.27 — 4.45)
- b. $D = 3.90$ m (+3; 3.82 — 3.98)

18.

- a. “The mirror has multiple focal points” **OR** “the mirror is parabolic” (+3; accept something to this effect)
- b. “The surface of the water is not smooth” **OR** something to the effect of 18(a) (+2)

19.

- a. “Iris” **OR** “Pupil” (+1)
- b. “Retina” **OR** “Photoreceptors” **OR** “rods and cones” (+1)
- c. “The beam reflects inside the prism *twice*, allowing the transmission of an image through a right angle without inverting it” (+3)

20.

- a. "Ultraviolet" (+1)
- b. "Violet light" (+1; do not accept "Visible Light")
- c. "The absorption spectrum has a shorter wavelength and therefore higher energy which is later emitted in longer wavelength, lower energy light" (+3; accept something to this effect)