Physics II Trivia Review — Answer Key

Ch. 22, 24, 25, 26: Induction, EM Waves, Mirrors, Lenses
General Physics IIA

Round 1 — Quick Warm-Up

1. No, no emf is induced.
2. The change in magnetic flux.
3. Speed.
4. It decreases.
5. Virtual and upright.
6. Virtual and upright.

Round 2 — Multiple Choice Challenge

7. **(b)** decrease its frequency
8. **(c)** between the focal point and the mirror
9. **(c)** a concave mirror or a converging lens
10. **(b)** is cut in half
11. **(b)** $c = \lambda f$
12. **(c)** frequency

Round 3 — Induction Round

13. The magnitude of the induced emf equals the rate of change of magnetic flux through the loop, and the sign indicates the induced emf opposes the change in flux.
14. Larger.
15. Out of the page.
16. The magnetic flux doubles.
17. Because the magnetic flux changes while the loop is entering the field, but once the loop is fully inside a constant field region, the flux no longer changes.
18. Greater than; the induced emf is multiplied by the number of loops.

Round 4 — EM Waves Round

19. The wavelength decreases.

20. Blue.

21. Its index of refraction is greater than 1 (and greater than that of vacuum).

Round 5 — Mirrors and Lenses

22. Real.

23. The image distance equals the object distance.

24. The image is inverted.

Round 6 — Quick Calculations

25.
$$I = \frac{\mathcal{E}}{R} = \frac{0.80}{4.0} = 0.20\,\text{A}$$

26.
$$\lambda = \frac{c}{f} = \frac{3.0 \times 10^8}{6.0 \times 10^{14}} = 5.0 \times 10^{-7}\,\text{m}$$

27. Visible light.

28.
$$v = \frac{c}{n} = \frac{3.0 \times 10^8}{1.33} \approx 2.26 \times 10^8\,\text{m/s}$$

29. Use the mirror equation:
$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$
$$\frac{1}{10} = \frac{1}{30} + \frac{1}{d_i} \Rightarrow \frac{1}{d_i} = \frac{1}{15} \Rightarrow d_i = 15\,\text{cm}$$

30. Use the lens equation:
$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$
$$\frac{1}{15} = \frac{1}{40} + \frac{1}{d_i} \Rightarrow \frac{1}{d_i} = \frac{1}{24} \Rightarrow d_i = 24\,\text{cm}$$

Final Round — Team Challenge

Radius:
$$r = 5.0\,\text{cm} = 0.050\,\text{m}$$

Area of the loop:
$$A = \pi r^2 = \pi(0.050)^2 = 7.85 \times 10^{-3}\,\text{m}^2$$

Change in magnetic field:

$$\Delta B = 0.50 - 0.10 = 0.40\,\mathrm{T}$$

Change in magnetic flux:

$$\Delta\Phi_B = A\Delta B = (7.85 \times 10^{-3})(0.40) = 3.14 \times 10^{-3}\,\mathrm{Wb}$$

Induced emf:

$$\mathcal{E} = \frac{\Delta\Phi_B}{\Delta t} = \frac{3.14 \times 10^{-3}}{0.20} = 1.57 \times 10^{-2}\,\mathrm{V}$$

$$\boxed{\mathcal{E} \approx 1.6 \times 10^{-2}\,\mathrm{V}}$$

The induced current must oppose the increase in magnetic flux, so it produces a magnetic field opposite the change.