Final Exam (2022 Spring)

PHYS 203B-001: College Physics

Date: 2022 May 2

(Name) (Signature)

Instructions

1. Seating direction: Please be seated on seats with seat numbers divisible by 4.
2. Total time = 50 minutes.
3. There are 8 questions in this exam.
4. Equation sheet is provided separately.
5. To be considered for partial credit you need to show your work in detail and organize it clearly.
6. A simple calculator (with trigonometric functions) is allowed.
7. Use of mobile phones is strictly prohibited. It should stay out of reach during the exam.

1. (**5 points.**) Calculate the total charge of one gram of electrons.

2. (**5 points.**) Briefly describe Faraday's law of inductance.

3. (**5 points.**) Is the image that you see of yourself in a flat bathroom mirror a real image or a virtual image?

4. (**10 points.**) Determine the equivalent resistance in the circuit in Figure 1. Given $R_1 = R_2 = R_3 = 25\,\Omega$.

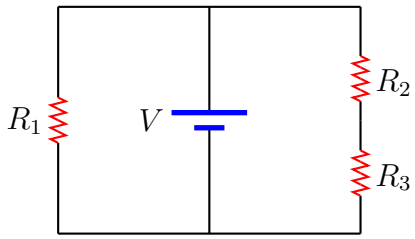

Figure 1: Problem 4

5. (**10 points.**) A loop in the shape of a right triangle of sides $a = 3.0\,\text{cm}$ and $b = 2.0\,\text{cm}$, carrying a current $I = 2.0\,\text{A}$, is placed in a magnetic field $0.30\,\text{T}$ going into the page. See Figure 2. Determine the magnitude and direction of the force on side 2 of the triangle.

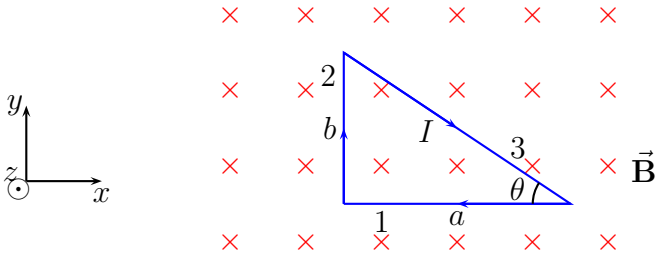

Figure 2: Problem 5.

6. (**10 points.**) A 1.0 cm object is placed upright at a distance 8.0 cm away from a convex mirror. The mirror's focal length is 4.0 cm.

   (a) Draw a ray diagram for the above case. Choose the scale for the two relevant directions appropriately so that the relevant features are illustrated well. Points will be awarded for clarity and accuracy.

   (b) What is the radius of curvature of the mirror?

   (c) Calculate the image distance.

   (d) What is the magnification?

   (e) Is the image real or virtual?

   (f) Is the image inverted or upright?

   (g) Determine the height of the image.

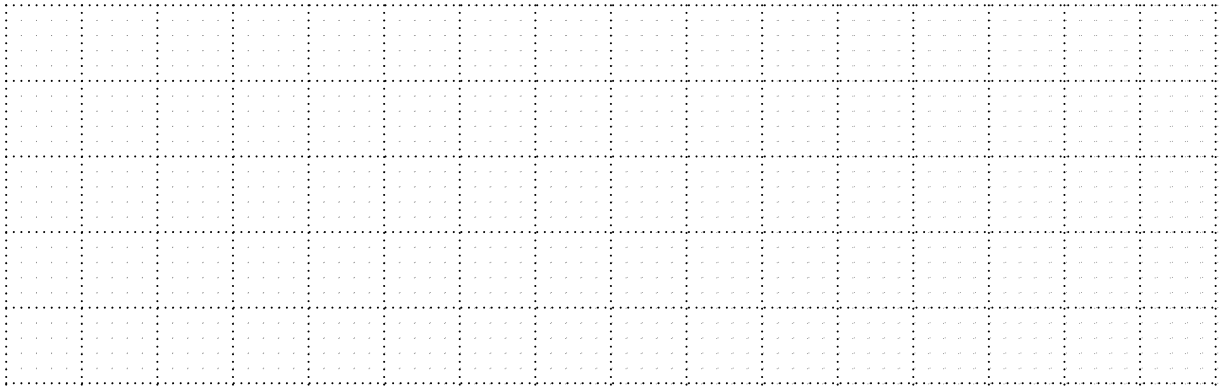

Figure 3: Problem 6

7. (**10 points.**) A 1.0 cm object is placed upright at a distance 10.0 cm away from a convex lens. The lens' focal length is 4.0 cm.

   (a) Drawing a ray diagram for the above case. Choose the scale for the two relevant directions appropriately so that the relevant features are illustrated well. Points will be awarded for clarity and accuracy.

   (b) Calculate the image distance.

   (c) What is the magnification?

   (d) Is the image real or virtual?

   (e) Is the image inverted or upright?

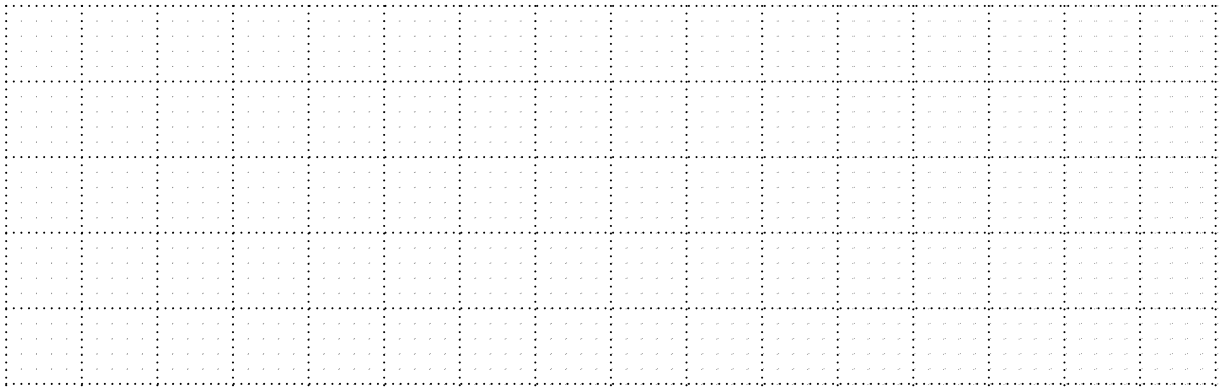

Figure 4: Problem 7

8. (**10 points.**) Light transmitted across a thin soap film in air is observed. Blue light of wavelength 480 nm has a refractive index of ($n = 1.4$) in soap film while it is ($n = 1.0$) in air. If the transmitted blue light experiences destructive interference, determine the plausible thicknesses for the soap film.