# Practice midterm 2 Fall 15

1. The image produced by a convex mirror of an object in front of the mirror is always:
   1. Virtual, erect, and larger than the object
   2. **Virtual, erect, and smaller than the object**
   3. Real, erect, and larger than the object
   4. Real, erect, and smaller than the object
   5. None of the above
2. A long straight wire is in the plane of a rectangular conducting loop. The straight wire carries an increasing current in the direction shown. The current in the rectangle is:

I

1. Zero
2. **Clockwise**
3. Counterclockwise
4. Clockwise in the left side and counterclockwise in the right side
5. Counterclockwise in the left side and clockwise in the right side
6. If a proton is released at the equator and falls toward the Earth under the influence of gravity, the magnetic force on the proton will be toward the:
   1. North
   2. South
   3. **East**
   4. West
7. A high-voltage power line 20m above the ground carries a current of 2000A. What is the magnetic field due to the current directly underneath the power line?
   1. **20μT**
   2. 35μT
   3. 14μT

B=μ0I/2πd=4π\*10-7 Tm/A\*2000A/ 2π\*20m=20μT

1. When white light disperses as it passes through the prism, which of the following colors moves at the lowest speed in the prism?
2. **Blue**
3. Green
4. Yellow
5. Red
6. A glass block with an index of refraction n=1.7 is immersed in an unknown liquid. A ray of light inside the block undergoes total internal reflection as shown in the figure. Which one of the following relations best indicates what may be concluded concerning the index of refraction of the fluid, nf ?
   1. nf <1.0 fluid
   2. nf >1.09
   3. nf > 1.30
   4. nf < 1.09
   5. **nf < 1.7**

Total internal reflection: nblock>nfluid

1. There is a current I flowing in a clockwise direction in a square loop of wire ACDE that is in the plane of the paper. If the magnetic field is toward the right, the loop will rotate:

O

A I C

M B N

E D

P

1. About the axis MN with the side AC coming out of paper and the side ED going into the paper
2. About the axis MN with the side ED coming out of paper and the side AC going into the paper
3. About the axis OP with the side AE coming out of paper and the side CD going into the paper
4. **About the axis OP with the side CD coming out of paper and the side AE going into the paper**

Part 2

* 1. Two long straight wires are perpendicular to the plane of the paper as shown in the drawing. Each wire carries a current of magnitude I=10.0A. The currents are directed out of the paper toward you. Determine the magnitude and direction of the total magnetic field at the origin of the x,y coordinate system.

y

B1

.x1=-0.12m x2=0.24m

x

B2

B=μ0I/2πd

B1= μ0I/2πd1=4π\*10-7Tm/A\*10.0A/2π\*0.12m=1.67\*10-5T, in the positive y- direction (rhr)

B2= μ0I/2πd2=4π\*10-7Tm/A\*10.0A/2π\*0.24m=0.83\*10-5T, in the negative y- direction (rhr)

Bnet=B1-B2=0.83\*10-5T, in the positive y- direction

* 1. A horizontal wire of length 6.0m carries a current of 6.0A and is oriented so that the current direction is 50o N of W. The Earth’s magnetic field is due north at this point and has a strength of 0.14\*10-4T. What is the magnitude and direction of the force on the wire?

The possible directions are:

* 1. Out of the Earth’s surface
  2. **Toward the Earth’s surface**
  3. Due east
  4. 40o S of E

I N

ϑ B

W 50o

F=I\*L\*B\*sinθ=6.0A\*6.0m\*0.14\*10-4T\*sin40o=3.24\*10-4N

1. A flat coil of wire consisting of 20 turns, each with an area of 50cm2, is positioned perpendicularly to a uniform magnetic field that increases in magnitude at a constant rate from 2.0T to 6.0T in 2.0s.

x x x x x x

x x x

x x x

x x x x x

x x x x x x x

1. If the coil has a total resistance of 0.40Ω, what is the magnitude of the induced current?
2. What is a direction of the induced current?
3. |ε|=∆Φ/∆t=N\*A\*cosθ\*∆B/∆t

|ε|=20\*50cm2\*10-4m2/cm2\*1\*4.0T/2.0s=0.2V

1. Since the flux through the loop increases, and the induced emf opposes the increase of the flux , the current will flow counterclockwise to produce magnetic field lines that point out of the plane of the page.

4. A 6.0-cm object is placed 30.0cm from a lens. The resulting image height has a magnitude of 2.0cm; the image is inverted.

a. What is the focal length of the lens?

b. Trace rays.

The image is inverted: therefore it is real, and the lens is converging.

h=6.0cm

h’= -2.0cm

p=30cm

m= h’/h=-1/3

m= -q/p= -1/3

q=p/3=10cm

f=pq/(p+q)=30cm\*10cm/40cm=7.5cm

p f f i

5. A 3.0cm tall object is placed in front of thin convex lens of 30cm focal length. If the object distance is 20cm, find

a. The image size and distance

b. Do ray tracing to show the formation of the image.

1. h=3.0cm

f=30cm

p=20cm

h’=?

m=h’/h

h’=m\*h

m=-q/p

q=f\*p/(p-f)=30cm\*20cm/(20cm-30cm)=-60cm

m=- -60cm/20cm=+3

h’=3\*3.0cm=9.0cm

q f p f