Exam 4--PHYS 102--S14

Multiple Choice

Identify the choice that best completes the statement or answers the question.

1. A current goes through a loop, which is allowed to rotate on an axis, as shown. What is the direction of the force on the circled side (labeled “b”)?
   a. out of the page
   b. into the page
   c. left
   d. right
   e. up

2. A positively charged particle enters a magnetic field as shown. What is the force acting on the particle?
   a. into the page
   b. out of the page
   c. left
   d. right
   e. up

3. Which of these statements is true?

   I. Magnets have only a north or south pole
   II. North poles of a magnet attract.
   III. Wood is ferromagnetic

   a. II & III
   b. I & II
   c. II
   d. all of these are true
   e. none of these are true

4. This figure shows the path of a charged particle. What is the direction of the magnetic field that has caused this motion?

   a. out of the page
   b. into the page
   c. up
   d. down

5. The magnetic field a distance 0.02 m from a long straight current-carrying wire is 2.0x10^-5 T. The current in the wire is:

   a. 1.0 A
   b. 4.0 A
   c. 0.16 A
   d. 2.0 A
   e. 25 A
6. Magnetic field lines inside the solenoid shown are:

   ![Diagram of solenoid with magnetic field lines]

   a. clockwise circles as one looks down the axis from the top of the page
   b. counterclockwise circles as one looks down the axis from the top of the page
   c. toward the top of the page
   d. toward the bottom of the page
   e. in no direction since \( B = 0 \)

7. A 2 C charge moves freely in a circular path perpendicular to a constant magnetic field. The charged particle, which has a mass of 0.01 kg, takes 0.0314 s to complete 1 revolution. Determine the magnitude of the magnetic field.

   a. 2.0 T
   b. 1.0 T
   c. 3.4x10^{-4} T
   d. 3.3 T

8. A high voltage power line carries about 100 A. What is the magnetic field 20 m from the line?

   a. 0.002 \( \mu \)T
   b. 1 \( \mu \)T
   c. 2000 \( \mu \)T
   d. 10 \( \mu \)T

9. A positive particle moves into the B-field of a mass spectrometer; the particle is moving at a speed of 2 m/s. The magnetic field has a magnitude of 2.0 T, and the radius of the particle’s path is 0.5 m. Following is a table with the masses and charges of some imaginary particles. Which is this particular particle?

   ![Table of particles]

   a. Delirium
   b. Notorium
   c. Rimnon
   d. Lusion

10. If the particle in the mass spectrometer is traveling as in this figure. What direction will it initially travel?

    ![Diagram of particle in mass spectrometer]

    a. up
    b. down
    c. left
    d. right
    e. out of the page
11. An electron is traveling at $1 \times 10^6$ m/s in a magnetic field that is orthogonal to the velocity and has a magnitude of 2 T. What is the magnitude of the force on the electron?

a. $2 \times 10^{-6}$ N  
b. $3.2 \times 10^{-13}$ N  
c. $2 \times 10^6$ N  
d. $3.5 \times 10^{17}$ N  

12. For an electric motor to function properly, what must happen?
   a. the current must have the proper potential  
   b. the current must change directions every half-turn of the armature  
   c. the current in the motor must be bigger than the current in the magnets  
   d. the magnetic field must point upwards  

13. Electrical charges and magnetic poles have many similarities, but one difference is:
   a. opposite magnetic poles repel.  
   b. a magnetic pole cannot be isolated.  
   c. one magnetic pole cannot create magnetic poles in other materials.  
   d. magnetic poles do not produce magnetic fields.  

14. The magnetic pole of the Earth nearest the geographic North Pole corresponds to which of the following?
   a. a magnetic south pole  
   b. a magnetic antarctic pole  
   c. a magnetic north pole  
   d. a magnetic arctic pole  

15. A positive charge approaches a wire with a current of 1 A flowing within it. The charge is deflected to the left as in this figure. What is the direction of the current?

   a. left  
   b. right  
   c. there is no current  

16. How are natural magnets created?
   a. ferromagnetic materials undergo very high pressure and temperature  
   b. iron mixes with magnetic particles to create a stronger magnet  
   c. fossilized dinosaurs are magnetic  
   d. molten metal solidifies in the presence of a magnetic field  

17. The Earth’s magnetic field plays a role in which of these atmospheric phenomena:
   a. aurora borealis  
   b. atmospheric refraction  
   c. mirages  
   d. high-energy particle showers  

18. Consider the light ray as it travels through the 2 media. Which of these statements is true?

   a. $n_1 > n_2$  
   b. $n_1 = n_2$  
   c. $n_1 < n_2$  
   d. Not enough information  

19. A light ray in air is incident on an air-to-glass boundary at an angle of 30.0° and is refracted in the glass at an angle of 21.0° with the normal. Find the index of refraction of the glass.

   a. 1.40  
   b. 1.23  
   c. 2.13  
   d. 1.74
20. A ray of light travels from a liquid to glass. The index of refraction for the liquid is 1.75; the index for glass is 1.52. What is the critical angle at the liquid-glass interface?

a. 52.2°
b. Critical angle does not exist.
c. 60.3°
d. 30.0°

21. Consider this arrangement of mirrors. What is the angle of reflection off of mirror #2?

a. 50°
b. 40°
c. 10°
d. 90°
e. 80°

22. Organize these types of radiation in order of shortest wavelength to longest wavelength:

Gamma
Radio
Ultraviolet
Visible

a. Gamma, Ultraviolet, Visible, Radio
b. Gamma, Visible, Ultraviolet, Radio
c. Ultraviolet, Visible, Radio, Gamma
d. Radio, Visible, Ultraviolet, Gamma

23. Newton explained light as a ______ because of ______; Huygens explained light as a ____ because of _____.

a. wave, interference; particle, photoelectric effect
b. particle, refraction; wave, interference
c. particle, reflection; wave, refraction
d. particle, reflection; wave, interference

24. The index of refraction is dependent on wavelength as shown in this figure. When white light passes through a prism, which color will be bent or refracted the most?

![Index of Refraction vs Wavelength](Image)

a. red
b. orange
c. green
d. blue

25. This is a figure of a fiber optics cable. A light ray coming into the acceptance zone will experience total internal reflection within the core. What must be true about the indices of refraction for the cladding ($n_{\text{clad}}$) and core ($n_{\text{core}}$)?

![Fiber Optics Cable](Image)

a. $n_{\text{clad}}>n_{\text{core}}$
b. $n_{\text{clad}}=n_{\text{core}}$
c. $n_{\text{clad}}<n_{\text{core}}$
d. it depends on the entry angle of light ray

26. The speed of light in a vacuum is $3\times10^8$ m/s. Glass has an index of refraction of $n=1.5$. What is the speed of light in glass?

a. $2\times10^8$ m/s
b. $3\times10^8$ m/s
c. $4.5\times10^8$ m/s
d. $6\times10^8$ m/s
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Answer Section

MULTIPLE CHOICE

1. ANS: B PTS: 1
2. ANS: B PTS: 1
3. ANS: E PTS: 1
4. ANS: A PTS: 1
5. ANS: D PTS: 1
6. ANS: C PTS: 1
7. ANS: B PTS: 1
8. ANS: B PTS: 1
9. ANS: A PTS: 1
10. ANS: B PTS: 1
11. ANS: B PTS: 1
12. ANS: B PTS: 1
13. ANS: B PTS: 1 DIF: 1 TOP: 19.1 Magnets
14. ANS: A PTS: 1 DIF: 1 TOP: 19.1 Magnets
15. ANS: B PTS: 1
16. ANS: D PTS: 1
17. ANS: A PTS: 1
18. ANS: C PTS: 1
19. ANS: A PTS: 1 DIF: 2 TOP: 22.3 The Law of Refraction
20. ANS: C PTS: 1 DIF: 2 TOP: 22.7 Total Internal Reflection
21. ANS: C PTS: 1
22. ANS: A PTS: 1
23. ANS: C PTS: 1
24. ANS: D PTS: 1
25. ANS: C PTS: 1
26. ANS: A PTS: 1