Exam 3

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

1. This figure shows the velocity vector of an electron as it enters a magnetic field. What is the direction of the force experienced by the electron?
   a. down  
   b. into the page  
   c. out of the page  
   d. up

2. This figure shows the direction of the current (I) in a wire and the direction of the force on the wire that results from this wire being in a magnetic field. What is the direction of the magnetic field?
   a. left  
   b. out of the page  
   c. right  
   d. down
3. This figure shows a circuit consisting of a battery (V = 10 V) and a resistive element (R = 1 Ω), which is represented by the wide line at the bottom of the circuit. The magnitude of the magnetic field is 1 T, and the resistive element is 0.5 meters long, what is the magnitude of the force felt by the wire?

   a. 10 N  
   b. 1 N  
   c. 5 N  
   d. 0.5 N

4. Which of these best explains why a permanent magnet is magnetized?
   a. it has a current through it  
   b. the stars are aligned  
   c. electrons spin randomly  
   d. the magnetic domains are aligned

5. Which pole of a magnet points towards the geographic north pole?
   a. South  
   b. North  
   c. depends on where you are on the Earth  
   d. none of these
6. A charged particle enters a mass spectrometer. The magnetic field inside the device is 0.35 T, the velocity of the particle is $1.79 \times 10^6 \text{ m/s}$, and the radius of the particle’s path is 0.16 m. From the information given here, what is this particle?

<table>
<thead>
<tr>
<th>Particle</th>
<th>Mass</th>
<th>Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen</td>
<td>$1.67 \times 10^{-27} \text{ kg}$</td>
<td>$1.6 \times 10^{-19} \text{ C}$</td>
</tr>
<tr>
<td>Deuterium</td>
<td>$3.35 \times 10^{-27} \text{ kg}$</td>
<td>$1.6 \times 10^{-19} \text{ C}$</td>
</tr>
<tr>
<td>Tritium</td>
<td>$5.01 \times 10^{-27} \text{ kg}$</td>
<td>$1.6 \times 10^{-19} \text{ C}$</td>
</tr>
<tr>
<td>Helium-3</td>
<td>$5.01 \times 10^{-27} \text{ kg}$</td>
<td>$3.2 \times 10^{-19} \text{ C}$</td>
</tr>
</tbody>
</table>

7. A positively charged particle enters a magnetic field as shown. What is the direction of the force the particle experiences?

- a. Out of the page
- b. Up
- c. Down
- d. Into the page
8. The point A is equidistance between these two, long parallel wires. What is the direction of the magnetic field at point A due to the two wires?

   a. Out of the page  
   b. To the right  
   c. To the left  
   d. Into the page  
   e. There is no magnetic field at A

9. In the figure for the previous question, assume the current I=1 Amp. What is the magnitude of the magnetic field due to the 2 wires at point A?

   a. $8 \times 10^{-6}$ T  
   b. $2 \times 10^{-6}$ T  
   c. 0 T  
   d. $4 \times 10^{-6}$ T
10. This figure shows the trajectory of a charged particle in a magnetic field. Which of these best describes the charge of this particle?

- a. neutrally charged
- b. positively charged
- c. not enough information given
- d. negatively charged

11. Which of these best supported the particle theory of light?

- a. optics
- b. refraction
- c. photoelectric effect
- d. interference

12. This figure shows a light ray traveling from a medium with index of refraction $n_1$ traveling into a medium with index of refraction $n_2$. Which of these statements is true?

- a. $n_1 > n_2$
- b. $n_1 < n_2$
- c. $n_1 = n_2$
13. In this image, a man is preparing to shoot the fish with his handgun. The actual position of the fish is shown. Should the man aim above or below the position where he sees the fish?

a. above  

b. below  

c. directly at the fish he sees  
d. none of these

14. Which of these statements describes this apparatus?

a. this is called a prism spectrometer  

b. the dispersing element in this device is a prism  

c. it separates the incoming light into separate wavelengths  
d. all of these
15. In this image, the incident angle is $\theta_1=30^\circ$. The index of refraction for air is 1, and the index of refraction for glass is 1.5. What is the refracted angle, $\theta_2$?

- a. $\theta_2=20^\circ$
- b. $\theta_2=30^\circ$
- c. $\theta_2=10^\circ$
- d. $\theta_2=5^\circ$

16. Rainbows are primarily the result of which physical phenomena:

- a. leprechauns
- b. refraction
- c. gravity
- d. reflection

17. In this diagram, the ray of light is undergoing total internal reflection. If $n_1=1.5$ and $n_2=1.0$, what is the critical angle $\theta_c$?

- a. $50^\circ$
- b. $90^\circ$
- c. $2^\circ$
- d. $40^\circ$
18. This figure shows a ray reflected from a flat mirror. If $\theta_1 = 30^\circ$, what is the angle of the reflected ray ($\theta'_1$)?

- a. $30^\circ$
- b. $15^\circ$
- c. $60^\circ$
- d. $45^\circ$

19. The speed of light in a vacuum is $3 \times 10^8$ m/s. Glass has an index of refraction of $n = 1.5$. What is the speed of light in glass?

- a. $2 \times 10^8$ m/s
- b. $3 \times 10^8$ m/s
- c. $6 \times 10^8$ m/s
- d. $4.5 \times 10^8$ m/s

20. In a vacuum, light has a wavelength of 300 nm. What is its frequency?

- a. $300$ Hz
- b. $1 \times 10^{-15}$ Hz
- c. $1 \times 10^{15}$ Hz
- d. $90$ Hz

21. Which of these statements is true? A **real image** formed by a single mirror...

- a. is upright
- b. has a positive image distance
- c. has a negative image distance
- d. can be created by a convex mirror
- e. none of these

22. If you move further away from a flat mirror, you will...

- a. see more of yourself in the mirror
- b. see the same amount of yourself in the mirror
- c. see less of yourself in the mirror
- d. disappear completely
23. In this figure, person #1 sees the image of the stone at location C. Where does person #2 see the image of the stone?

- A
- B
- C
- D
- E

24. Which of these rays is drawn incorrectly?

- All are correct
- None are correct
- 1
- 2
- 3
25. A convex mirror has a focal length of 10 cm (either positive or negative). An object is at a distance of 5 cm from the mirror. What is the magnification of the image?

a. 0.1  
b. -0.7  
c. 0.7  
d. -1

26. A concave mirror can form which of these images:

I. real  
II. virtual  
III. no image

a. I  
b. II  
c. I & II  
d. I, II, & III

27. Which of these is an example of a concave mirror?

a. the passenger side-mirror on a car  
b. the rear view mirror in a car  
c. the reflecting surface in a flashlight  
d. security mirror in a store

28. The correct answer to this question is “A.” Please bubble it and write “Version A” next to your name.

a. A  
b. B  
c. C  
d. D
# Exam 3

## Answer Section

### MULTIPLE CHOICE

1. ANS: A  
   PTS: 1
2. ANS: C  
   PTS: 1
3. ANS: C  
   PTS: 1
4. ANS: D  
   PTS: 1
5. ANS: B  
   PTS: 1
6. ANS: C  
   PTS: 1
7. ANS: B  
   PTS: 1
8. ANS: A  
   PTS: 1
9. ANS: A  
   PTS: 1
10. ANS: B  
    PTS: 1
11. ANS: C  
    PTS: 1
12. ANS: B  
    PTS: 1
13. ANS: B  
    PTS: 1
14. ANS: D  
    PTS: 1
15. ANS: A  
    PTS: 1
16. ANS: B  
    PTS: 1
17. ANS: D  
    PTS: 1
18. ANS: A  
    PTS: 1
19. ANS: A  
    PTS: 1
20. ANS: C  
    PTS: 1
21. ANS: B  
    PTS: 1
22. ANS: B  
    PTS: 1
23. ANS: C  
    PTS: 1
24. ANS: D  
    PTS: 1
25. ANS: C  
    PTS: 1
26. ANS: D  
    PTS: 1
27. ANS: C  
    PTS: 1
28. ANS: A  
    PTS: 1