Exam 2

Multiple Choice

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

___ 1. For this circuit, which of these equations is correct?

a. \(-80-30I_1-20I_2-I_3=0\)

b. \(-40I_1+80-11I_1-20I_3=0\)

c. \(I_2+I_3=I_1\)

d. \(30I_1+40I_3+11I_3-45=0\)

___ 2. What is the current in this circuit?

a. 8 A

b. 190 A

c. 0.33 A

d. 0 A
__ 3. In the circuit of your house, what happens to the voltage to each electrical device as you add more appliances?

   a. the voltage decreases  
   b. the voltage stays the same  
   c. the voltage increases  
   d. none of these

__ 4. When 2 or more resistors are connected in parallel to a battery,

   a. the voltage across each resistor is the same  
   b. all of the above  
   c. the equivalent resistance of the combination is less than or equal to the resistance of any one of the resistors  
   d. the total current flowing from the battery equals the sum of the currents flowing through each resistor

__ 5. What does GFCI do?

   a. provides a clear path to ground  
   b. checks if \( I_{\text{in}} > I_{\text{out}} \)  
   c. turns off the circuit if the current exceeds a certain amount  
   d. protects you from magnetic fields

__ 6. On a circuit breaker, you have a 2400 W heater, a 240 W light bulb, and a 60 W radio. When you add a 120 W blender, the circuit breaker turns off. Assume all the devices operate at 120 V. Which of these is the maximum allowed current for the breaker?

   a. 18 A  
   b. 23 A  
   c. 25 A  
   d. 20 A  
   e. 23.5 A
7. What is the equivalent resistance of this circuit?

![Circuit Diagram]

a. 3.3 Ω  
b. 5.0 Ω  
c. 21 Ω  
d. 13 Ω

8. Two resistors are connected in series to an ideal battery with V= 6 V. One of the resistors is twice the resistance of other resistor. What is the potential across the bigger resistor?

a. 2 V  
b. 3 V  
c. 4 V  
d. 6 V
9. In this RC circuit, the capacitor \((10 \, \mu F)\) is fully charged. The resistor has a resistance of \(20 \, M\Omega\). How long does it take to discharge the capacitor?

\[
\begin{align*}
\text{a.} & \quad 2000 \, s & \text{d.} & \quad 0.5 s \\
\text{b.} & \quad 20 \, s & \text{e.} & \quad 2 \, s \\
\text{c.} & \quad 200 \, s
\end{align*}
\]

10. 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?

\[
\begin{align*}
\text{a.} & \quad \text{into the page} & \text{d.} & \quad \text{out of the page} \\
\text{b.} & \quad \text{down} & \text{e.} & \quad \text{right} \\
\text{c.} & \quad \text{left}
\end{align*}
\]

11. Which of these best explains why a permanent magnet is magnetized?

\[
\begin{align*}
\text{a.} & \quad \text{the magnetic domains of the atoms are aligned} & \text{c.} & \quad \text{electrons produce their own magnetic field} \\
\text{b.} & \quad \text{ferromagnetic materials are always magnetic} & \text{d.} & \quad \text{it has a current through it}
\end{align*}
\]

12. Which pole of a magnet points towards the magnetic north pole?

\[
\begin{align*}
\text{a.} & \quad \text{South} & \text{c.} & \quad \text{North} \\
\text{b.} & \quad \text{depends on where you are on the Earth} & \text{d.} & \quad \text{none of these}
\end{align*}
\]
13. A charged particle enters a mass spectrometer. The magnetic field inside the device is 0.5 T, the velocity of the particle is $2 \times 10^6 \text{ m/s}$, and the radius of the particle’s path is 6.26 cm. 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>

a. Hydrogen   c. Tritium
b. Deuterium  d. Helium-3

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

a. Into the page   c. Up
b. Down           d. Out of the page
15. The point A is equidistance between these two, long parallel wires, which each have the same current I. What is the direction of the magnetic field at point A due to the two wires?

- Out of the page
- To the right
- To the left
- Into the page
- There is no magnetic field at A

16. A wire carries a current of 1 A in a direction that makes an angle of 30° with the direction of a magnetic field of strength 2 T. What is the magnetic force on a 30.0 m length of the wire?

- 50 N
- 15 N
- 30 N
- 5.0 N

17. A current of 30 A is in a circular loop with a radius of 0.1 meters. The loop produces a magnetic field of 2 T. How many turns of wire are in the loop?

- 10
- 10,000
- 100
- 1000
18. An electron enters an electric field as shown. What must be the direction of a magnetic field, \( B \), such that the electron will go undeflected?

\[ \vec{v} \]
\[ \vec{q} \]
\[ \vec{E} \]

- a. out of the page
- b. up
- c. left
- d. into the page
- e. right

19. This figure shows 3 configurations of three wires, which are either going into or coming out of the page. Which configuration produces a net magnetic field with the largest magnitude at the point \( p \), which is equidistant from each of the three wires?

\[ a \]
\[ b \]
\[ c \]

- a. A
- b. B
- c. C
- d. All the same
20. Light travels through saltwater of depth 200 m. How much more time is required for it to travel through the water than the time required to travel through air? (Assume the index of refraction for the water is 1.5.)

a. \(1 \times 10^{-6}\) seconds  
b. \(5 \times 10^5\) seconds  
c. \(3.3 \times 10^{-7}\) seconds  
d. \(6.7 \times 10^{-6}\) seconds

21. This figure shows a ray of light in water and incident at the water-air interface. What must the incident angle be for total internal reflection to occur? (The index of refraction for water is 1.3)

a. 30°  
b. 0.06°  
c. Total internal reflection will not occur  
d. 50°

22. Which photon from the following portions of the electromagnetic spectrum has the lowest energy?

a. Visible light  
b. gamma-rays  
c. x-rays  
d. ultra-violet light
23. Which of the following is true?

- n₁ > n₂
- n₁ < n₂
- n₁ = n₂
- Not enough information

24. Light is incident on a glass plane mirror, as shown in this figure, with an incident angle of 20°. What is the reflected angle? (The index of refraction for glass is 1.5)

- 45°
- 31°
- 13°
- 20°

25. Which of these phenomena reflect the wave nature of light?

- Reflection
- Refraction
- Interference
- Photoelectric effect

- I & IV
- II
- III & IV
- I
26. 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

27. 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. $4.5 \times 10^8$ m/s  
d. $6 \times 10^8$ m/s

28. The answer to this question is “B.” Bubble “B” on your scantron.

a. A  

b. B  

c. C  
d. D
Exam 2
Answer Section

MULTIPLE CHOICE

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