Exam 3--PHYS 102--S17

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

1. Which of these is constant for appliances in your home?
   I. Voltage
   II. Current
   III. Power
   IV. Resistance
   a. II & III
   b. I only
   c. I & IV
   d. II & IV
   e. none of these are constant

2. On a circuit breaker, you have a 1200 W heater, a 240 W light bulb, and a 360 W radio. When you add a 480 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. 25 A
   c. 23 A
   d. 32 A

3. Consider a series, discharging RC circuit for which $R = 2.0 \, \text{M}\Omega$ and $C=10.0 \, \mu\text{F}$. The capacitor is fully charged by a battery with $\varepsilon=10.0 \, \text{V}$. As the capacitor discharges, what is the charge on the capacitor after 5.0 seconds?
   a. 80 \mu C
   b. 120 \mu C
   c. 20 \mu C
   d. 40 \mu C
   e. 0 \mu C

4. Which of these statements about a household circuit is true:
   I. The household circuit is a combination of series and parallel circuits.
   II. All devices in a household circuit operate at the same power.
   III. As you add more devices to a household circuit, the voltage across each device decreases.
   IV. A circuit breaker turns off if the incoming current exceeds the outgoing current.
   a. I & II
   b. II & III
   c. I, II, & III
   d. none these are correct
   e. III & IV

5. An electron moves through a region of crossed electric and magnetic fields. The electric field $E = 1000 \, \text{V/m}$ and is directed straight down. The magnetic field $B = 2.0 \, \text{T}$ and is directed to the left. For what velocity $v$ of the electron into the paper will the electric force exactly cancel the magnetic force?
   a. 2,500 m/s
   b. 10,000 m/s
   c. 500 m/s
   d. 1,000 m/s
6. Which of these plots shows the voltage vs time for a discharging capacitor?

- A
- B
- C
- D

7. An 2 C charge is traveling at 6 m/s in a magnetic field that is orthogonal to the velocity and has a magnitude of 3 T. What is the magnitude of the force on the electron?

- a. 0.25 N
- b. 1 N
- c. 36 N
- d. 4 N

8. Which of these statements about the magnetic force on a charged particle travelling through a magnetic field is true:
   I. The magnetic force is parallel to the magnetic field.
   II. The magnetic force is always opposite the electric force.
   III. The magnetic force can change the energy of a particle.

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

9. A current of 30 A is in a circular loop with a radius of 0.1 meters. The loop has 10,000 turns of wire. What is the magnetic field generated by the loop?

- a. 2 T
- b. 3000 T
- c. 12 T
- d. 24 T

10. How are natural magnets created?

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

11. The Earth’s magnetic field plays a role in which of these atmospheric phenomena:

- a. high-energy particle showers
- b. atmospheric refraction
- c. mirages
- d. aurora borealis

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

- a. the magnetic domains of the atoms are aligned
- b. ferromagnetic materials are always magnetic
- c. it has a current through it
- d. electrons produce their own magnetic field
13. A positive charge is travelling towards a wire as shown. Initially, there is no current through the wire. What direction will the charge travel when the current is turned on?

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

14. This figure shows two wires, each of which has a current I. At point P, which of the arrows shows the direction of the net magnetic field due to the two wires?

a. a
b. b
c. c
d. d
e. e

15. A negative charge enters a magnetic field as shown. In what direction will it feel a force?

a. left
b. right
c. down
d. up
e. into the page

16. A positive particle travels into the page through the N and S poles of this magnet. In order for the particle to go through undeflected, an electric field must also be present. What must be the direction of that electric field?

a. up
b. down
c. right
d. left

17. Organize these types of radiation in order of longest to shortest wavelength:
gamma-ray
microwave
visible
x-ray

a. visible, x-ray, microwave, gamma-ray
b. visible, microwave, x-ray, gamma-ray
c. gamma-ray, x-ray, microwave, visible
d. microwave, visible, x-ray, gamma-ray
18. Which of the following statements is true?

I. Newton believed light was a wave because of reflection
II. Einstein believed light was a particle because of the photoelectric effect
III. Huygens believed light was a wave because of refraction
IV. Young believed light was a particle because of the double-slit experiment.

a. II & III  
b. II & IV  
c. I, II, & III  
d. I & IV  
e. all are true

19. These two mirrors sit at an angle of 130° to one another. A ray of light is incident at 40° on the first mirror. What is the angle of reflection (θ_r), with respect to a perpendicular line to the second mirror, as shown? (Angles might not be drawn to scale.)

a. 60°  
b. 70°  
c. 20°  
d. 50°  
e. 40°

20. Light travels through 3 media as shown here. Rank the media from highest to lowest index of refraction.

![Diagram of light traveling through three media]

a. 1, 2, 3  
b. 2, 1, 3  
c. 3, 1, 2  
d. 3, 2, 1  
e. 1, 3, 2

21. If a material has an index of refraction of 1.5, the speed of light through it is

a. $6.0 \times 10^8$ m/s  
b. $4.5 \times 10^8$ m/s  
c. $3.0 \times 10^8$ m/s  
d. $1.5 \times 10^8$ m/s  
e. $2.0 \times 10^8$ m/s

22. Light travels from glass to air; the index of refraction for glass is 1.5. What must be the incident angle of the light in order for total internal reflection to occur?

a. total internal reflection will not occur  
b. 42°  
c. 37°  
d. 90°  
e. 45°

23. The following figure shows a fiber optic cable. In order for total internal reflection to occur, which of these statements about the indices of refraction must be true?

![Diagram of fiber optic cable]

a. $n_1 > n_2$  
b. $n_1 = n_2$  
c. $n_1 < n_2$  
d. Total internal reflection will occur for all of these scenarios.
24. A mirror produces an upright image. The object is 8 cm high and to the left of the mirror; the image is 4 cm high. The center of curvature of the mirror is 8 cm. Where is the image located?

a. 6 cm to the right of the mirror
b. 4 cm to the right of the mirror
c. 2 cm to the right of the mirror
d. 4 cm to the left of the mirror
e. there is no image

25. A security mirror has a focal length of 20 cm. If you stand 40 cm from the mirror, what is its magnification?

a. +1
b. \( \frac{1}{3} \)
c. -8
d. -2

26. Which of the following best describes the image of a concave mirror when the object's distance from the mirror is less than the focal point distance?

a. virtual, upright and magnification less than one
b. real, inverted and magnification less than one
c. virtual, upright and magnification greater than one
d. real, inverted and magnification greater than one

27. Consider this object and image. The image is upright and bigger than the object. What type of mirror has created this image?

28. Consider the rays drawn for this concave mirror. Which ray(s) is/are drawn incorrectly?

29. Which is your favorite class this semester?

a. Business calculus
b. Bootcamp PE
c. Inorganic Chemistry
d. PHYS 102!!!
Exam 3--PHYS 102--S17
Answer Section

MULTIPLE CHOICE

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