Exam

Name_____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

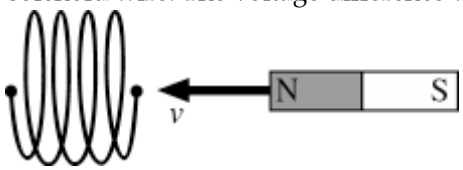
1) A jeweler needs to electroplate gold (atomic mass 196.97 u) onto a bracelet. He knows that the charge carriers in the ionic solution are gold ions, and has calculated that he must deposit 0.81 g of gold to reach the necessary thickness. How much current does he need to plate the bracelet in 3.0 hours? (Avogadro's number is 6.02×10^{23}). 1) _____

A) 7200 mA B) 130 A C) 37 mA D) 2200 mA

2) The current flowing through a circuit is changing at a rate of 3.00 A/s. If the circuit contains a 690.0 H inductor, what is the emf across the inductor? 2) _____

A) $\frac{1}{690}$ V B) 230 V C) $\frac{1}{230}$ V D) 2070 V

3) While a magnet is moved towards the end of a solenoid, a voltage difference is induced between the two ends of the solenoid wire. The voltage difference would be larger if 3) _____



A) The bar magnet produced a stronger magnetic field.
B) the solenoid contained more loops (while having the same length).
C) the speed of the magnet were increased.
D) All of the above statements are true.
E) Only two of the above statements are true.

4) A parallel–plate capacitor has a potential energy due to its charge of 7.00 mJ. It is accidentally filled with water in such a way as not to discharge its plates. How much energy does it continue to store after it is filled? (The dielectric constant for water is 78 and for air is 1.0006.) 4) _____

A) 0.04 mJ B) 546 mJ C) 7.00 mJ D) 0.090 mJ

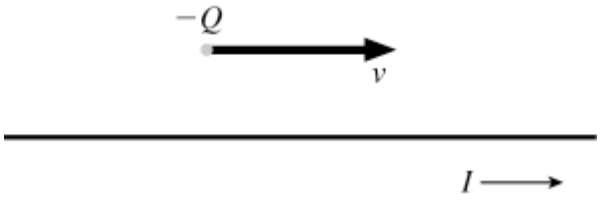
5) A 6.0 A current passes through an inductor. If the inductor stores 10 J of energy, what is the inductance? 5) _____

A) 60 H B) 180 H C) 0.56 H D) 1.8 H

6) A solenoid of length 12 cm consists of a wire wrapped tightly around a wooden core. The magnetic field strength is 4.0 T inside the solenoid. If the solenoid is stretched to 30 cm by applying a force to it, what does the magnetic field become? 6) _____

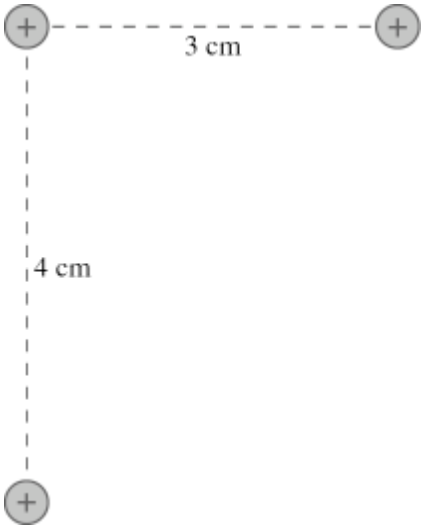
A) 1.6 T B) 4.0 T C) 20 T D) 10.0 T

7) A negatively charged particle is moving to the right, directly above a wire having a current flowing to the right, as shown below. In which direction is the magnetic force exerted on the particle? 7) _____



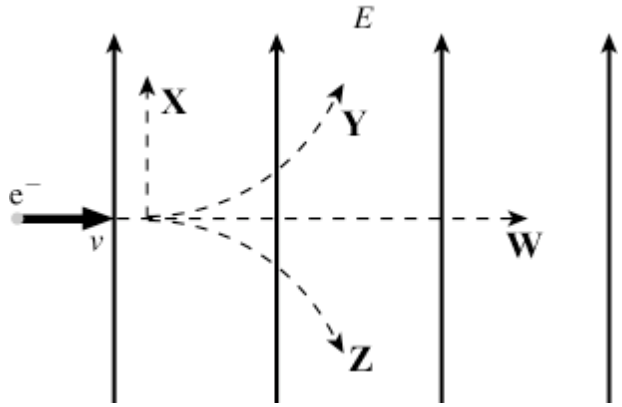
A) into the page
B) downward
C) upward
D) out of the page
E) The magnetic force is zero since the velocity is parallel to the current.

8) Consider the group of charges in this figure. All three charges have $Q = 9.6$ nC. What is their electric potential energy? 8) _____



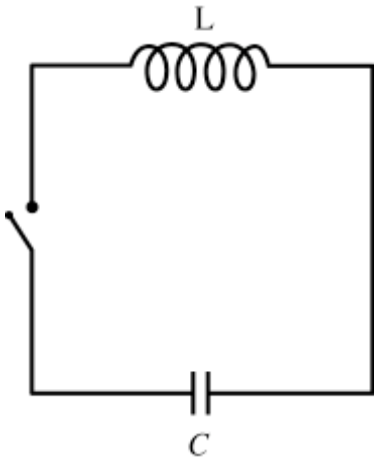
A) 7.4×10^{-5} J B) 6.5×10^{-5} J C) 6.8×10^{-5} J D) 7.0×10^{-5} J

9) An electron is initially moving to the right when it enters a uniform electric field directed upwards. Which trajectory shown below will the electron follow? 9) _____



A) Trajectory Y B) Trajectory Z C) Trajectory W D) Trajectory X

10) A capacitor, initially having a charge Q on the left plate and a charge $-Q$ on the right plate, is connected to a switch and an inductor, as shown below. 10) _____



Assuming the resistance of the circuit is zero, when the switch is closed,

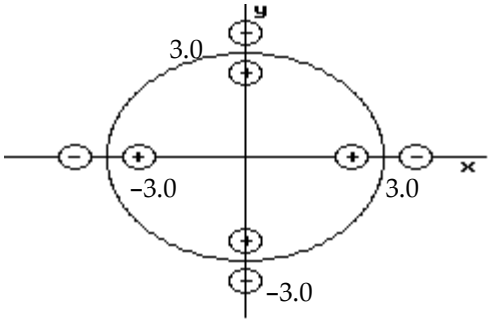
A) Current will flow through the inductor back and forth, with the magnitude of the current decreasing and eventually going to zero.

B) current will flow until the left plate of the capacitor has a charge $-Q$, and then current will flow in the opposite direction, reversing again when the left plate has a charge of $+Q$. The cycle will then repeat over and over.

C) charge will flow out of the capacitor until the left plate is no longer charged, and then all current ceases.

D) None of the above

11) Four dipoles, each consisting of two charges ±5.0 μC, are located in the *xy*–plane 3.0 mm from the origin, as shown. What is the flux through the sphere? 11) _____

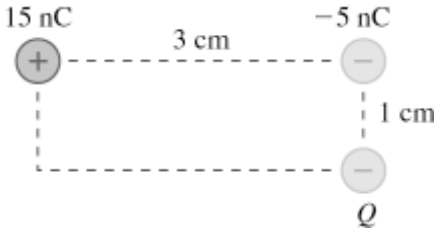


A) 4.5 x 10^6 N•m^2/C
B) 5.6 x 10^5 N•m^2/C
C) 0 N•m^2/C
D) 2.3 x 10^6 N•m^2/C

12) A charged particle of mass 0.0010 kg is subjected to a 4.0 T magnetic field which acts at a right angle to its motion. If the particle moves in a circle of radius 0.20 m at a speed of 5.0 m/s, what is the magnitude of the charge on the particle? 12) _____

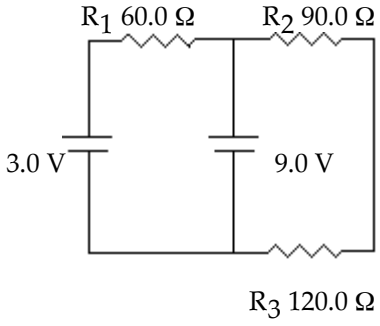
A) 0.0063 C
B) 160 C
C) 5000 C
D) 0.00020 C

13) The charge in the bottom right corner of the figure is Q =– 10 nC. What is the magnitude of the force on Q? 13) _____



A) 4.3 x 10^{-3} N
B) 5.9 x 10^{-3} N
C) 3.2 x 10^{-3} N
D) 7.9 x 10^{-3} N

14) What is the current through resistor R_1 in this circuit? 14) _____



A) 0.20 A
B) 0.022 A
C) 0.044 A
D) 0.10 A

15) A proton is located at $x = 3.0$ nm, $y = 0.0$ nm and an electron is located at $x = 0.0$ nm, $y = 3.0$ nm. Find the attractive Coulombic force between them. (The value of k is 9.0×10^9 N•m^2/C^2.) 15) _____

A) 8.4×10^{-15} N B) 1.3×10^{-11} N C) 5.0×10^{8} N D) 5.0×10^{-18} N

16) A hollow spherical conductor of inner radius 1.0 cm has a 2.0 C point charge at its center. Find the surface charge density at the inner surface of the sphere. 16) _____

A) –2.0 C/m^2 B) 2.0 C/m^2 C) –1600 C/m^2 D) 1600 C/m^2

17) The magnitude of a magnetic field a distance 2.0 μm from a wire is 36.0×10^{-4} T. How much current is flowing through the wire. Assume the wire is the only contributor to the magnetic field. 17) _____

A) 226 mA B) 452 mA C) 36 mA D) 23 mA

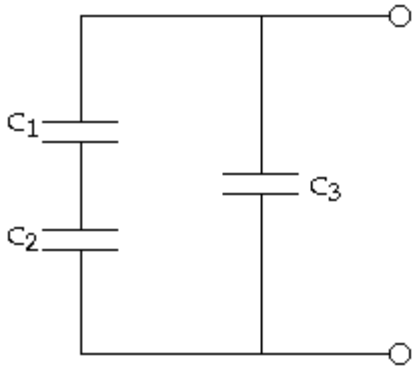
18) A conductor is formed into a loop that encloses an area of 1.0 m^2. The loop is oriented such that the normal vector makes an angle of at 60.0° angle with the z–axis. A varying magnetic field is oriented parallel to the z–axis. If the emf induced in the loop is 40.0 V, what is the rate at which the magnetic field strength is changing? 18) _____

A) 46 T/s B) 20 T/s C) 35 T/s D) 80 T/s

19) A circular parallel–plate capacitor is formed of two closely spaced disks. The electric field strength in the space between the plates is 1.0×10^5 N/C as a result of transferring 9.5×10^9 electrons from one disk to the other. What is the diameter of the disks? 19) _____

A) 2.3 cm B) 9.4 cm C) 7.0 cm D) 4.7 cm

20) Three capacitors of equal capacitance are arranged as shown. The voltage drop across C_1 is 90.0 V. What is the voltage drop across C_3? 20) _____



A) 270 V B) 180 V C) 360 V D) 90.0 V

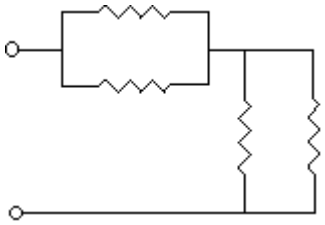
21) A space probe approaches a planet, taking measurements as it goes. If it detects a potential difference of 6000.0 MV between the altitudes of 260,000.0 km and 278,000.0 km above the planet's surface, what is the approximate electric field strength produced by the planet at 269,000.0 km above the surface? Assume the electric field strength is approximately constant at these altitudes. 21) _____

A) 0.33333 N/C B) 333.33 N/C C) 619.58 μN/C D) 33.333 N/C

22) The density of conduction electrons in aluminum is 2.1 x 10^{29} m^{-3}. What is the drift velocity in an aluminum conductor that has a 3.0 μm by 4.0 μm rectangular cross section and when a 35.0 mA current flows through the conductor? 22) _____

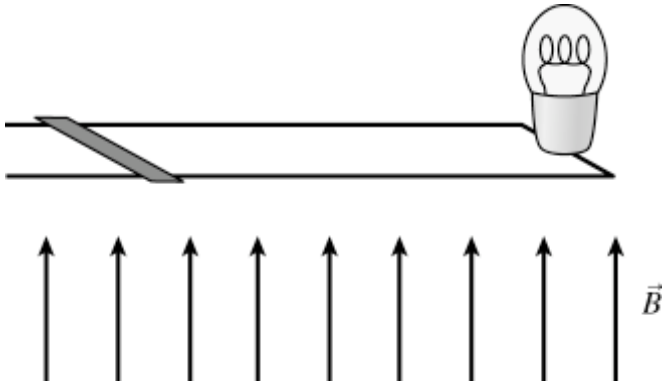
A) 0.087 m/s B) 0.054 m/s C) 0.14 m/s D) 0.22 m/s

23) The resistors in the circuit shown each have a resistance of 500 Ω. What is the equivalent resistance of the circuit? 23) _____



A) 125 Ω B) 500 Ω C) 1000 Ω D) 2000 Ω

24) A conducting bar is free to slide horizontally on the rails of a conducting frame, as shown in the figure below. A light bulb is attached to the right end of the rails. A spatially uniform magnetic field is oriented vertically (perpendicular to the horizontal plane of the rails and bar). Initially the bar is stationary. The strength of the magnetic field begins increasing in time at a constant rate, which induces a current through the bar, frame, and light bulb. The bar begins to move due to the magnetic force exerted on it. Once the bar begins to move, the brightness of the light bulb 24) _____



A) decreases. B) increases.
C) suddenly drops to zero. D) stays the same.

1) C
2) D
3) D
4) D
5) C
6) A
7) C
8) B
9) B
10) B
11) D
12) A
13) A
14) D
15) B
16) C
17) C
18) A
19) D
20) B
21) B
22) A
23) B
24) A