Practice Midterm #2

1. A point charge of 9 µC is located at the origin, and a point charge of unknown value is located on the y axis at the point y = 3 m. If the force on the unknown point charge is 0.04 N in the positive y direction, what is the value of the unknown point charge?

a) 2.11 µC
b) 4.45 µC
c) 5.01 µC
d) 6.67 µC
e) 8.01 µC

2. Four point charges are located at the corners of a square that has sides of length 20 cm. The point charges have values of 3 nC, 3 nC, 3 nC, and -3 C. What is the magnitude of the electric field at the center of the square?

a) 2700 N/C
b) 674 N/C
c) 432 N/C
d) 1200 N/C
e) 821 N/C

3. Two oppositely charged parallel plates have a potential difference of 100 V between them. If an electron is released from rest at the negative plate, what will its speed just before it collides with the positive plate? Use 9.1 x 10-31 kg for the mass of the electron.

a) 9.38 x 106 m/s
b) 3.15 x 106 m/s
c) 5.93 x 106 m/s
d) 8.39 x 106 m/s
e) 7.26 x 106 m/s

4. In the circuit on shown, C1 = 10 μF, C2 = 10 μF, and C3 = 12 μF. If the charge stored on the C3 capacitor is 34 μC, what is the voltage of the battery? Hint: The charge stored on C3 is the same as the charge stored on the equivalent capacitance.

a) 9.00 V
b) 7.20 V
c) 3.20 V
d) 5.87 V
e) 4.53 V
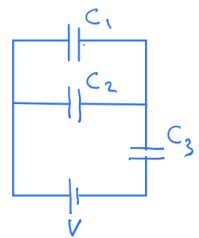
5. Twelve identical light bulbs are connected in series to a 90 V power supply. If the current in the bulbs is 450 mA, what is the resistance of each light bulb?

a) 30.0 W
b) 21.4 W
c) 16.7 W
d) 41.4 W
e) 50.0 W

6. In the circuit below, given that current I2 is 6 A, find the current I1. Hint: This problem can be solved using just one loop, if you pick the appropriate one.

a) 8.74 A
b) 7.74 A
c) 6.74 A
d) 5.74 A
e) 4.74 A

12 V
40 Ω   30 Ω
12 V I3 50 Ω   I1
10 Ω   60 Ω   I2
30 V
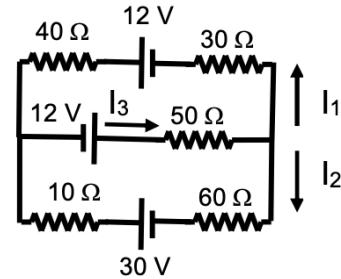
7. Given that a long wire lying along the y axis carries a current of 2.5 A in the + y direction, and a long wire lying along the x axis carries a current of 1.5 A in the + x direction, what is the magnitude of the magnetic field at the point (2 m, 3 m) in the x-y plane?

a) 2.00 x 10-7 T
b) 1.50 x 10-7 T
c) 3.50 x 10-7 T
d) 3.00 x 10-7 T
e) 2.50 x 10-7 T
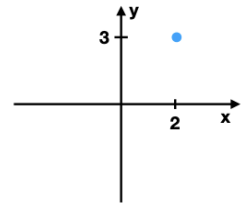
8. A metal bar is pulled by an applied force at a constant speed of 1.3 m/s to the right along two frictionless, metal rails, which are placed in the plane of the page as shown. The two rails are connected by a resistor of 12 W. There is also a uniform magnetic field of 750 mT everywhere, which is perpendicular to the page and points out of the page. The distance between the rails is 26 cm. What is the magnitude of the induced current in the metal bar?

a) 21.1 mA
b) 14.6 mA
c) 27.6 mA
d) 34.1 mA
e) 41.2 mA
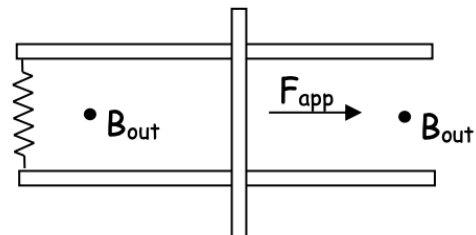
9. At a certain distance d from a light bulb that emits light at a power of 50 W, the amplitude of the B field wave has a value of 5×10^{-8} T. Assuming that the bulb emits light uniformly in all directions, what is the magnitude of the distance d?

a) 5.77 m
b) 7.30 m
c) 9.32 m
d) 3.65 m
e) 4.47 m

10. Which of the following statements is false?

a) The frequency of an X-ray with wavelength of 0.03 nm is 1.00×10^{19} Hz.
b) The wavelength of visible light with frequency of 5.45×10^{14} Hz is 550 nm.
c) Light propagates in a direction that is perpendicular to both the electric field and the magnetic field directions.
d) For a light wave, if the amplitude of the electric wave is 35 N/C, the amplitude of the magnetic wave is 1.17×10^{-7} T.
e) In a light wave, the electric and the magnetic field waves are parallel to each other.