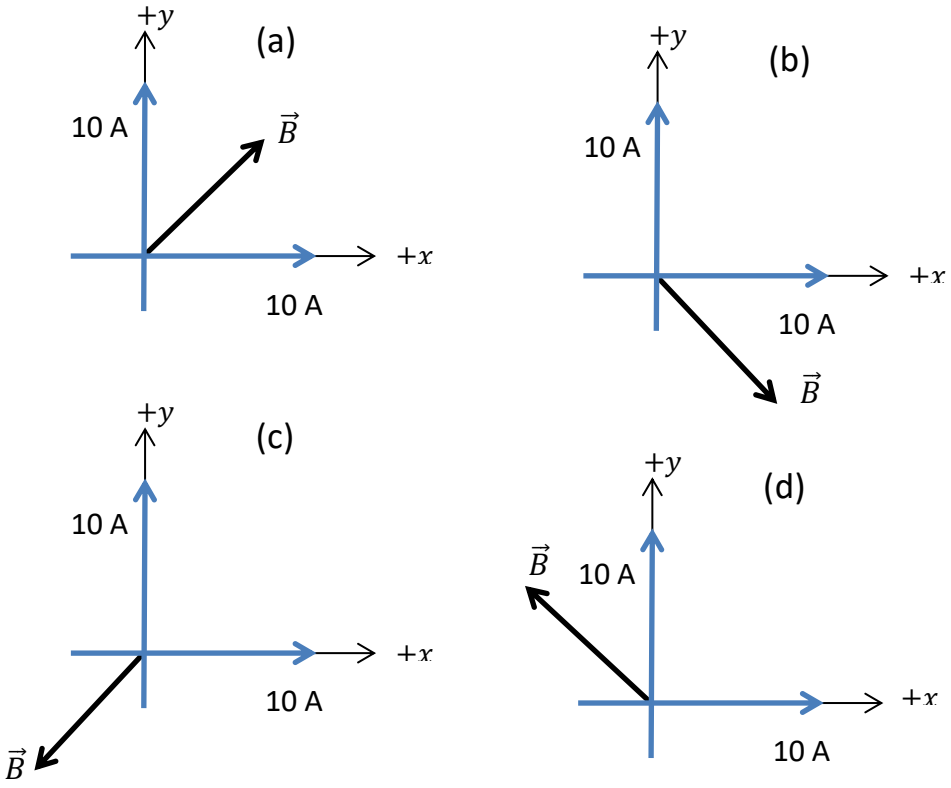
Practice Exam 22100 Spring 2019

Your name: _____PRACTICE_____

Your student ID: _____EXAM !!!_____

1. Please write your name on your exam paper. The exam paper must be returned to the instructor at the end of the exam along with the opscan sheet. Be ready to show your student ID.
2. Please use a #2 pencil to fill in data on the opscan sheet.
3. **Please make sure to enter:**
    a. **Your name**
    b. **Your student ID**
4. Mark correct answers for each problem on the opscan sheet and on the exam printout. Please check that your exam has all 8 problems.
5. Each question is of equal weight
6. You can remove the last page which contains useful formulas and physical constants. Use the numerical values of physical constants provided on this page for your calculations.

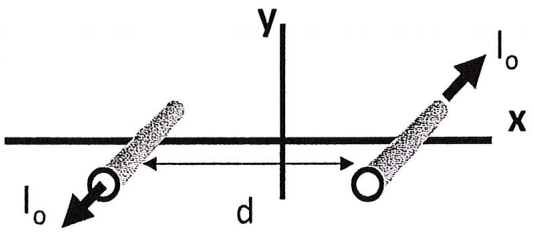
1. Two long, straight wires are placed in the x-y plane, with one carrying current $I = 10\ A$ in the +x direction and the other carrying the same current in the +y direction. What is the direction of the magnetic field at any point on the positive z-axis?



(e) None of the above

2. An angry bee flies east with a speed of 1 m/s in a magnetic field of 10^{-4} Tesla which is oriented in the northerly direction. If the bee carries a charge of 1 nC, what is the Lorenz force that acts on it?
    a. 10^{-13} N up
    b. 10^{-13} N down
    c. 10^{-5} N up
    d. 10^{-5} N down
    e. None of the above

3. Two parallel wires, each having a length of 2 m, are separated by a distance d=2 cm, as shown below. Each wire carries a DC current of I_0=5 A in opposite directions. If both the current I_0 and the distance d, are doubled, how will the force acting on each wire change?

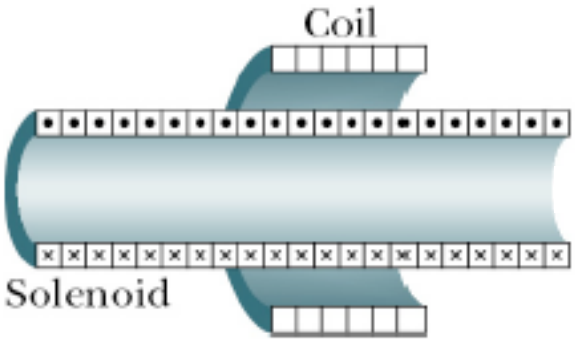


    a. It will double
    b. It will be reduced by ½
    c. It will quadruple
    d. It will remain unchanged
    e. None of the above

4. An AC voltage source with an RMS voltage of 12 V is obtained by plugging a transformer into a 120 V electrical outlet. If this voltage source is connected to a resistance of 0.5 Ω, what is the RMS current drawn from the electrical outlet?

   a. 24 A
   b. 2.4 A
   c. 288 A
   d. 2.88 A
   e. None of the above

5. A long solenoid with n=200 turns/cm and a radius of 2 cm carries a current I=1.5 A. A coil with 100 turns of wire and a radius of 3 cm surrounds the solenoid as shown:



If the current in solenoid is decreased to zero over 25 ms, what is the induced EMF in the coil?

(a) 0.95 mV
(b) 0.95 V
(c) 9.5 V
(d) 2.1 mV
(e) None of the above

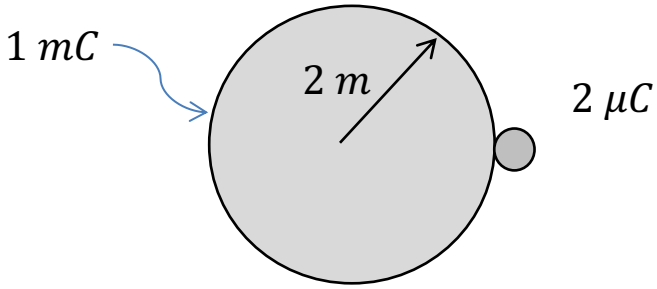
6. Two identical capacitors are charged in such a way that one has a potential difference V while the other has potential difference of $2V$. What will the potential difference be when these two capacitors are connected in *parallel*?

(a) 3.0 V (b) 1.5 V

(c) 0.667 V (d) 0.333 V

(e) None of the above

7. A point charge of $2\ \mu C$ is located at the surface of a conducting sphere of radius $2\ m$ on which a net charge of $1\ mC$ has been placed as shown below. If the point charge is released from rest, how much kinetic energy will it eventually have?

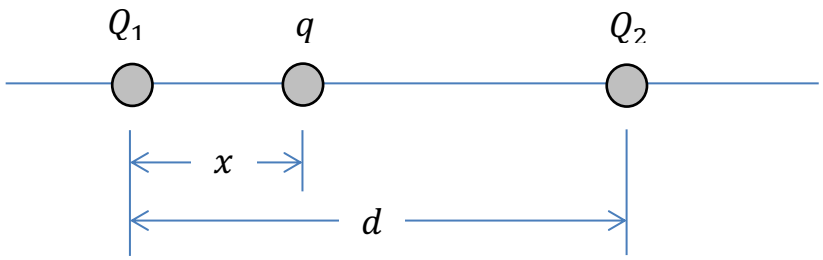


(a) 9 J (b) 4.5 J

(c) 18 J (d) 0.009 J

(e) none of the above

8. Two charges, $Q_1 = 9\ \mu C$ and $Q_2 = 4\ \mu C$ are separated by a distance, $d = 20\ cm$. A third charge $q = -1\ \mu C$ is placed on the line between Q_1 and Q_2 as shown below. At what distance x from Q_1 should the charge q be placed so that the net force on q vanishes?



(a) 8 cm

(b) 10 cm

(c) 12 cm

(d) 16 cm

(e) none of the above