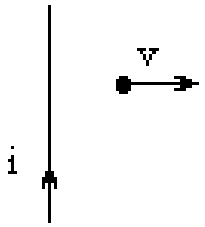
▪ Sample Exam, Physics 121 Common Exam 3, Spring 2022

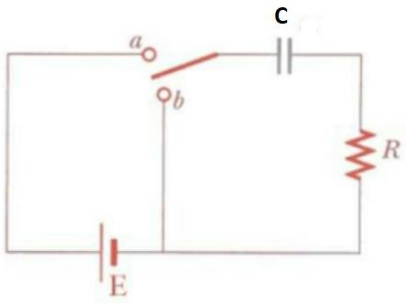
1. A particle with positive charge $q := .3 \cdot 10^{-6}$-C is a distance $d := 1.5 \cdot 10^{-2}$-m from a long straight wire that carries a current $i := 5$-A. The particle is traveling with speed v = 1000 m/s perpendicular to the wire. What are the direction and magnitude of the force on the particle if it is moving away from the wire? (in N)

A) $1.0 \cdot 10^{-8}$ up
B) $1.0 \cdot 10^{-8}$ down
C) $2.0 \cdot 10^{-8}$ up
D) $2.0 \cdot 10^{-8}$ down
E) $2.0 \cdot 10^{-7}$ up



2. The sketch at right shows a series RC circuit. The applied EMF E = 12 V., R = 1.0 MΩ, and C = 5.0 μF. The capacitor is initially uncharged. After the switch is closed at point "a", how long does it take for the charging current through the resistor to fall to 30% of its initial value? Select the closest answer:

A) 6.0 sec
B) 80 sec
C) 0.3 sec
D) 3.0 sec
E) 1.2 sec

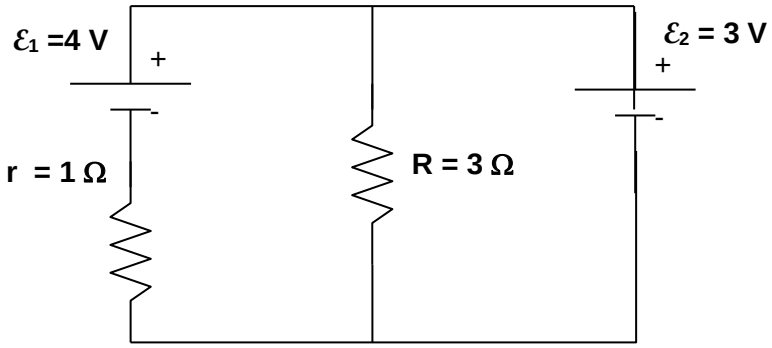


3. The capacitor in a single-loop *RC* circuit is discharged to 25% of its initial potential difference in 60 s. What is the time constant for this circuit?

A) 0.5 s
B) 60 s
C) 23.0 s
D) 0.043 s
E) 43.3 s

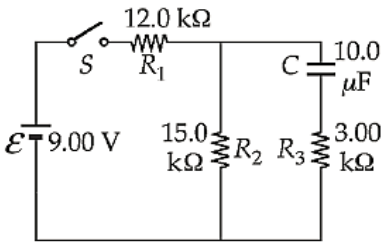
4. The figure at right shows an ideal battery with E_2 = 3 V. and a real battery E_1 = 4 V whose internal resistance r = 1 Ω. Both EMF's are connected to a 3 Ω resistor. What is the current through the 1 Ω resistor?

A) 1.33 A
B) 1.25 A
C) 1.0 A
D) 2.0 A
E) 3.0 A

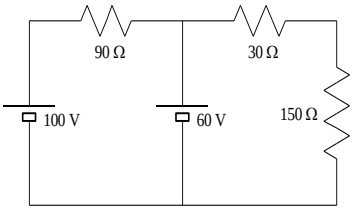


5. Suppose the switch has been closed for a time interval sufficiently long for the capacitor to become fully charged. Find the charge on the capacitor.

A) 0.045C
B) 0. 75 mC
C) 12 x10^{-6}C
D) 2 .0 C
E) 50 µC



6. Consider the circuit below:

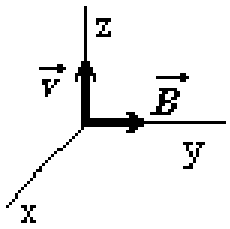


What is the current through resistor 30 Ω in the circuit at right?
A) 2.5 A
B) 0.33 A
C) 4.7 A
D) 0.63 A
E) 0.08 A

7. What is the current through 60 V battery?
A) 0.77 A
B) 0 44 A
C) 0.11 A
D) 1.24 A
E) 0.55 A

8. A proton is moving with velocity v = 5 x 10^5 m/s in the positive z direction. It is crossing a region in which a uniform magnetic field with B = 0.20 T points in the positive y direction. Find the force acting on the particle.

A) 10^{-14} N, -z direction
B) 1.6 x 10^{-14} N, +x direction
C) 1.6 x 10^{-14} N, -x direction
D) 8.0 x 10^{-13} N, -y direction
E) 8.0 x 10^{-13} N, +z direction

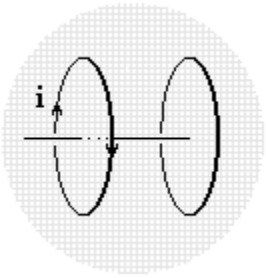


9. The uniform magnetic field over a certain region is given by $\underline{\mathbf{B}} = B_x\mathbf{i} + B_y\underline{\mathbf{j}}$ where B_x = 2 T and B_y = 2 T. An electron moves into the field with a velocity $\underline{\mathbf{v}} = v_x\underline{\mathbf{i}} + v_y\underline{\mathbf{j}} + v_z\underline{\mathbf{k}}$, where v_x = 5 m/s, v_y = 5 m/s and v_z = 5 m/s. The charge on the electron is -1.6×10^{-19} C.
What force **F** does the magnetic field exert on the electron?

A) **F** = 1.6 x 10^{-18} **i** + 1.6 x 10^{-18}**k**
B) **F** = 1.6 x 10^{-18} **i** + 1.6 x 10^{-18} **j**
C) F = 1.6 x 10^{-18} i - 1.6 x 10^{-18} j
D) **F** = 2.4 x 10^{-18} **i** +2.4 x 10^{-18}**j** +2.4 x 10^{-18}**k**
E) **F** = 2.4 x 10^{-18} **j** + 2.4 x 10^{-18} **k**

10. Two circular coils of equal radius 2 cm are placed several centimeters apart. If viewed from left, the current in the both loops is clockwise. The direction of magnetic field along the axis passing through the loops' centers and halfway

A) is to the right.
B) is to the left.
C) is oscillating.
D) zero
E) depends on the distance between coils



11. A long, straight wire lies on a horizontal table and carries a current of 1.20 mA. In a vacuum, a proton moves parallel to the wire (opposite the current) with a constant speed of 2.30x 10^4 m/s at a distance *d* above the wire. Determine the value of *d*. You may ignore the magnetic field due to the Earth.

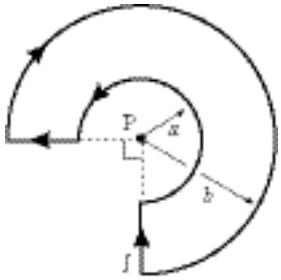
A) 3.1cm
B) 7.9cm
C) 5.4cm
D) 6.7cm
E) 1.9cm

12. A pair of parallel wires are each carrying currents of 10 A in opposite directions. The wires are separated by a perpendicular distance of 0.5 cm. The force per unit length between the wires is:

A) 0.004 N/m, repulsion
B) 0.004 N/m, attraction
C) 0.001 N/m, repulsion
D) 0.001 N/m, attraction
E) zero

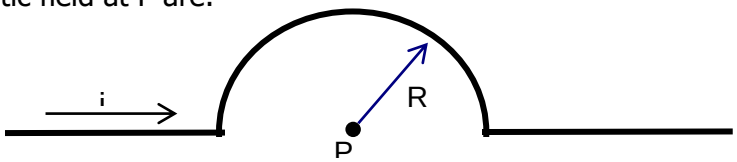
13. What is the magnitude of the magnetic field at point P if *a = 5 mm* and *b = 12 mm* and current *I = 16 A*?

A) 0.28 mT
B) 0.44 mT
C) 0.85 mT
D) 1.08 mT
E) 1.50 mT



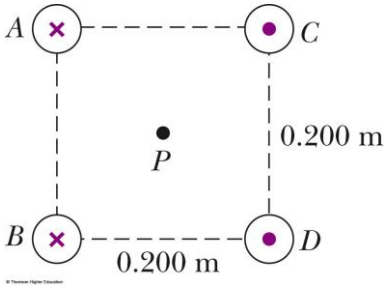
14. Point P is the center of the semicircle in the accompanying sketch, with current I flowing from left to right as shown. The magnitude and direction of the magnetic field at P are:

A) $\mu_0 i/4R$, out of paper
B) $\mu_0 i/4\pi R$, into paper
C) $\mu_0 i/4\pi R$, out of paper
D) $\mu_0 i/4R$, into paper
E) $\mu_0 i/2R$, into paper



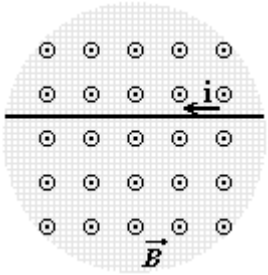
15. The sketch shows four very long parallel wires carrying equal currents of I = 1.0 A that are flowing into or out of the plane of the sketch. The wires are located at the corners of a square, each side of which is 0.200 m long. Current flows into the sketch at A and B, and flows out of the sketch at C and D. Find the magnitude and direction of the net magnetic field at point P – the center of the square.

A) 0 T
B) 4.0×10^{-6} T. down
C) 1.0×10^{-6} T. up
D) 1.0×10^{-5} T. down
E) 4.0×10^{-5} T. up

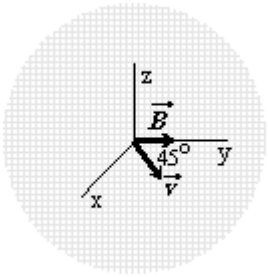


16. Magnetic field B = 1 T goes out of the plane of the page. A straight wire carries a current 1 A from right to left. Find the direction of force acting on the wire.

A) out of the page
B) into the page
C) left, in the plane of the page
D) right, in the plane of the page
E) up, in the plane of the page



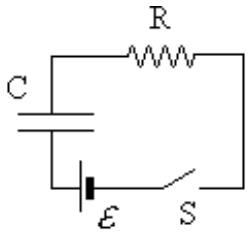
17. The magnetic field B = 0.5**j** is acting on proton moving in xy plane with velocity **v** =10^5**i** +10^5**j** (in $^{m}/_{s}$). Find the force acting on the proton.



A) 8 x 10^{-15} N, in the positive z-direction
B) 8 x 10^{-15} N, in the negative z-direction
C) 1.6 x 10^{-19} N, in the positive y-direction
D) 1.6 x 10^{-19} N, in the negative y-direction
E) zero

18. For the RC circuit shown (R = 1MΩ, C = 5 μF and E = 30 V) find the potential difference across the resistor 10 sec after the switch is closed.

A) 0.5 V
B) 1.5 V
C) 3.0 V
D) 3.5 V
E) 4.0 V



19. The figure shows, in cross section, three conductors that carry currents perpendicular to the plane of the figure. If the currents I_1, I_2, and I_3 all have the same magnitude, for which path(s) is/are the line integral of the magnetic field equal to zero?

A) path *a* only
B) paths *a* and *c*
C) paths *b* and *d*
D) paths *a*, *b*, *c*, and *d*
E) depends on whether the integral goes clockwise or counterclockwise around the path