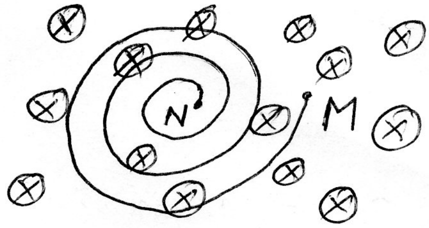
PHYSICS 161

PRACTICE TEST

(1.) The figure shows the spiral path of a particle that has entered a resistive medium where a uniform magnetic field is maintained perpendicular and into the plane of the spiral (i.e., into the plane of the page). Then, the particle is :-



a.) Positively charged and entering at M.

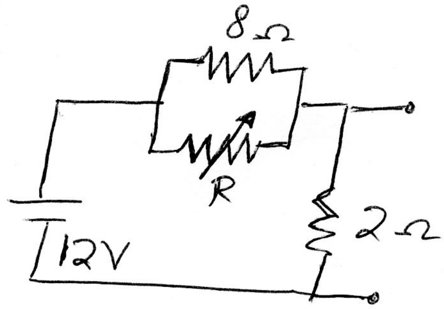
b.) Positively charged and entering at N.

c.) Negatively charged and entering at M.

d.) Negatively charged and entering at N.

e.) None of the above.

(2.) The value of the resistance R in the figure is adjusted such that power dissipated in the 2 Ω resistor is maximum. Under this condition :-



a.) R = 0.

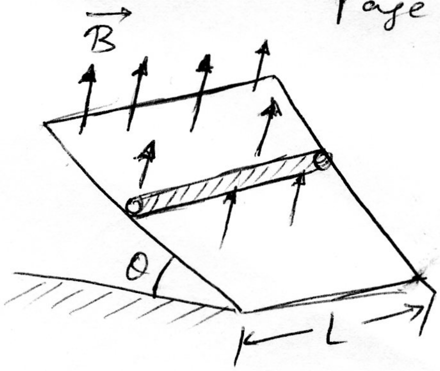
b.) R = 8 Ω.

c.) power dissipated in the 2 Ω resistor is 72 W.

d.) a.) & c.) are both true.

e.) None of the above.

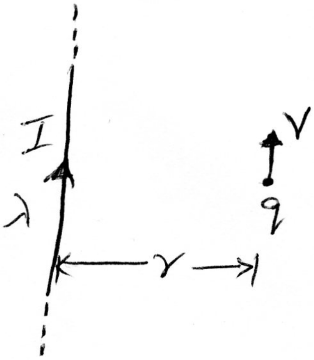
(3.) A straight piece of conducting wire is placed an incline where a uniform $\vec{B}$-field exists in the vertical direction. The wire has mass M and length L, and the plane is inclined at θ to the horizontal. The wire will be prevented from rolling down the incline (assumed frictionless) if (I is the current through the wire) :-



a.) $I = \frac{Mg\cos\theta}{BL}$ b.) $I = \frac{Mg\tan\theta}{BL}$ c.) $I = \frac{Mg\sin\theta}{BL}$

d.) None of the above.

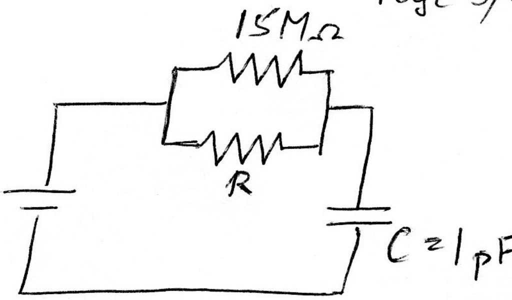
(4.) A particle with charge q is traveling with velocity V parallel to a wire with a uniform linear charge distribution λ per unit length. The wire also carries a current I as shown in the figure. The velocity with which the particle travels in a straight line parallel to the wire at a distance 'r' away is :-



a.) $\frac{\lambda}{\mu_0 \varepsilon_0 I}$ b.) $\frac{\lambda}{2\mu_0\varepsilon_0 I}$

c.) $\frac{\lambda\sqrt{\mu_0\varepsilon_0}}{I}$ d.) $\frac{2\lambda}{\mu_0\varepsilon_0 I}$

5.) Refer to the attached RC Transient Response plot. The value of R in the circuit shown is :-



a.) 5 MΩ

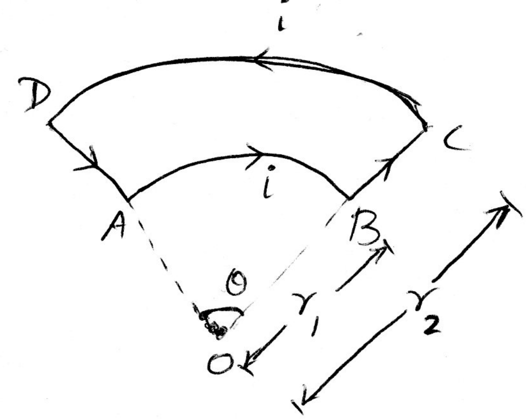
b.) 10 MΩ

c.) 15 MΩ

d.) 30 MΩ

e.) 45 MΩ

6.) ABCD is a loop of conductor where AB and CD are concentric arcs of radii $OA = OB = r_1$ and $OC = OD = r_2$. If the loop carries a current 'i', the net magnetic field at O is :-



a.) $\frac{\mu_0}{4\pi} i\theta\left(\frac{1}{r_1} - \frac{1}{r_2}\right)$

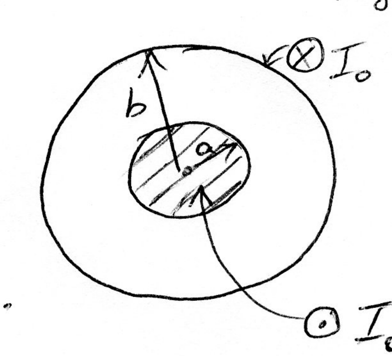
b.) $\frac{\mu_0}{4\pi} i\theta\left(\frac{1}{r_1} + \frac{1}{r_2}\right)$

c.) $\frac{\mu_0 i}{4\pi}\left(\frac{1}{r_1} + \frac{1}{r_2}\right) \sin\theta$

d.) $\frac{\mu_0 i}{4\pi}\left(\frac{1}{r_1} + \frac{1}{r_2}\right) \cos\theta$.

e.) None of the above.

7. Consider the coaxial cable shown, with an inner core of radius a and an outer conducting shell of radius b.



Current I_o flows out of the plane of the page and is uniformly distributed over the inner core. The same current I_o flows into the plane of the page, carried by the outer conducting shell.

a.) For $r < a$, $B = \dfrac{\mu_0 I_o r}{2\pi a^2}$

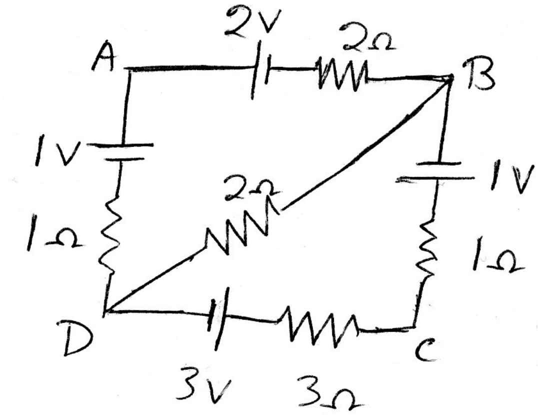
b.) For $a < r < b$, $B = \dfrac{\mu_0 I_o}{2\pi r}$.

c.) For $r > b$, $B = 0$.

d.) All of the above.

e.) None of the above.

8. In the network shown, the potential difference across the 2Ω resistor connected between B and D is :-



a.) $\left(\frac{1}{13}\right)$ V

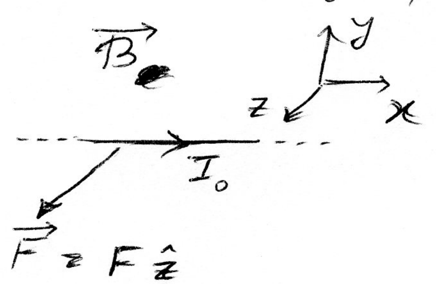
b.) $\left(\frac{2}{13}\right)$ V

c.) $\left(\frac{5}{13}\right)$ V

d.) $\left(\frac{19}{13}\right)$ V

e.) $\left(\frac{21}{13}\right)$ V.

(9.) A current I_0 is oriented along the $+\hat{x}$-direction, when it feels a force $\vec{F} = F\hat{z}$ under the influence of a uniform magnetic field $\vec{B}$. Then, $\vec{B}$ is oriented in :-



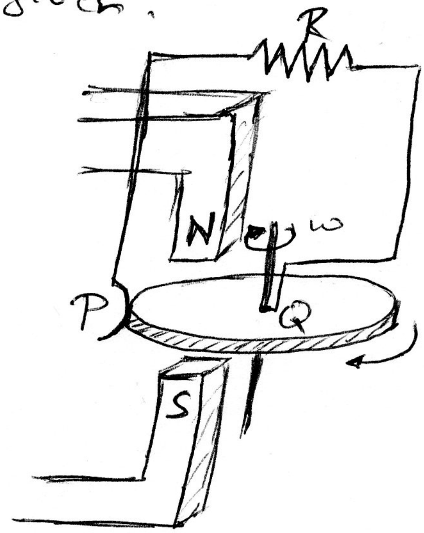
a.) The $+\hat{y}$ direction.

b.) The $+\hat{x}$ direction

c.) The $+\hat{z}$ direction.

d.) Insufficient information given.

(10.) A metal disk rotates freely, between the poles of the magnet in the direction indicated. Brushes P and Q make contact with the edge of the disk and the metal axle. What current flows through R (V_P and V_Q are the potentials at P and Q, respectively)?



a.) $\dfrac{(V_P - V_Q)}{R}$ b.) $\dfrac{(V_Q - V_P)}{R}$

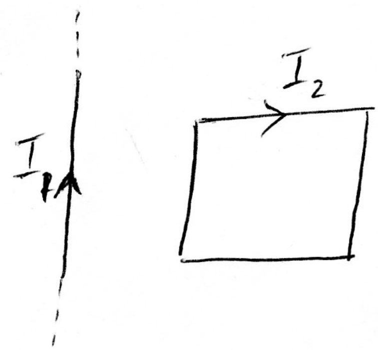
c.) No current, because of a back EMF.

d.) No current, because the EMF induced on one side of the disk is opposed by EMF induced on the opposite side.

(11.) A current I flows through a uniform wire of diameter d, when the mean electron velocity is v. The same current will flow through a wire of diameter $(d/2)$ made of the same material if the mean drift velocity of the electron is :-

a.) $\left(\frac{v}{4}\right)$ b.) $\left(\frac{v}{2}\right)$ c.) v d.) $2v$ e.) $4v$.

(12.) Consider the setup shown alongside. The straight wire is fixed, but the loop can move under a magnetic force.



The loop will :-

a.) remain stationary.

b.) move towards the wire.

c.) move away from the wire.

d.) rotate about the wire.

e.) Insufficient information given.

X —— X —— X