بسم الله الرحمن الرحيم

Lava

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& Weam Mikhani

Test Bank : Chapter 30

INDUCTION AND INDUCTANCE

1 ans: C

$\phi_B = BA\cos\theta \Longrightarrow \phi_1 = \phi_2 \Longrightarrow \cancel{B}(1)\cos 60 = \cancel{B} A_2 \cos 0$

$0.5 = A_2$

2 ans: B

$\phi_B = BA\cos\theta = 5\cos 30 = 4.3\ Wb$

3 $\boxed{\text{ans: C}}$

$\phi_B = BA\cos\theta = (2)(3)\cos 30^\circ = 5.19 \approx 5.2\ Wb$

4 ans: E

$\phi_{B_1} = BA_1\cos 30 = 5\,wb = B\cos 30 \Longrightarrow \phi_{B_2} = BA_2\cos 30 = (5)(2) = 10\,wb$

5 ans: D

$\phi_B = B.A = T.m$

6 ans: A

$\varepsilon = -\dfrac{d\phi_B}{dt}$ (Faraday's law)

7 ans: E

$\varepsilon = BLv = [T][m][m/s] = T.m^2/s$

8 $\boxed{\text{ans: C}}$

$\varepsilon = -\dfrac{d\phi_B}{dt}$ (Faraday's law)

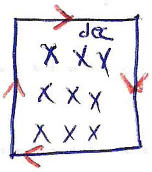
مهم *

connected

$\boxed{9}$ $\boxed{\text{ans: B}}$ حوله حدود السطح المستخدم لحساب التدفق المغناطيسي

$\boxed{10}$ ans : D حسب قانون فارادي يجب انه يكون قوة دافعة حوله الحدود

$\boxed{11}$ $\boxed{\text{ans: B}}$



لما أن المجال يتناقص ، التدفق يتناقص

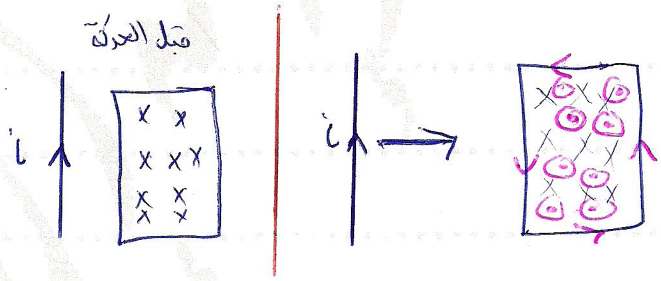
يتولد تيار حثي بحيث يعطي مجال بنفس الاتجاه $\Longrightarrow$ Clock wise

$\boxed{12}$ $\boxed{\text{ans: D}}$ لما ان المجال يزداد ، التدفق يزداد ، ينتج مجال يقاوم الأصليه . (عكسه الأصلي)

جيدة *

$\boxed{13}$ $\boxed{\text{ans: A}}$

$\boxed{14}$ $\boxed{\text{ans: C}}$



$\boxed{15}$ $\boxed{\text{ans: C}}$

an increasing current $\Rightarrow$ increasing flux $\rightarrow$ oppiste field counter clockwise

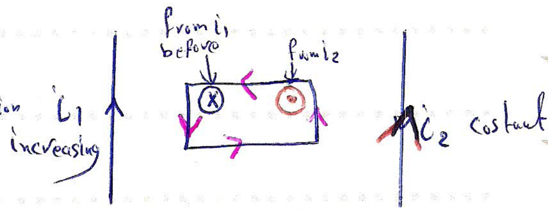
$\boxed{16}$ $\boxed{\text{ans: B}}$

current shut off $\Rightarrow$ decreasing flux $\Rightarrow$ ~~m~~ magnetic field in the same direction

$\Rightarrow$ so clock wise current ☺

$\boxed{17}$ $\boxed{\text{ans: C}}$

i_1 increasing, flux increasing, $\vec{B}$ produced in opp direction



$i \Longrightarrow$ Counter clock wise

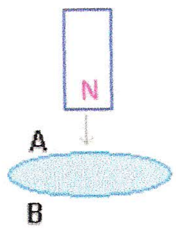
18) Ans :C

Counter clock wise

$\vec{B}$ increases $\Rightarrow$ flux will increase $\Rightarrow$ will produce B in opp direction

$(\odot)$ $\Rightarrow$ i is counter clock wise

19) Ans :E



When north enters the coil, the current in the coil flows so that the end A of the coil is a north pole. When the magnet moves away from end A, the direction of current reverses in the coil and end A behaves like a south pole. At the instant when the midpoint of the magnet is in the plane of the loop, induced current at point P, is essentially zero.

20) Ans:E

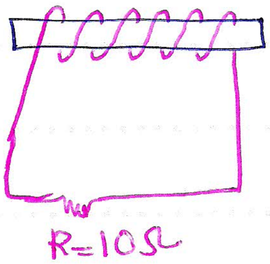
As the area of the loop projected on a plane perpendicular to the field decreases, Lenz' Law tells us that induced current will flow so that the induced field will increase the flux through the loop. However, as the area of the loop projected on a plane perpendicular to the field increases, Lenz' Law tells us that induced current will flow so that the induced field will decrease the flux through the loop. These are opposite directions, so the induced current

alternates between clockwise and counterclockwise.

21) Ans :D

22) Ans:B

$\boxed{23}$ $\boxed{\text{ans: D}}$



$N = 100$ turn , $A = 0.1\ m^2$ $B_1 = +1T$ $B_2 = 1T$

$$\varepsilon = -N\frac{d\phi_B}{dt} = -NA\frac{dB}{dt} = -100(0.1)\frac{-1-1}{dt}$$

$$\varepsilon = \frac{+20}{dt}$$ but $\varepsilon = IR = \frac{dq}{dt}R$

$$q = \frac{\varepsilon t}{R} = \frac{20}{10} = 2C$$

مهمة

$\boxed{24}$ ans: E $\boxed{25}$ ans: E

$\boxed{26}$ $\boxed{\text{ans: B}}$

لأن $\varepsilon = -\frac{d\phi_B}{dt}$ حسب فاراداي

الفترة $\boxed{2}$ أقل شيء لأنه التغير في المجال = صفر بالتالي التدفق صفر والخيار B

هو الخيار الوحيد الذي بيه أ، ب $\boxed{2}$ طبعاً عا نفس العلاقة بحكي

ترتيب الباقي

$\boxed{27}$ $\boxed{\text{Ans: B}}$

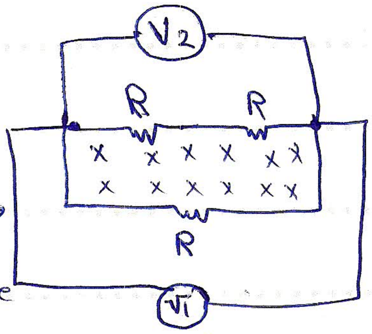
$$\varepsilon = IR = -\frac{d\phi_B}{dt}$$

$$(0.2)(10) = -A\frac{dB}{dt} \Longrightarrow \frac{2}{(12\times10^{-2})^2} = -\frac{dB}{dt}$$

$$\frac{dB}{dt} = -140\ T/s$$

مهم

$\boxed{28}$



Because of the changing magnetic flux, i.e. induced emf, the two voltmeter don't have the same reading. There is no changing magnetic flux in the region between voltmeter $\boxed{1}$ and $\boxed{R}$, niether between voltmeter 2 and RR so voltmeter $\boxed{1}$ ~~measure~~ mesure the voltage across R and Voltmeter 2 measure the voltage acrross RR $\Longrightarrow$

Continued $\boxed{28}$

Let the current through all resistors be i, using ohm's law to determine the voltage across R to be iR and that across RR to be $2iR$. Therefore V_2 Reads <u>2mV</u>.

خلاصة الموضوع يا جماعة! كل فولتميتر بقرأ المقاومات اللي فشه

عالموقف بنيهم

(29) ans: A

حتى يتولد ~~بالحلقة~~ تيار مع عقارب الساعة يجب أن يكون المجال الناشئ للداخل

بالتالي نفس الموجود إذن نحن بحاجة لتقليل التدفق بالتالي نحركه

نحو <u>+X</u>

مهمة
دائرة وبسيطة

$\boxed{30}$ ans: D   1, then 2 and 3 tie, then 4

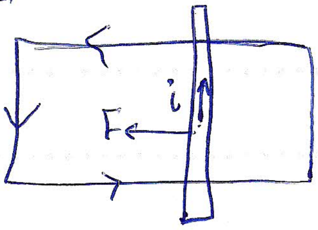
(a) $emf_1 = BLV$ $emf_3 = B(2L)V = 2BLV$

(b) $emf_2 = B2LV = 2BLV$ $emf_4 = B(3L)V = 3BLV$

مهم

$\boxed{31}$ ans: C   When the loop enters the magnetic field (the flux will increase) and this produce emf and a current will flow in it. As the loop leaves the flux (decrease) then a current will flow in the opposite direction

$\boxed{32}$ $\boxed{\text{ans: C}}$



السلك سيتأثر "دائما" بقوة تعاكس

السرعة اتجاها بالتالي حسب قاعدة

اليد اليمنى المجال نحو الداخل

$\boxed{33}$ $\varepsilon = BLV = (0.5\times10^{-4})(1.7)\left(\frac{75\times1000}{3600}\right) = 1.8\times10^{-3}\,V$

ans : B

$\boxed{34}$ $\boxed{\text{ans: D}}$

هامة

$\boxed{35}$ $\boxed{\text{ans: C}}$

ans: C

$$\mathcal{E} = -\frac{d\phi}{dt} = -\frac{d(B\,vt\,L)}{dt}$$ where L is the length of the rod

$$\mathcal{E} = -\frac{dB}{dt}vtL - BvL = 0$$

$$\Rightarrow \frac{dB}{B} = -\frac{dt}{t} \qquad \ln Bt = C \qquad \Rightarrow B = \frac{C'}{t}$$

مهم

$\boxed{36}$ $\boxed{\text{ans: D}}$

مرتبطة ببعضها

$$\varepsilon = -\frac{d\phi}{dt} = -\frac{d\,BA\cos\theta}{dt} = BA\sin\theta\,\underbrace{\frac{d\theta}{dt}}_{}^{\omega} = BA\sin\theta\,(2\pi f)$$

$= BA\sin\theta(2\pi f) \rightarrow emf_{max}$ is when $\theta = \frac{\pi}{2}$

so $emf_{max} = BA2\pi f$ and this when flux $= 0$

$\boxed{37}$ ans: A when $\theta = \frac{\pi}{2} \Rightarrow$ flux $= 0$

$\boxed{38}$ ans: C

$\boxed{39}$ ans: B

$\boxed{40}$ ans: C $\Rightarrow emf_{(max)} = NBAw$ { w = angular velocity of rotation $= 2\pi f$

f = number of revolution per sec = 60 rev/sec $\Rightarrow$ then $W = 2\pi\,60$
$= 376.8$ rad/s

N = number of turns = 10, $B = 0.5T$, A = area of cross section of the loop $= \pi R^2$

$A = (\pi(0.03)^2)\,m^2 \Rightarrow \varepsilon = (10)(0.5)(120\pi)(9\times10^{-4})\pi$

$= \boxed{5.3}$

$\boxed{41}$ $\boxed{\text{ans: D}}$

$$emf_{max} = NBA\omega \Rightarrow \omega = \frac{emf(max)}{NBA} = \frac{(1)}{(1)(1.6)(5.625)\times 10^{-3}\pi}$$

$$= 35 \text{ rad/s}$$

$\boxed{42}$ Ans: A $\qquad emf = \frac{d\phi}{dt}$ and $\theta = \frac{\pi}{2}$ So $emf = 0$

$$\phi_B = B \cdot A = BA\cos\theta$$

$\boxed{43}$ ans: D

44 $\boxed{\text{ans: D}}$

Motional emf is $\varepsilon = BLV$. We find the induced current $i = \frac{\varepsilon}{R} = \frac{BLV}{R}$ Counterclockwise from Lenz law. The ~~magnitude~~ Magnetic force on the rod is $F = iLB = \left(\frac{BLV}{R}\right)LB = \frac{L^2B^2V}{R}$ toward left using the right hand rule. Therefore a person must pulling the rod with a force to the right with the same magnitude to make the rod moving at constant velocity

؟ $\boxed{45}$ Ans: A

By A.D.kh

كلمة through تعني ان السلك بأكمله داخل المجال ⇐ التغير في التدفق

يساوي صفر بالتالي لا يوجد قوة دافعة حثية ⇐ ومن ثم لا يوجد تيار

بالتالي القوة التي نحتاجها صفر

(46) ans: D $\quad Power = i^2 R \Rightarrow i = \sqrt{\frac{power}{R}} = 20\,mA$

(47) ans: B $\quad Power = \frac{V^2}{R} \Rightarrow V = \sqrt{(power)(R)} =$

(48) ans: B $\quad$ time-dependent magnetic field

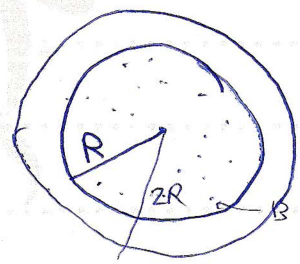
(49) ans: C

$$\oint \vec{E}\cdot d\vec{s} = -\frac{d\phi_B}{dt}$$

$$E(2\cancel{\pi}\,\cancel{\tfrac{1}{2}}\cancel{r}) = -\cancel{\pi}\,\tfrac{1}{4}\,r^2\,\frac{dB}{dt}$$

$$-\frac{4E}{r} = \frac{dB}{dt} \Rightarrow \frac{dB}{dt} = -\frac{4(4.5\times10^{-3})}{3\times10^{-2}} = \boxed{0.6\,T/s}$$

(50) ans is: E



$$\oint \vec{E}\cdot d\vec{s} = -\frac{d\phi_B}{dt}$$

$$E(2\cancel{\pi}(2R)) = -\frac{dB}{dt}(\cancel{\pi}R^2)$$

$$\Rightarrow E = \left(\frac{R}{4}\right)\frac{dB}{dt}$$

(51) $\boxed{\text{ans: B}}$

B = at

$$\oint \vec{E}\cdot d\vec{s} = -\frac{d\phi_B}{dt}$$

$$E(2\pi r) = -\frac{d}{dt}\left((\pi r^2)B\right)$$

$$E(2\cancel{\pi}\cancel{r}) = -\cancel{\pi}r^2\frac{dB}{dt} \Rightarrow E = \frac{(-)r}{2}\frac{dB}{dt} \Rightarrow E = \frac{ra}{2}$$

so $E \propto r$

52 ans: D

By: A.D.kh → Thanks

$\oint \vec{E} \cdot \vec{ds} = -\frac{d\phi_B}{dt}$

$E(2\pi r) = -\frac{dB}{dt} \, \pi R^2 \Longrightarrow E = \frac{\text{constant}}{2\pi r}$

constant

constant

53 ans: A

$L = \frac{N\phi_B}{i} \Rightarrow \varepsilon = \frac{-d\phi_B}{dt} = -\frac{d(Li)}{dt}$ constant

$Li = N\phi_B$

$\varepsilon = -L\frac{di}{dt} \Rightarrow L = -\frac{\varepsilon}{\frac{di}{dt}} \Rightarrow [L] = \frac{\text{V.second}}{\text{Ampere}}$

54 ans: D the current is increasing and leftward

55 ans: C

$L = 3.5 \times 10^{-3}\,H \quad i = 2.0 \quad N = 10$

$L = \frac{N\phi_B}{i} \Rightarrow \phi_B = \frac{Li}{N} = 7 \times 10^{-4}$ ans: C

56 ans: E $\frac{di}{dt} = \frac{-\varepsilon}{L} = 500\,A/s$ نعوض الطرفين عدد اللفات

~~56~~ $\cancel{L = \frac{N\varepsilon}{\frac{di}{dt}} \Rightarrow \frac{di}{dt} = \frac{N\varepsilon}{L}}$

~~55~~

$\cancel{L = \frac{N\phi_B}{i} \Rightarrow \phi_B = \frac{Li}{N} \Rightarrow \varepsilon = \frac{d(\frac{Li}{N})}{dt} \Rightarrow}$

$\cancel{\varepsilon = \frac{L}{N}\frac{di}{dt} \Rightarrow \frac{di}{dt} = \frac{\varepsilon N}{L} = \frac{di}{dt}}$

57 ans: B

للي حابب يعرف كيف يحفظها

$\frac{\mu_0 n^2 A}{l}$ يقول براسه $\frac{\text{منا}}{\text{ل}}$

$N\phi_B = (n'l)(BA)$ in which n' is the number of turns per unit length $n' = \frac{n}{L}$ and $B = \mu_0 i n'$

$$L = \frac{N\phi_B}{i} = \frac{n'l(\overbrace{\mu_0 i n'}^{B})A}{\cancel{i}} = \mu_0 n'^2 A$$

$$L = \frac{\mu_0 n^2 A}{l}$$

من يحتاج إلى أي توضيح يفتح الكتاب صفحة 805

أو دفتره المحاضرات

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58 ans: C

$L = \frac{\mu_0 n^2 A}{l} \Rightarrow L \propto n^2 \Rightarrow \quad 5 \longrightarrow L$

$\therefore L = (4)^2 L = 16L \qquad 20 \div 5 = 4$

59 ans: E

$i = \frac{\varepsilon}{R}\left(1 - e^{-Rt/L}\right)$

قوانين

60 ans: D $\quad \varepsilon e^{-Rt/L}$

61 ans: E $\quad \varepsilon\left(1 - e^{-Rt/L}\right)$

62 Ans: A In this case we have $i(t) = i_{final}\left(1 - e^{-Rt/L}\right)$ and

We want to know when $i(t) = 0.5\, i_{final}$

so we have: $0.5 = 1 - e^{-Rt/L} \Rightarrow 0.5 = e^{-Rt/L} \Rightarrow \ln(0.5) = -Rt/L$

$t = -(L/R)\left(\ln(0.5)\right) = -\left(8.0\times10^{-3}/2\right)\ln(0.5) = \boxed{2.8\ \text{ms}}$

مزوري تكون فاهمين

63 ans: B

After a long time ($t \gg L/R$), the current is set by the value of the resistor $I = \frac{\mathcal{E}}{R} = \frac{20}{2} = \boxed{10\ A}$

وبما انه ال inductor وال resistor موصولين عالتوالي

بالتالي التيار المار في ال inductor بعد مدة طويلة جدا هو ايضا 10A

مزوري تكون فاهمين

64 ans: B After a long time, L's current is max, and its resistance is negligible. The only ΔV thus is across R, so $\Delta V_L = 0$; $\Delta V_R = 20V$

65 ans: A $0, \mathcal{E}$

66 ans: E $\Rightarrow \tau = \frac{L}{R} \Rightarrow \frac{\cancel{2}L}{\cancel{2}R}$ unchanged

67 ans: B L/R_2

When S is closed, emf of battery acts directly on the seires of L & R_2

68 ans: C L is open circuit

$I_1 = 0 \quad I_2 = \frac{E}{R} \quad I_3 = \frac{E}{2R}$

Rank least to greatest 1, 3, 2

69 ans: D

$V_0 / (R_1 + R_2)$

70 ans: E

$L_1 = 3.5\,mH \;,\; L_2 = 4.5\,mH$

~~series~~ Series $\longrightarrow L_{eq} = L_1 + L_2 = 8\,mH$

محترم

71 ans: B ~~When they are in series, this is just a voltage divider question~~

$V = i\,[Z_1 + Z_2]$

$16 = i\,[jw\,3.5 + jw\,4.5]$

$i = \dfrac{16}{8wj} \Longrightarrow V_{4.5} = i\,Z_{4.5} = \dfrac{16}{8wj}\,4.5wj$

$= 9$ Volt

By A.D.kh (Thanks) اللي مش يفهم الدائرة يدرس تجربة ٩ بمختبر 112 فيزياء.

72 Ans: A

Parallel $\rightarrow L_{eq} = \dfrac{L_1 L_2}{L_1 + L_2} = 2$

73 ans: B

Parallel configuration $\longrightarrow$ Same $\mathcal{E}$ for both L

$\mathcal{E} = L\,\dfrac{dI}{dt} \Longrightarrow \dfrac{dI_{4.5}}{dt} = \dfrac{16\,V}{4.5 \times 10^{-3}\,H} \approx 3.6 \times 10^{3}\,A/s$

74 ans: E

Parallel $\longrightarrow V_L = V_{2L}$

$\cancel{L}\,\dfrac{di_1}{dt} = 2\cancel{L}\,\dfrac{di_2}{dt}$

$\dfrac{di_1}{dt} = 2 * 1200\,A/s = 2400\,A/s$

75 ans: E none of the above $U_B = \frac{1}{2} L i^2$

76 ans: E $U = \frac{1}{2} L i^2 \Rightarrow$ at $t \to 0$

~~the current will~~ the current will goes to zero

but at $t \to \infty$ the current will be constant

i.e. a long time ago

77 ans: D (By A.D.kh)

$U = \frac{1}{2} L i^2$ but $i = i_0 (1 - e^{\frac{-Rt}{L}})$

$U = \frac{1}{2} L i_0^2 (1 - e^{\frac{-t}{\tau}})^2$

$$P = \frac{dU}{dt} = \frac{1}{2} L (2) \left(\frac{1}{\tau}\right) (i_0^2) \left(1 - e^{\frac{-t}{\tau}}\right) \left(e^{\frac{-t}{\tau}}\right)$$

$$\frac{dP}{dt} = \frac{L}{\tau^2} i_0^2 \left(1 - 2e^{\frac{-t}{\tau}}\right) e^{\frac{-t}{\tau}} = 0$$

$$1 - 2^{\frac{-t}{\tau}} = 0 \quad \therefore \tau = \tau \ln 2 = \frac{L}{R} \ln(2)$$

(at $t_{\frac{1}{2}}$) The Max Rate of U at $t_{\frac{1}{2}}$

78 ans: C

79 Ans: B $U = \frac{1}{2} L I^2 \Rightarrow L = \frac{2U}{I^2} = \frac{2(40)}{(10)^2} = 0.8\,H$

$\Delta U = \frac{1}{2}(0.8)\left[(-5)^2 - (10)^2\right] = -30\,J$

$\boxed{80}$ $\boxed{\text{ans: B}}$ $U = \frac{1}{2} L i^2 = \frac{1}{2}\, 6\times10^{-3}\,(25)$

$= 7.5\times10^{-2}\,J$

$\boxed{81}$ ans: E

$L = 6\,mH$; $i = 5$; $\frac{di}{dt} = 800$ $\quad \frac{dU}{dt} = ??$

$\Longrightarrow V = L\frac{di}{dt} = 6\times10^{-3} * 200 = 1.2$

$power = \frac{dU}{dt} = i.V = 5 * 1.2 = 6$ watt

$\boxed{82}$ Ans: C $\quad I = \frac{E}{R}\left(1 - e^{\frac{-Rt}{L}}\right) = \frac{12}{3}\left[1 - \exp\left(\frac{-(3\Omega)(2\,ms)}{6\,mH}\right)\right]$

$= 4\left(1 - e^{-1}\right) A \approx 2.53\,A$

$U = \frac{1}{2} L I^2 \approx \frac{1}{2}\,(6\,mH)(2.53\,A)^2 = 19.2\,mJ$

$\boxed{83}$ $\boxed{\text{ans: D}}$ $\quad \frac{B^2}{\mu_0} = \frac{U}{Volume} = \frac{J}{m^3}$

$\boxed{84}$ $\boxed{\text{ans: B}}$ The energy stored in the field is $\frac{B^2\,\cancel{V}olume}{2\mu_0}$

$= \frac{(5\times10^{-3})^2\left(\pi\left((0.2\times10^{-2})^2\left(\frac{3}{100}\right)\right)\right)}{2 \times 1.26\times10^{-7}}$

$\approx 3.8\times10^{-5}$

see

85 ans: E

تم وبحمد الله