بسم الله الرحمن الرحيم

Lara

A. Dikh & Weam Mikhawi

Test Bank : Chapter 30

INDUCTION AND INDUCTANCE

① ans: C

$\phi_B = BA\cos\theta \Rightarrow \phi_1 = \phi_2 \Rightarrow B(1)\cos 60 = B A_2 \cos 0$

$0.5 = A_2$

② ans: B

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

③ ans: C

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

④ ans: E

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

⑤ ans: D

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

⑥ ans: A

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

⑦ ans: E

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

⑧ ans: C

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

STUDENTS-HUB.com Uploaded By: anonymous

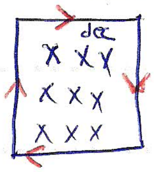
connected

مهم *

9 ans: B حوله حدود السطح المستخدم لحساب التدفق المغناطيسي

10 ans: D حسب قانون فارادي يجب انه يكون قوة دافعة حوله الحدود

11 ans: B



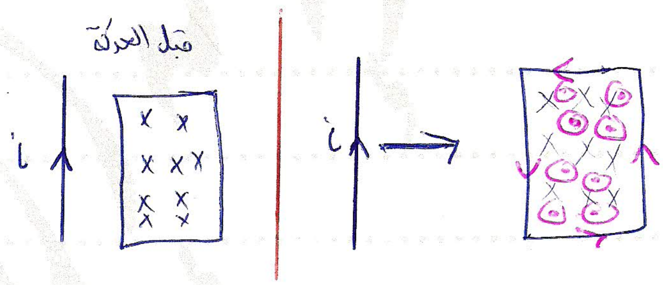
لما ان المجال يتناقص فالتدفق يتناقص
يتولد تيار حثي بحيث يعطي مجال بنفس الاتجاه ⟹ Clock wise

12 ans: D لما ان المجال يزداد فالتدفق يزداد فينتج مجال يقاوم الاصلي (عكس الاصلي)

جيدة *

13 ans: A

14 ans: C



15 ans: C

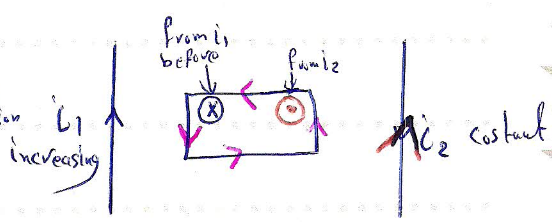
an increasing current ⟹ increasing flux ⟶ oppiste fields counter clockwise

16 ans: B

current shut off ⟹ decreasing flux ⟹ magnetic field in the same direction
⟹ so clock wise current

17 ans: C

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



i ⟹ Counter clock wise

STUDENTS-HUB.com Uploaded By: anonymous

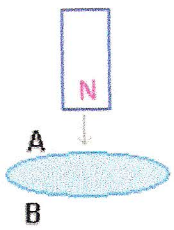
18) Ans :C

Counter clock wise

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

(⊙) ⇒ 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

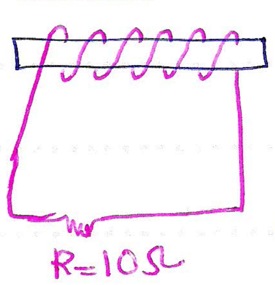
alternates between clockwise and counterclockwise.

21) Ans :D

22) Ans:B

STUDENTS-HUB.com Uploaded By: anonymous

23 **ans: D**



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

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

$$\varepsilon = \frac{+20}{dt}$$

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

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

24 **ans: E** — مهمة **25** **ans: E**

26 **ans: B**

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

الفترة [2] أقل شيء لأنه التغير في المجال = صفر بالتالي التدفق صفر والتيار B

هو التيار الوحيد الذي بين أ ب [2] طبعاً كل نفس العلاقة يمكن

ترتيب الباقي

27 **Ans: B**

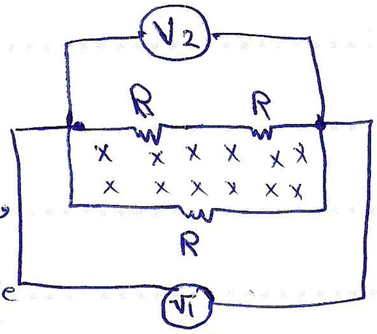
$$\varepsilon = IR = -\frac{d\phi_B}{dt}$$

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

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

مهمة

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 [1] and [R], niether between voltmeter 2 and RR So voltmeter [1] ~~measure~~ mesure the voltage across R and Volt meter 2 measure the voltage acrross RR $\Longrightarrow$

STUDENTS-HUB.com Uploaded By: anonymous

Continued [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 فش
عاله مخاطي بينهم

(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>

دائرة وبسيطة
مهمة

[30] ans: D 1, then 2 and 3 tie, then 4

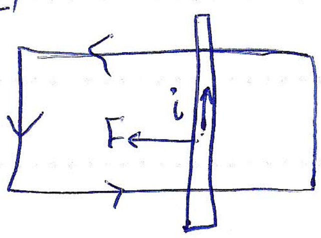
(a) $emf_1 = BLV$ $emf_3 = B(2L)V = 2BLV$

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

مهم

[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

[32] ans: C



السلك سيتأثر (أي) بقوة تعاكس
السرعة اتجاها بالتالي حسب قاعدة
اليد اليمنى المجال نحو الداخل

STUDENTS-HUB.com
Uploaded By: anonymous

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

ans: B

34 ans: D

مهم

35 ans: C

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

ans: C

$$\varepsilon = -\frac{dB}{dt}vtl - Bvl = 0$$

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

مهم

36 ans: D

مرتبطة ببعض

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

($\frac{d\theta}{dt} = \omega$)

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

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

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

38 ans: C

39 ans: B

40 ans: C $\Longrightarrow emf_{(max)} = NBA\omega$ { ω = angular velocity of rotation $= 2\pi f$ }

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

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

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

$= 5.3$

STUDENTS-HUB.com Uploaded By: anonymous

41 **ans: D**

$$emf_{max} = NBA\omega \Rightarrow \omega = \frac{emf(max)}{NBA} = \frac{(1)}{(1)(1.6)(5.625)\times10^{-3}\pi}$$

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

42 **Ans: A**

$$emf = \frac{d\phi}{dt} \text{ and } \theta = \frac{\pi}{2} \quad \text{So } emf = 0$$

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

43 **ans: D**

44 **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

45 **Ans: A**

By A.D.kh

كلمة through تعني أن 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

STUDENTS-HUB.com Uploaded By: anonymous

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

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

محيرة (48) ans: B   time-dependent magnetic field

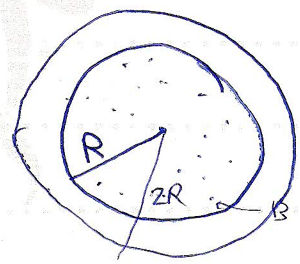
(49) ans: C

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

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

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

(50) ans is: E



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

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

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

(51) ans: B

B = at

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

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

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

so $E \propto r$

STUDENTS-HUB.com   Uploaded By: anonymous

By: A.D. kh → Thanks ☺

52 (ans: D)

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

$$E(2\pi r) = -\frac{dB}{dt}\,\pi R^3 \Longrightarrow E = \frac{\text{constant}}{2\pi r}$$

($\frac{dB}{dt}$ constant; πR^3 constant)

53 (ans: A)

$$L = \frac{N\Phi_B}{i} \Longrightarrow \mathcal{E} = \frac{-d\Phi_B}{dt} = -\frac{d(Li)}{dt}$$

(L constant)

$$Li = N\Phi_B$$

$$\mathcal{E} = -L\frac{di}{dt} \Longrightarrow L = -\frac{\mathcal{E}}{\frac{di}{dt}} \Longrightarrow [L] = \frac{\text{V.second}}{\text{Ampere}}$$

54 (ans: D) the current is increasing and leftward

55 (ans: C)

$L = 3.5\times10^{-3}$ H $\quad i = 2.0 \quad N = 10$

$$L = \frac{N\Phi_B}{i} \Longrightarrow \Phi_B = \frac{Li}{N} = 7\times10^{-4}$$ (ans: C)

56 (ans: E) $\frac{di}{dt} = \frac{-\mathcal{E}}{L} = 500\ \text{A/s}$ نعوض الطرفين عن المقابلة

~~56 $L = (N)\,\mathcal{E} / \frac{di}{dt} \Longrightarrow \frac{di}{dt} = \frac{N\mathcal{E}}{L}$~~

~~57 $L = \frac{N\Phi_B}{i} \Longrightarrow \Phi_B = \frac{Li}{N} \Longrightarrow \mathcal{E} = \frac{d(\frac{Li}{N})}{dt} \Longrightarrow$~~

~~$\mathcal{E} = \frac{L}{N}\frac{di}{dt} \Longrightarrow \frac{di}{dt} = \frac{\mathcal{E}N}{L}$~~

STUDENTS-HUB.com

Uploaded By: anonymous

(57) ans: B

للي حابب يعرف كيف يحفظها

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

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

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

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

من يحتاج إلى أي توضيح يفتح الكتاب صفحة 805 أو دفتره المحاضرات

---

(58) ans: C

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

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

(59) ans: E

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

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

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

قوانين

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

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

STUDENTS-HUB.com

Uploaded By: anonymous

مزاوين فاهمين

(63) (ans: B)

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

وبما انه ال inductor وال resistor موصولين على التوالي

بالتالي التيار الجاري في ال inductor بعد مدة طويلة تقريبا هي ايضا 10A

مزاوين 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) $\Rightarrow$ $\tau = \frac{L}{R} \Rightarrow \frac{2L}{2R}$ 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)

$V_0 / (R_1 + R_2)$

STUDENTS-HUB.com Uploaded By: anonymous

70 (ans: E) $L_1 = 3.5\,mH$, $L_2 = 4.5\,mH$

~~[illegible]~~ Series $\rightarrow L_{eq} = L_1 + L_2 = 8\,mH$

محترم

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

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

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

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

$$= 9 \text{ Volt}$$

By A.D.kh (Thanks ☺) الي مش يفهم الدائرة يدرس تجربة 9 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

$$\mathcal{E} = L\frac{dI}{dt} \Longrightarrow \frac{dI_{4.5}}{dt} = \frac{16\,V}{4.5\times10^{-3}\,H} \approx 3.6\times10^{3}\,A/s$$

74 (ans: E) Parallel $\longrightarrow V_L = V_{2L}$

$$L\frac{di_1}{dt} = 2L\frac{di_2}{dt}$$

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

STUDENTS-HUB.com Uploaded By: anonymous

75 ans: E (none of the above) $U_B = \frac{1}{2}Li^2$

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

~~[illegible]~~ the current will goes to zero

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

i.e along time ago

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

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

$U = \frac{1}{2}Li_0^2(1 - e^{\frac{-t}{\tau}})^2$

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

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

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

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

80 78 ans: C

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

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

STUDENTS-HUB.com Uploaded By: anonymous

80 ans: B

$U = \frac{1}{2} L i^2 = \frac{1}{2} 6\times10^{-3} (25)$

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

81 ans: E

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

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

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

82 Ans: C

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

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

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

83 ans: D

$\frac{B^2}{\mu_0} = \frac{U}{Volume} = \frac{J}{m^3}$

84 ans: B

The energy stored in the field is $\frac{B^2 Volume}{2\mu_0}$

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

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

for

85 ans: E

تم بحمد الله

STUDENTS-HUB.com Uploaded By: anonymous