A.P. "C" Ch 26 Induction Practice

1. c
2. b
3. b
4. a
5. b
6. d
7. c
8. c
9. c
10. b
11. a
12. e
13. d
14. e
15. e
16. d
17. d
18. a
19. d
20. a
21. b
22. c
23. a
24. a
25. c
26. c

Magnetic Induction Practice

(#1) $\phi = NBA \cos\theta$
$= (100 \text{ turns})(.35T)(.0015 m^2) \cos 55° = .0301 \text{ wb}$

C

(#2) $\phi = BA\cos\theta = (10 T)(1 m^2)\cos 37° = 7.99 \text{ wb}$

b

(#3) $\mathcal{E} = -\frac{d\phi}{dt} = -\left(\frac{1}{50\pi}\right)(100\pi)(-\sin 100\pi t)$
$\times N$

$\mathcal{E} = 100(2)\left(\frac{\sin 100\pi}{200\pi}\right) = \boxed{200 V}$

B

(#4) A - Faraday's Law

(#5) Lenz's Law - If the loop moves away from the magnet, an induced current will result which attempts to pull the magnet back towards the loop.

B

(#6) 1) increasing upward flux would produce clockwise current
2) decreasing downward would produce clockwise current
3) increasing downward would produce counter clockwise
* 4) increasing downward would produce counterclockwise
5) decreasing upward would produce counterclockwise

D

(#7) C - definition of Lenz's Law

(#8) $\mathcal{E} = B\ell v = (.080T)(.25m)(12m/s) = .24V$

C

(#9) $F = IB\ell$ $\vec{B}$ = Flux density = .002T

$F = (5A)(.002T)(.25m) = .001N$

C

(#10) $I = \frac{\mathcal{E}}{R} = \frac{B\ell v}{R} = \frac{(1.2T)(.3m)(8m/s)}{3.5\Omega} = .823A$

Since flux is increasing downward, Induced current must have upward flux increasing. So I = c.c.w.

B

#1 $\mathcal{E} = \frac{d\Phi}{dt} = BA\frac{d\cos\theta}{dt} = (.05T)(.2m^2)\left(\frac{1}{.04s}\right)$

$= .25\ V$ ✓

A

#12 Increasing the load on a motor lowers $\frac{d\cos\theta}{dt}$ so the Induced EMF decreases. If the ~~current~~ voltage supplied remains constant, the current in the motor increases.

E

#13 $E_{Max} = NBA\omega = (200\ turn)(.25T)(.0005m^2)$ ~~$\left(\frac{1}{60Hz}\right)$~~

$\omega = 2\pi f = 377$

$E_{Max} = 9.4V$ ✓

D

#14 $\mathcal{E} = \frac{d\Phi}{dt} = L\frac{dI}{dt} = 325V$ ✓

E

#15 $L = \mu_0 n^2 A l = \frac{\mu_0 N^2 A}{l}$

$N = \sqrt{\frac{Ll}{\mu_0 A}} = 5513$

E

(#16) $\tau = \frac{L}{R} = \frac{.0054\,H}{25\,\Omega} \rightarrow .000216$

[d]

(#17) τ = time needed to get within $\frac{1}{e}$ of final value.

$\frac{1}{e} = .37$ so to get within $\frac{1}{e}\frac{V_{final}}{R} = .63\frac{V}{R}$

so a little more than $\frac{V}{2R}$ - only answer above $\frac{V}{2R}$ (3ms) is 4ms

[d]

(#18) $I = \frac{V}{R}\left(1-e^{-t/\tau}\right) \quad \tau = \frac{L}{R} = \frac{.0075\,H}{30\,\Omega} = .00025$

$I = \frac{12}{30}\left(1-e^{-(.00005/.00025)}\right) = \frac{12}{30}\left(1-e^{-.2}\right)$

$= .0725\,A$

[A]

(#19) $.75 \cancel{I_f} = \cancel{I_f}\left(1-e^{-t/\tau}\right)$

$.75 = \left(1-e^{-4.5/\tau}\right)$

$.25 = e^{-4.5/\tau}$

$-1.386 = -4.5/\tau \qquad \tau = 3.247$

[D]

#20 $I = \frac{V}{R}\left(1 - e^{-t/\tau}\right)$ $\tau = \frac{L}{R} = \frac{.48H}{6\Omega} = .08s$

$I = \frac{12V}{6\Omega}\left(1 - e^{-.25/.08}\right) = 1.91\ A$

$P = IV = (1.91A)(12V) = 22.9\ W$

A

#21 from #20 $I = 1.91A$

Rate of Joule Heating $= I^2R$ (Power lost at resistor)

$= (1.91A)^2(6\Omega) = 21.9\ W$

b

#22 $U_m = \frac{1}{2}LI^2$ doubling I increases

U_m 4x

C

#23 A - definition of Inductor

#24 Magnet A dropped over earth will fall = freefall. Magnet B dropped over a metal plate will induce a current in the plate that opposes the increase of flux caused by the falling magnet. This will repel the magnet that is falling down. Therefore, A will hit first.

A

#25 $\mathcal{E}_{max} = NBA\omega = (50)(.2T)(.02m^2)(100\pi \text{ rad/s})$

$= 628 V$

C

#26 $\mathcal{E} = NBA\omega \sin(\omega t + \delta) = NBA\omega \sin\theta$

if $\theta = 0$ $\mathcal{E} = 0$ and it is a sine function so

C