DPP - Daily Practice Problems

Name : ____________ Date : ____________

Start Time : ____________ End Time : ____________

PHYSICS 44

SYLLABUS : ELECTROMAGNETIC INDUCTION-1 (Magnetic flux, Faraday's law of electromagnetic induction, Lenz's law, motional e.m.f.)

Max. Marks : 116 **Time : 60 min.**

GENERAL INSTRUCTIONS

- The Daily Practice Problem Sheet contains 29 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.
- You have to evaluate your Response Grids yourself with the help of solution booklet.
- Each correct answer will get you 4 marks and 1 mark shall be deduced for each incorrect answer. No mark will be given/ deducted if no bubble is filled. Keep a timer in front of you and stop immediately at the end of 60 min.
- The sheet follows a particular syllabus. Do not attempt the sheet before you have completed your preparation for that syllabus. Refer syllabus sheet in the starting of the book for the syllabus of all the DPP sheets.
- After completing the sheet check your answers with the solution booklet and complete the Result Grid. Finally spend time to analyse your performance and revise the areas which emerge out as weak in your evaluation.

DIRECTIONS (Q.1-Q.20) : There are 20 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which **ONLY ONE** choice is correct.

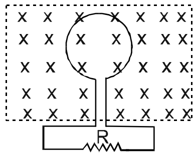
Q.1 A loop of wire is placed in a magnetic field $\vec{B} = 0.02\hat{i}$ T. Then the flux through the loop if its area vector

$\vec{A} = 30\hat{i} + 16\hat{j} + 23\hat{k}$ cm^2 is

(a) 60 μWb (b) 32 μ Wb

(c) 46 μ Wb (d) 138 μ Wb

Q.2 The magnetic flux passing perpendicular to the plane of the coil and directed into the paper is varying according to the relation $\phi = 3t^2 + 2t + 3$, where ϕ is in milliweber and t is in second. Then the magnitude of emf induced in the loop when t = 2 second is-



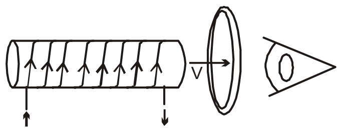
(a) 31 mV

(b) 19 mV

(c) 14 mV

(d) 6 mV

Q.3 A current carrying solenoid is approaching a conducting loop as shown in the figure. The direction of induced current as observed by an observer on the other side of the loop will be -



(a) anti-clockwise

(b) clockwise

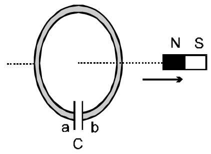
(c) east

(d) west

RESPONSE GRID	1. ⓐⓑⓒⓓ	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ

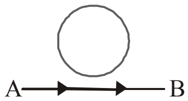
Space for Rough Work

Q.4 Consider the arrangement shown in figure in which the north pole of a magnet is moved away from a thick conducting loop containing capacitor. Then excess positive charge will arrive on



(a) plate a
(b) plate b
(c) both plates a and b
(d) neither a nor b plates

Q.5 An electron moves along the line AB, which lies in the same plane as a circular loop of conducting wires as shown in the diagram. What will be the direction of current induced if any, in the loop?



(a) No current will be induced
(b) The current will be clockwise
(c) The current will be anticlockwise
(d) The current will change direction as the electron passes by

Q.6 When a small piece of wire passes between the magnetic poles of a horse-shoe magnet in 0.1 sec, emf of 4×10^{-3} volt is induced in it. The magnetic flux between the poles is :
(a) 4×10^{-2} weber (b) 4×10^{-3} weber
(c) 4×10^{-4} weber (d) 4×10^{-6} weber

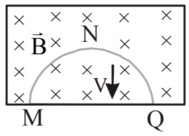
Q.7 The normal magnetic flux passing through a coil changes with time according to following equation

$$\phi = 10t^2 + 5t + 1$$

where ϕ is in milliweber and t is in second. The value of induced e.m.f. produced in the coil at t = 5s will be –
(a) zero (b) 1 V (c) 2 V (d) 0.105 V

Q.8 A bicycle wheel of radius 0.5 m has 32 spokes. It is rotating at the rate of 120 revolutions per minute, perpendicular to the horizontal component of earth's magnetic field $B_H = 4 \times 10^{-5}$ tesla. The emf induced between the rim and the centre of the wheel will be-
(a) 6.28×10^{-5} V (b) 4.8×10^{-5} V
(c) 6.0×10^{-5} V (d) 1.6×10^{-5} V

Q.9 A thin semicircular conducting ring of radius R is falling with its plane vertical in a horizontal magnetic induction B. At the position MNQ shown in the fig, the speed of the ring is V. The potential difference developed across the semicircular ring is

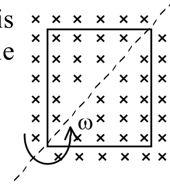


(a) Zero
(b) $B vR^2/2$ and M is at higher potential
(c) πRBV and Q is at higher potential
(d) 2RBV and Q is at higher potential

Q.10 An aeroplane having a distance of 50 metre between the edges of its wings is flying horizontally with a speed of 360km/hour. If the vertical component of earth's magnetic field is 4×10^{-4} weber/m^2, then the induced emf between the edges of its wings will be –
(a) 2 mV (b) 2 V (c) 0.2 V (d) 20 V

Q.11 At certain location in the northern hemisphere, the earth's magnetic field has a magnitude of 42 μT and points down ward at 57° to vertical. The flux through a horizontal surface of area 2.5 m^2 will be- (Given cos 33° = 0.839, cos 57° = 0.545)
(a) 42×10^{-6} Wb/m^2 (b) 42×10^{-6} Wb/m^2
(c) 57×10^{-6} Wb/m^2 (d) 57×10^{-6} Wb/m^2

Q.12 A square loop of side a is rotating about its diagonal with angular velocity ω in a perpendicular magnetic field as shown in the figure. If the number of turns in it is 10 then the magnetic flux linked with the loop at any instant will be–



(a) $10Ba^2 \cos \omega t$ (b) 10Ba
(c) $10Ba^2$ (d) $20Ba^2$

Q.13 Two identical coaxial circular loops carry current *i* each circulating in the clockwise direction. If the loops are approaching each other, then
(a) Current in each loop increases
(b) Current in each loop remains the same
(c) Current in each loop decreases
(d) Current in one-loop increases and in the other it decreases

Q.14 The distance between the ends of wings of an aeroplane is 3m. This aeroplane is descending down with a speed of 300 km/hour. If the horizontal component of earths magnetic field is 0.4 gauss then the value of e.m.f. induced in the wings of the plane will be –
(a) 1 V (b) 2 V (c) 0.01 V (d) 0.1 V

RESPONSE GRID

4. ⓐⓑⓒⓓ 5. ⓐⓑⓒⓓ 6. ⓐⓑⓒⓓ 7. ⓐⓑⓒⓓ 8. ⓐⓑⓒⓓ
9. ⓐⓑⓒⓓ 10. ⓐⓑⓒⓓ 11. ⓐⓑⓒⓓ 12. ⓐⓑⓒⓓ 13. ⓐⓑⓒⓓ
14. ⓐⓑⓒⓓ

Space for Rough Work

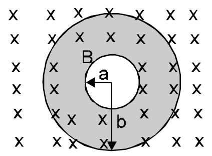
Q.15 A gramophone disc of brass of diameter 30 cm rotates horizontally at the rate of 100/3 revolutions per minute. If the vertical component of the earth's magnetic field be 0.01 weber/metre^2, then the emf induced between the centre and the rim of the disc will be-
(a) 7.065×10^{-4} V (b) 3.9×10^{-4} V
(c) 2.32×10^{-4} V (d) None of the above

Q.16 A closed coil consists of 500 turns on a rectangular frame of area 4.0 cm^2 and has a resistance of 50 ohm. The coil is kept with its plane perpendicular to a uniform magnetic field of 0.2 weber/meter^2. The amount of charge flowing through the coil if it is turned over (rotated through 180º) will be -
(a) 1.6×10^{-19} C (b) 1.6×10^{-9} C
(c) 1.6×10^{-3} C (d) 1.6×10^{-2} C

Q.17 A copper disc of radius 0.1 m rotates about its centre with 10 revolution per second in 'a uniform magnetic field of 0.1 T. The emf induced across the radius of the disc is -
(a) $\pi/10$ V (b) $2\pi/10$ V (c) 10π mV (d) 20π mV

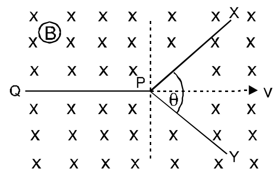
Q.18 Two rail tracks, insulated from each other and the ground, are connected to milli voltmeter. What is the reading of the milli voltmeter when a train passes at a speed of 180 km/hr along the track ? Given that – the horizontal component of earth's magnetic field B_H is 0.2×10^{-4} Wb/m^2 and rails are separated by 1 metre.
(a) 1 mV (b) 10 mV (c) 100 mV (d) 1 V

Q.19 The annular disc of copper, with inner radius a and outer radius b is rotating with a uniform angular speed ω, in a region where a uniform magnetic field B along the axis of rotation exists. Then, the emf induced between inner side and the outer rim of the disc is-



(a) Zero (b) $\frac{1}{2}B\omega a^2$
(c) $\frac{1}{2}B\omega b^2$ (d) $\frac{1}{2}B\omega (b^2 - a^2)$

Q.20 A conducting wire in the shape of Y with each side of length ℓ is moving in a uniform magnetic field B, with a uniform speed v as shown in fig. The induced emf at the two ends X and Y of the wire will be-



(a) zero
(b) $2B\ell v$
(c) $2B\ell v \sin(\theta/2)$
(d) $2B\ell v \cos(\theta/2)$

DIRECTIONS (Q.21-Q.23) : In the following questions, more than one of the answers given are correct. Select the correct answers and mark it according to the following codes:

Codes :
(a) 1, 2 and 3 are correct **(b)** 1 and 2 are correct
(c) 2 and 4 are correct **(d)** 1 and 3 are correct

Q.21 A rectangular coil of size 10 cm ×20 cm has 60 turns. It is rotating about one of its diagonals in magnetic field 0.5 Wb/m^2 with a rate of 1800 revolution per minute. The induced e.m.f. in the coil can be
(1) 111 V (2) 112 V (3) 113 V (4) 114 V

Q.22 A closed coil of copper whose area is 1m × 1m is free to rotate about an axis. The coil is placed perpendicular to a magnetic field of 0.10 Wb/m^2. It is rotated through 180º in 0.01 second. Then (The resistance of the coil is 2.0Ω)
(1) The induced e.m.f. in the coil is 20 V
(2) The induced current in the coil is 10 A
(3) The induced e.m.f. in the coil is 10 V
(4) The induced current in the coil is 20 A

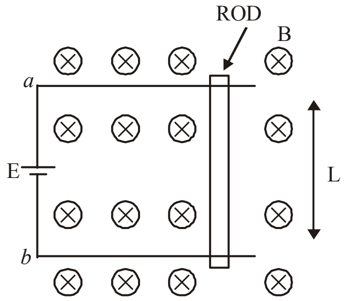
Q.23 5.5×10^{-4} magnetic flux lines are passing through a coil of resistance 10 ohm and number of turns 1000. If the number of flux lines reduces to 5×10^{-5} in 0.1 sec. Then
(1) The electromotive force induced in the coil is 5V
(2) The electromotive force induced in the coil is 5×10^{-4} V
(3) The current induced in the coil is 0.5 A
(4) The current induced in the coil is 10 A

DIRECTIONS (Q.24-Q.26) : Read the passage given below and answer the questions that follows :

In the figure shown, the rod has a resistance *R*, the horizontal rails have negligible friction. Magnetic field of intensity B is directed perpendicular into the plane of paper. A cell of e.m.f. *E* and negligible internal resistance is connected between points *a* and *b*. The rod is initially at rest.

RESPONSE GRID
15. ⓐⓑⓒⓓ 16. ⓐⓑⓒⓓ 17. ⓐⓑⓒⓓ 18. ⓐⓑⓒⓓ 19. ⓐⓑⓒⓓ
20. ⓐⓑⓒⓓ 21. ⓐⓑⓒⓓ 22. ⓐⓑⓒⓓ 23. ⓐⓑⓒⓓ

Space for Rough Work



Q.24 The velocity of the rod as a function of time t (where $\tau = mR/B\ell^2$) is

(a) $\frac{E}{B\ell}(1-e^{-t/\tau})$ (b) $\frac{E}{B\ell}(1+e^{-t/\tau})$

(c) $\frac{3}{2}\frac{E}{B\ell}(1-e^{-t/\tau})$ (d) $\frac{E}{2B\ell}(1-e^{-t/\tau})$

Q.25 After some time the rod will approach a terminal speed. The speed is

(a) $\frac{3}{2}\frac{E}{B\ell}$ (b) $\frac{E}{2B\ell}$ (c) $\frac{E}{B\ell}$ (d) $\frac{2E}{B\ell}$

Q.26 The current when the rod attains its terminal speed is

(a) $\frac{2E}{R}$ (b) $\frac{E}{R}$ (c) $\frac{3}{2}\frac{E}{R}$ (d) zero

DIRECTIONS (Q. 27-Q.29) : Each of these questions contains two statements: Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

(a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
(c) Statement -1 is False, Statement-2 is True.
(d) Statement -1 is True, Statement-2 is False.

Q.27 Statement-1 : The induced e.m.f. and current will be same in two identical loops of copper and aluminium, when rotated with same speed in the same magnetic field.
Statement-2 : Induced e.m.f. is proportional to rate of change of magnetic field while induced current depends on resistance of wire.

Q.28 Statement-1 : An aircraft flies along the meridian, the potential at the ends of its wings will be the same.
Statement-2 : Whenever there is change in the magnetic flux e.m.f. induces.

Q.29 Statement-1 : Lenz's law violates the principle of conservation of energy.
Statement-2 : Induced e.m.f. opposes the change in magnetic flux responsible for its production.

RESPONSE GRID	
	24. ⓐⓑⓒⓓ 25. ⓐⓑⓒⓓ 26. ⓐⓑⓒⓓ 27. ⓐⓑⓒⓓ 28. ⓐⓑⓒⓓ 29. ⓐⓑⓒⓓ

DAILY PRACTICE PROBLEM SHEET 44 - PHYSICS			
Total Questions	29	Total Marks	116
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	26	Qualifying Score	46
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work

DAILY PRACTICE PROBLEMS

PHYSICS SOLUTIONS

44

(1) (a) $\phi = \vec{B}.\vec{A}$

$= (0.02\hat{i}).(30\hat{i}+16\hat{j}+23\hat{k}) \times 10^{-4}$

$= 0.6 \times 10^{-4}$ Wb $= 60\mu$ Wb

(2) (c) The induced emf

$E = -d\phi/dt = -\frac{d}{dt}(3t^2+2t+3) \times 10^{-3}$

(because given flux is in mWb).

Thus $E = (-6t-2) \times 10^{-3}$

At t = 2 sec,

$E = (-6 \times 2 - 2) \times 10^{-3} = -14$ mV.

(3) (a) The direction of current in the solenoid is clockwise. On displacing it towards the loop a current in the loop will be induced in opposite sense so as to oppose its approach. Therefore the direction of induced current as observed by the observer will be anticlockwise.

(4) (b) When north pole of the magnet is moved away, then south pole is induced on the face of the loop in front of the magnet i.e. as seen from the magnet side, a clockwise induced current flows in the loop. This makes free electrons to move in opposite direction, to plate a. Thus excess positive charge appear on plate b.

(5) (d) If electron is moving from left to right, the flux linked with the loop (which is into the page) will first increase and then decrease as the eletron passes by. So the induced current in the loop will be first anticlockwise and will change direction as the electron passes by.

(6) (c) $E = -\frac{d\phi}{dt}$

or $d\phi = -Edt = (0 - \phi)$

or $\phi = 4 \times 10^{-3} \times 0.1$

$= 4 \times 10^{-4}$ weber

(7) (d) $e = \frac{d\phi}{dt} = -\frac{d}{dt}[10t^2+5t+1] \times 10^{-3}$

$= -[10 \times 10^{-3}(2t) + 5 \times 10^{-3}]$

at t = 5 second

$e = -[10 \times 10^{-2} + 5 \times 10^{-3}] = [0.1 + 0.005]$

$|e| = 0.105$V

(8) (a) For each spoke, the induced emf between the centre O and the rim will be the same

$e = \frac{1}{2}B\omega L^2 = B\pi L^2 f \,(\because \omega = 2\pi f)$

Further for all spokes, centre O will be positive while rim will be negative. Thus all emf's are in parallel giving total emf $e = B\pi L^2 f$

independent of the number of the spokes.

Substituting the values

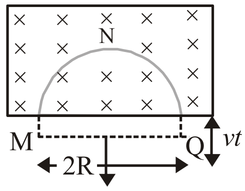
$e = 4 \times 10^{-5} \times 3.14 \times (.5)^2 \times 2 = 6.28 \times 10^{-5}$ volt

(9) (d) Rate of decrease of area of the semicircular ring

$-\frac{dA}{dt} = (2R)V$

According to Faraday's law of induction, induced emf

$e = -\frac{d\phi}{dt} = -B\frac{dA}{dt} = -B(2RV)$



The induced current in the ring must generate magnetic field in the upward direction. Thus Q is at higher potential.

(10) (b) $E = B\ell v$

$= 4 \times 10^{-4} \times 50 \times \frac{360 \times 1000}{60 \times 60} = 2$ V

(11) (c) The flux through the area is

$\phi = BA\cos 57° = 42 \times 10^{-6} \times 2.5 \times 0.545$

$= 57 \times 10^{-6}$ Wb.

(12) (a) The magnetic flux linked with the loop at any instant of time t is given by

$\phi = BAN\cos\omega t$

or $\phi = 10Ba^2\cos\omega t$

Here N = 10, $A = a^2$

(13) (b) According to Lenz's Law

(14) (c) $e = Bv\ell = 0.4 \times 10^{-4} \times \frac{300 \times 10^3}{60 \times 60} \times 3 = 10^{-2}$ V

(15) (b) Magnetic flux passing through the disc is $\phi = BA$

$= 0.01\frac{\text{weber}}{\text{meter}^2} \times 3.14 \times (15 \times 10^{-2}\text{ meter})^2$

$= 7.065 \times 10^{-4}$ weber.

The line joining the centre and the circumference of the disc cuts 7.065 x 10^{-4} weber flux in one round. So, the rate of cutting flux (i.e. induced emf)

= flux × number of revolutions per second

$= 7.065 \times 10^{-4} \times \frac{100}{60 \times 3} = 3.9 \times 10^{-4}$ volt.

(16) (c) The magnetic flux passing through each turn of a coil of area A, perpendicular to a magnetic field B is given by

$\phi_1 = BA$.

The magnetic flux through it on rotating it through 180° will be

$\phi_2 = -BA$.(- sign is put because now the flux lines enters the coils through the outer face)

$\therefore$ change in magnetic flux
$\Delta\phi = \phi_1 - \phi_2 = -BA - (BA) = -2BA$.
Suppose this change takes in time Δt. According to Faraday's law, the emf induced in the coil is given by

$$e = -N\frac{\Delta\phi}{\Delta t} = \frac{2NBA}{\Delta t},$$

where N is number of turns in the coil. The current in the coil will be

$$i = \frac{e}{R} = \frac{1}{R}\frac{2NBA}{\Delta t}$$

where R is the resistance of the circuit. The current persists only during the change of flux i.e. for the time interval Δt second. So, the charge passed through the circuit is

$$q = i \times \Delta t = \frac{2NBA}{R}.$$

Here N = 500, B = 0.2 weber/meter^2,
A = 4.0 cm^2 = 4.0×10^{-4} meter^2 and R = 50 ohm.

$$\therefore\ q = \frac{2 \times 500 \times 0.2 \times 4.0 \times 10^{-4}}{50}$$

$= 1.6 \times 10^{-3}$ coulomb.

(17) (a) T

(18) (c) The induced emf between centre and rim of the rotating disc is

$$E = \frac{1}{2}B\omega R^2 = \frac{1}{2} \times 0.1 \times 2\pi \times 10 \times (0.1)^2$$

$= 10\pi \times 10^{-3}$ volt,

(19) (a) The induced emf
$E = B\ell v = 0.2 \times 10^{-4} \times 1 \times 180 \times 1000/3600$
$= 0.2 \times 18/3600 = 1 \times 10^{-3}$. V = 1mV

(20) (d) The induced emf is obtained by considering a strip on the disc fig. Then, the linear speed of a small element dr at a distance r from the centre is = ωr. The induced emf across the ends of the small element is-
$de = B(dr)v = B\,\omega r\,dr$
Thus the induced emf across the inner and outer sides of the disc is

$$e = \int_a^b B\omega r\,dr = \frac{1}{2}B\omega(b^2 - a^2)$$

(21) (c) The induced emf $e = -(\vec{v} \times \vec{B}).\vec{\ell}$

For the part PX, $\vec{v} \perp \vec{B}$, and the angle between $(\vec{v} \times \vec{B})$ direction (the dotted line in figure and $\vec{\ell}$ is $(90 - \theta)$.
Thus
$e_P - e_x = vB\ell\cos(90 - \theta/2) = vB\ell\sin(\theta/2)$
Similarly $e_y - e_p = vB\ell\sin(\theta/2)$
Therefore induced emf
between X and Y is $e_{yx} = 2\,B\,v\,\ell\sin(\theta/2)$

(22) (a) Given, area = 10×20 cm^2 = 200×10^{-4} m^2
B = 0.5 T, N = 60, $\omega = 2\pi \times 1800/60$

$$\because\ e = -\frac{d(N\phi)}{dt}$$

$$= -N\frac{d}{dt}(BA\cos\omega t)$$

$= NBA\omega\sin\omega t$
$\therefore e_{max} = NAB\omega$
$= 60 \times 2 \times 10^{-2} \times 0.5 \times 2\pi \times 1800/60 = 113$ volt.
Hence, induced emf can be 111 V, 112 V and 113.04 V

(23) (b) The change is flux linked with the coil on rotating it through 180º is
$= nAB - (-nAB) = 2nAB$

$$\therefore \text{induced e.m.f.} = -\frac{d\phi}{dt}$$

$$= 2nAB/dt\ (\text{numerically}) = \frac{2 \times 1 \times 0.1}{0.01} = 20\text{ V}$$

The coil is closed and has a resistance of 2.0 Ω.
Therefore i = 20/2 = 10A.

(24) (d) Initial magnetic flux $\phi_1 = 5.5 \times 10^{-4}$ weber.
Final magnetic flux $\phi_2 = 5 \times 10^{-5}$ weber.
$\therefore$ change in flux
$\Delta\phi = \phi_2 - \phi_1 = (5 \times 10^{-5}) - (5.5 \times 10^{-4}) = -50 \times 10^{-5}$ weber.
Time interval for this change, $\Delta t = 0.1$ sec.
$\therefore$ induced emf in the coil

$$e = -N\frac{\Delta\phi}{\Delta t} = -1000 \times \frac{(-50 \times 10^{-5})}{0.1} = 5\text{ volt.}$$

Resistance of the coil, R = 10 ohm. Hence induced current in the coil is

$$i = \frac{e}{R} = \frac{5\text{ volt}}{10\text{ ohm}} = 0.5\text{ ampere.}$$

(25) **(a), (26) (c), (27) (b)**
(a) The current of the battery at any instant, I = E/R.
The magnetic force due to this current

$$F_B = IBL = \frac{EB\ell}{R}$$

This magnetic force will accelerate the rod from its position of rest. The motional e.m.f. developed in the rod id B/v.
The induced current,

$$I_{induced} = \frac{B\ell v}{R}$$

The magnetic force due to the induced current,

$$F_{induced} = I_{induced} = \frac{B^2\ell^2 v}{R}$$

From Fleming's left hand rule, foce F_B is to the right and $F_{induced}$ is to the left.
Net force on the rod = $F_B - F_{induced}$.

From Newton's law,

$$F_B - F_{induced} = m\frac{dv}{dt}$$

$$\frac{EB\ell}{R} - \frac{B^2\ell^2 v}{R} = m\frac{dv}{dt}$$

On separating variables and integrating speed from v_0 to v and time from 0 to t, we have

$$\frac{dv}{E - Bv\ell} = \frac{B\ell}{mR}dt$$

$$\int_0^v \frac{dv}{E - Bv\ell} = \frac{B\ell}{mR}\int_0^t dt$$

$$-\ln\left(\frac{E - Bv\ell}{E}\right) = \frac{B^2\ell^2}{mR}t$$

$$\frac{E - Bv\ell}{E} = e^{-\frac{B^2\ell^2}{mR}t}$$

$$v = \frac{E}{B\ell}(1 - e^{-t/\tau})$$

where $\quad t = \frac{mR}{(B\ell)^2}$

(b) The rod will attain a terminal velocity at $t \to \infty$, i.e., when $e^{-t/t} = 0$, the velocity is independent of time.

$$v_T = \frac{E}{B\ell}$$

(d) The induced current $I_{induced} = B\ell v/R$. When the rod has attained terminal speed.

$$I_{induced} = \frac{B\ell}{R} \times \left(\frac{E}{B\ell}\right) = E/R$$

The current of battery and the induced current are of same magnitude, hence net current through the circuit is zero.

(28) (c) Since both the loops are identical (same area and number of turns) and moving with a same speed in same magnetic field. Therefore same emf is induced in both the coils. But the induced current will be more in the copper loop as its resistance will be lesser as compared to that of the aluminium loop.

(29) (c) As the aircraft flies, magnetic flux changes through its wings due to the vertical component of the earth's magnetic field. Due to this, induced emf is produced across the wings of the aircraft. Therefore, the wings of the aircraft will not be at the same potential.

(30) (c) Lenz's Law is based on conservation of energy and induced emf opposes the cause of it *i.e.*, change in magnetic flux.