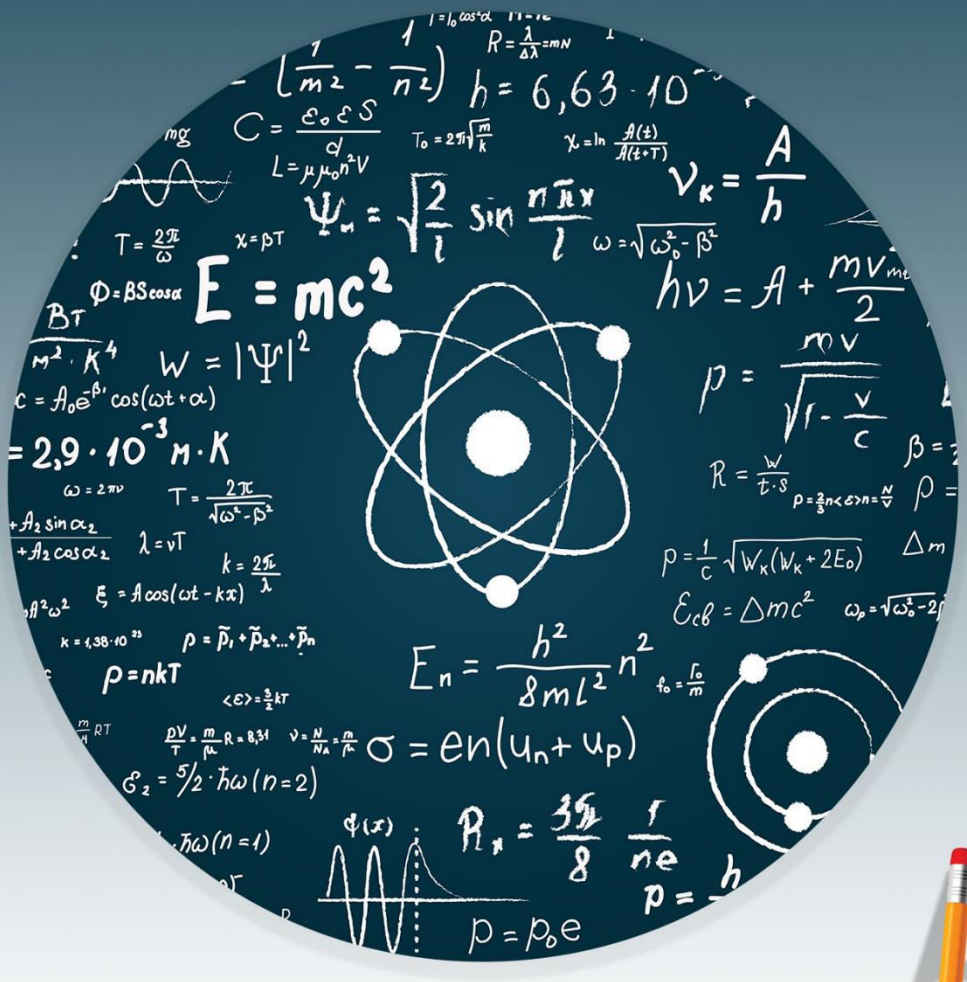
PHYSICS



WORKSHEET-6

STEP

A PROJECT BY PUNJAB GROUP

Worksheet-06

Topics:- Electromagnetic Induction, Faraday's Law, Lenz's Law, Alternating Current Generator

USE THIS SPACE FOR SCRATCH WORK

Q.1 **A metallic rod falls under gravity in such a way that it's two ends points in the direction of east and west, then:**

A) No e.m.f is induced at all

B) An e.m.f is induced in it as it cuts earth's magnetic field

C) Two e.m.f's of equal but opposite directions are generated giving no net e.m.f induced

D) Gravitational field opposes it's downward motion

Q.2 **A bar magnet of magnetic field 2 T is made to move towards a coil having a galvanometer with a speed of 4 m s^{-1} such that galvanometer shows a deflection "θ_1". Now if the same bar magnet is made to move away from same coil with same speed and galvanometer shows deflection "θ_2" then what is true?**

A) $\theta_1=\theta_2$ and both deflections are in same direction

B) $\theta_1<\theta_2$ and both deflections are in same direction

C) $\theta_1>\theta_2$ and both deflections are is opposite directions

D) $\theta_1=\theta_2$ but both deflections are in opposite direction

Q.3 **With reference to the Q.2 if only $\vec{B}$ is doubled and bar is only made to move towards coil with a speed of 4 m s^{-1} then:**

A) Induced e.m.f becomes half

B) Induced e.m.f remains same

C) Induced e.m.f is doubled

D) None of these

Q.4 **With reference to the Q.2 if both $\vec{B}$ and speed of bar magnet are doubled then:**

A) Induced e.m.f becomes quadrupled

B) Induced e.m.f remains same

C) Induced e.m.f is doubled

D) None of these

Q.5 **With reference to Q.2 if only number of turns of coil are doubled then:**

A) Induced e.m.f becomes half

B) Induced e.m.f remains same

C) Induced e.m.f is doubled

D) None of these

USE THIS SPACE FOR SCRATCH WORK

Q.6 **The relation for motional e.m.f is written as:**

A) $\varepsilon = -vBL\cos\theta$ C) $\varepsilon = +vBL\sin\theta$

B) $\varepsilon = -vBL\sin\theta$ D) $\varepsilon = -vBL\tan\theta$

Q.7 If a conductor is moved across a $\vec{B}$ such that θ=90° then induced e.m.f:

A) Is a maximum C) $\varepsilon = -vBL$

B) Is zero D) Both "A" and "C"

Q.8 At what angle when a rod is moved in a uniform $\vec{B}$ such that induced e.m.f becomes half of its maximum?

A) 30° C) 60°

B) 45° D) 90°

Q.9 According to Lenz's law the direction of induced current is such that it:

A) Decreases flux if it is increasing

B) Opposes the cause which produces it

C) Increases flux if it is decreasing

D) All of these

Q.10 The value of induced e.m.f in a coil mainly depends upon:

A) Increase in flux

B) Decrease in flux

C) Both "A" & "B"

D) Rate of change of magnetic flux

Q.11 If we take away north-pole of a bar magnet from a coil then the end of coil facing north-pole act as:

A) A north pole C) May be north or south

B) A south pole D) No pole will be induced

Q.12 Which of the following is true about dependence upon resistance of the coil in which e.m.f is generated?

A) Only induced current depends upon resistance of coil

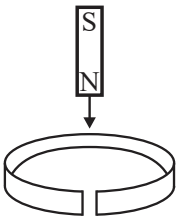
B) Only e.m.f depends upon resistance of coil

C) Both e.m.f and induced current depends upon resistance of coil

D) Can't be predicted

Q.13 A bar magnet as shown in figure is allowed to fall down into a coil having a cut. What is true?

USE THIS SPACE FOR SCRATCH WORK



A) e.m.f will be induced only

B) Neither e.m.f nor current will be induced

C) Both e.m.f and current will be induced

D) None of these

Q.14 Considering the statement of Q.13 what is true about the acceleration of bar magnet while coming down?

A) $a=g$ C) $a>g$

B) $a<g$ D) $a=0$

Q.15 Considering the figure of Q.13 if the coil is complete and does not have cut in it then:

A) Only e.m.f will be induced

B) Only current will be induced

C) Both e.m.f and current will be induced in it

D) Nothing will be induced

Q.16 Considering the statement of Q.15 what is true about the acceleration produced in the bar magnet while falling downwards?

A) $a=g$ C) $a<g$

B) $a>g$ D) $a=0$

Q.17 Under which of the following conditions even when both area of coil and $\vec{B}$ in the region are continuously changing yet there is no e.m.f induced?

A) If $A \propto \frac{1}{B}$

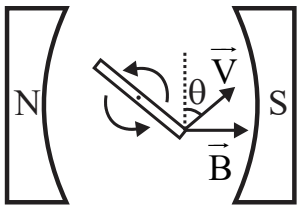
B) If flux remains zero

C) If coil is placed parallel to $\vec{B}$

D) All of these

Q.18 Consider the figure in which an upper view for a rotating coil is shown placed in the uniform magnetic field. For which value of "θ" the induced e.m.f will be a maximum?

USE THIS SPACE FOR SCRATCH WORK



A) 90° C) 60°

B) 30° D) 0°

Q.19 The relation for e.m.f produced by an A.C generator is:

A) $\varepsilon = \varepsilon_{\circ} \sin\theta$ C) Both "A" and "B"

B) $\varepsilon = N\omega AB \sin\theta$ D) None of these

Q.20 The maximum e.m.f induced by an A.C generator which has only one turn is:

A) $N\omega AB$ C) ωAB

B) NAB D) None of these

USE THIS SPACE FOR SCRATCH WORK

Q.21 An A.C generator produces current given by I=100 sin100πt. It will achieve value of 50 A after _____second.

A) $\frac{1}{600}$ C) $\frac{1}{300}$

B) $\frac{1}{1800}$ D) $\frac{1}{900}$

Q.22 A bulb is connected with output of A.C generator. The intensity of light from the bulb:

A) Changes continuously

B) Decreases and becomes zero

C) Increases and reaches to its maximum

D) Remains constant

Q.23 Two A.Cs are represented by $I_1 = 100 \sin 100\pi t$ and $I_2 = 100 \sin 200\pi t$, the relation between the frequencies of these A.Cs is:

A) $f_1 = f_2$ C) $f_2 = 2f_1$

B) $f_1 = 2f_2$ D) $f_1 = 10f_2$

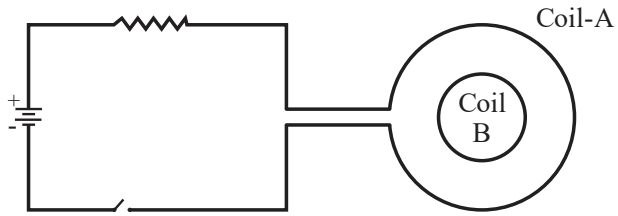
USE THIS SPACE FOR SCRATCH WORK

Q.24 How many times A.C achieves zero value in one cycle:

A) Once C) Thrice

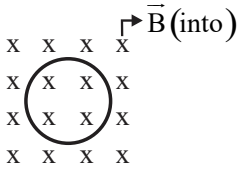
B) Twice D) Four times

Q.25 In the figure shown, what is the direction of induced current in the coil B at the moment when the switch is closed?



A) Clockwise
B) Anticlockwise
C) No current is induced
D) Induced current changes its direction form clockwise to anticlockwise

Q.26 A loop of wire is placed in a perpendicular magnetic field. Suddenly, the magnitude of magnetic field begins to increase, what is the direction of the induced current in the loop?



A) Clockwise
B) Anticlockwise
C) No current is induced
D) Out of the page

Q.27 In the figure shown, the magnet is moved towards the coil with a speed v. The induced emf in coil is "ε". Now if the magnet and coil recede away from one another each moving with speed v. The induced emf in the coil is:

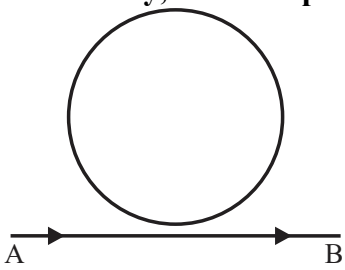
A) ε
C) $\frac{\varepsilon}{2}$
B) 2ε
D) 4ε

Q.28 The north pole of a long horizontal bar magnet is being brought closer to a vertical conducting coil along the perpendicular direction. The direction of the induced current in the conducting coil will be:

A) Horizontal
C) Vertical
B) Clockwise
D) Anticlockwise

Q.29 An electron starts moving along the line AB, which lies in the same plane as a circular loop of conducting wire

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 pass by

Q.30 The coil of area A is kept parallel in a magnetic field B. If coil is rotated by 90° such that its axis is perpendicular to magnetic field, the change in flux will be:

A) BA C) Zero
B) 2BA D) 4BA

Q.31 A 50 turns circular coil has a radius of 3 cm. It is kept in a magnetic field acting normal to the area of the coil. The magnetic field B is increased from 0.10 T to 0.35 T in 2 ms. The average induced emf in the coil is:

A) 1.77 V C) 177 V
B) 17.7 V D) 0.177 V

Q.32 There is an aerial 1 m long in a car. It is moving from east to west with a velocity 100 km h^{-1}. If the horizontal component of earth's magnetic field is 0.18×10^{-4} T, then induced emf is:

A) 0.50 mV C) 0.75 mV
B) 0.25 mV D) 1 mV

ANSWER KEY (Worksheet-06)							
1	B	11	B	21	A	31	B
2	D	12	A	22	A	32	A
3	C	13	A	23	C		
4	A	14	A	24	B		
5	C	15	C	25	B		
6	B	16	C	26	B		
7	D	17	D	27	B		
8	A	18	D	28	D		
9	D	19	C	29	C		
10	D	20	C	30	A		

SOLUTIONS

Unit – 09A (WS-06)

Q.1 Answer is "B"

Solution:- Since the metallic rod is moving in earth's magnetic field, so motional e.m.f will be produced.

Q.2 Answer is "D"

Solution:- The induced current will flow opposite in both cases as the direction of motion of bar is opposite in both cases. Also, the magnitude of current will be same as the speed of conductor with which it is moving is same.

Q.3 Answer is "C"

Solution:- $\varepsilon = -vBL\sin\theta \quad \Rightarrow \quad \varepsilon \propto B$

Q.4 Answer is "A"

Solution:- $\varepsilon = -vBL\sin\theta$

Q.5 Answer is "C"

Solution:- $\varepsilon = -N\dfrac{\Delta\phi}{\Delta t}$

Q.6 Answer is "B"

Solution:- Motional e.m.f in a conductor is given as

$\varepsilon = -vBL\sin\theta$

Q.7 Answer is "D"

Solution:- $\varepsilon = -vBL\sin\theta$

Q.8 Answer is "A"

Solution:- Put $\varepsilon = -\dfrac{vBL}{2}$ and find "θ".

Q.9 Answer is "D"

Solution:- Lenz's law

Q.10 Answer is "D"

Solution:- E.m.f is caused by change in flux. The rate of change of flux determines its value.

Q.11 Answer is "B"

Solution:- Induced current opposes the cause which produces it.

Q.12 Answer is "A"

Solution:- First short question of Ch:15.

$\varepsilon = -N\dfrac{\Delta\phi}{\Delta t} = \text{constant}$ and $I = \dfrac{\varepsilon}{R}$

$\Rightarrow I \propto \dfrac{1}{R}$

Q.13 Answer is "A"

Solution:- As $I = \dfrac{\varepsilon}{R}$ and for ring with a cut it acts as open circuit whose R=infinite.

Q.14 Answer is "A"

Solution:- As no current is induced so this coil will not become a magnet and hence can't oppose the motion of falling bar magnet which will only fall with a = g.

Q.15 Answer is "C"

Solution:- Current flows only is close path.

Q.16 Answer is "C"

Solution:- As now current can be generated so coil will become magnet and will oppose motion of falling magnet.

Q.17 Answer is "D"

Solution:- In all cases; $\Delta\phi = 0 \Rightarrow \varepsilon = 0$

Q.18 Answer is "D"

Solution:- E.m.f induced in one side of coil is given as;

$\varepsilon = -vBLsin\ \alpha$

Where α is angle between $\vec{v}$ and $\vec{B}$. In the given figure α can be expressed as:

$\alpha = 90° - \theta$

If $\theta = 0°$, $\alpha = 90°$

$\sin 90° = 1 = \max$

So e.m.f will be maximum when $\theta = 0°$.

Q.19 Answer is "C"

Solution:- E.m.f produced by generator is given as:

$\varepsilon = N\omega AB\sin\theta$

Where $N\omega AB = \varepsilon_\circ = $ maximum emf

So, $\varepsilon = \varepsilon_\circ sin\theta$

Q.20 Answer is "C"

Solution:- $\varepsilon = N\omega AB\ sin\ \theta$ For maximum e.m.f in one turn coil, put; N =1 , $\theta = 90°$

Q.21 Answer is "A"

Solution:- $I = 100\sin 100\pi t$

$50 = 100\sin 100\pi t$ solve it

Q.22 Answer is "A"

Solution:- Intensity $\propto I_{ins}$

Q.23 Answer is "C"

Solution:- Compare I_1 and I_2

Q.24 Answer is "B"

Solution:- In one cycle of A.C, it achieves zero value twice i.e at 0° and at 180°.

Q.25 Answer is "B"

Solution:-
When switch is closed, the current in coil-A increases from zero to maximum, so its magnetic flux also increases from zero to maximum, this flux is linked with coil-B. Since the field of coil-A is into the page so to oppose this cause (increasing flux) the field of induced current in coil-B must be out of the page. Hence current in coil B must be in anti-clockwise direction.

Q.26 Answer is "B"

Solution:-
To oppose the cause i.e increasing flux, the field of coil must be out of page (opposite to increasing field). So, the current in coil will be anticlockwise.

Q.27 Answer is "B"

Solution:-
The relative speed between coil and magnet becomes "2v" so emf induced will also be doubled.

Q.28 Answer is "D"

Solution:-
Simply follow the statement of Lenz's law.

Q.29 Answer is "C"

Solution:-
Simple follow the statement of Lenz's Law keeping in mind that the magnetic field linked with the coil is because of electronic current i.e the direction of

magnetic field will be opposite to that obtained by right hand rule.

Q.30 Answer is "A"

Solution:-

$\phi_i = BA\cos 90° = 0$

$\phi_f = BA\cos 0° = BA$

$\Delta\phi = \phi_f - \phi_i$

$\Delta\phi = BA - 0$

$\Delta\phi = BA$

Q.31 Answer is "B"

Solution:-

$$\Delta\phi = NA(B_2 - B_1) = 50 \times \frac{22}{7}\left(3 \times 10^{-2}\right)^2$$

$\Delta\phi = 353 \times 10^{-4}$ Wb

Now

$$\varepsilon = \frac{NA\left(B_2 - B_1\right)}{\Delta t}$$

$$\varepsilon = \frac{353 \times 10^{-4}}{2 \times 10^{-3}}$$

$$\varepsilon = 17.7V$$

Q.32 Answer is "A"

Solution:-

Magnitude of emf is

$$\varepsilon = vBL\sin 90°$$

$$\varepsilon = \frac{100 \times 1000}{3600} \times 0.18 \times 10^{-4} \times 1$$

$$\varepsilon = 0.5\ mV$$

STEP

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