Q. 1 **Does the induced emf in a circuit depend on the resistance of the circuit? Does the induced current depend on the resistance of the circuit?**

Ans. The induced emf does not depend upon the resistance of the circuit. It depends upon rate of change of magnetic flux as given by relation $\varepsilon = -N\,\Delta\varphi/\Delta t$

The induced current depends upon the resistance of the circuit. If resistance increases, current will decrease from the relation; $\varepsilon = IR$ or $I = \varepsilon / R$

Q. 2 **A square loop of wire is moving through a uniform magnetic field. The normal to the loop is oriented parallel to magnetic field. Is an emf induced in the loop? Give reasons.**

Ans. No emf will induce in the loop. From the relation $\varepsilon = -vBL\sin\theta$. As normal to the loop and **v** is parallel to **B**, so $\theta = 0$, $E = -vBL\sin 0^o = 0$

Also there is no change of flux due to parallel motion, so $\Delta\varphi / \Delta t = 0$

$\varepsilon = -N\,\Delta\varphi / \Delta t = -N \times 0 = 0$; so no emf will produce.

Q. 3 **A light metallic ring is released from above in to a vertical bar magnet (in the fig). Viewed for above, does the current flow clockwise or anticlockwise in the ring?**

Ans. When viewed from above, current in ring will flow in clockwise direction. According to Lenz's law induced current is such that it opposes motion of the ring. Thus N-pole of the magnetic field produced due to the induce current in the ring must face to N-pole of bar magnet. It is only possible when induced current in ring will flow clockwise direction.

Q. 4 **What is the direction of the current through resistor R in the fig? When switch S is; (a) closed (b) opened**

Ans. a) The direction of current is left to right when switch is closed. The induced current must flow in anticlockwise direction according to Lenz's law.

b) The direction of current is from right to left when the switch is opened. The induced current must flow in clockwise direction according to Lenz's law.

Q. 5 **Does the induced emf always act to decrease the magnetic flux through a circuit?**

Ans. No induced emf does not always act to decrease the magnetic flux through a circuit. According to Lenz's Law it acts to maintain magnetic flux by opposing any change in it. Thus if magnetic flux decreases it tends to increase the magnetic flux and if magnetic flux increases it tends to decrease it.

Q. 6 **When the switch in the circuit is closed a current established in the coil and the metal ring jumps upward (see the fig. in book) Why? Describe what would happen to the ring if battery polarity were reversed?**

Ans. When switch is closed then current will increase from zero to maximum in the coil. This will induce the emf in the metallic ring. Due to induce current in the ring magnetic field will be produced around the ring which will oppose the magnetic field of the coil according to Lenz's law. Due to this opposition the ring jumps in the upward direction. In this case the S-poles of both the magnetic fields will face each other. The ring will jump upward in the same manner, if the battery polarity is reversed. In this case the N-poles of both the magnetic fields will face each other.

Q. 7 **The Fig. in book shows a coil of wire in the xy plane with a magnetic field directed along the y- axis. Around which of the three coordinate axes should the coil be rotated in order to generate an emf and a current in the coil?**

Ans. If the coil is rotated around X-axis then emf and a current is generated in the coil due to change of magnetic flux passing through the coil.

Q. 8 **How would you position a flat loop of wire in a changing magnetic field so that there is no emf induced in the loop?**

Ans. If plane of the loop is parallel to the magnetic field, then angle between vector area '**A**' and magnetic field '**B**' will be 90^o then flux will be zero according to the equation

$\Delta\varphi = \mathbf{B \cdot A} = BA\cos 90^o = 0$ Hence no emf will be induced as given by the relation

$\varepsilon = -N\,\Delta\varphi / \Delta t = -N \times 0 = 0$

Q. 9 **In a certain region the earth's magnetic field point vertically down. When a plane flies due north, which wingtip is positively charged?**

Ans. According to right hand rule, the direction of the magnetic force will be from East to West. This force will move the positive charges to the West wing tip. Hence West wingtip will be positively charged.

Q.10 **Show that ε and ΔΦ / Δt have the same units.**

Ans. As $\varepsilon = W/q$

Units of $\varepsilon = J/C$ …..(1)

As $\Delta\varphi / \Delta t = \Delta B\, A / \Delta t$

Hence Units of $\Delta B\, A/ \Delta t = N\, A^{-1}\, m^{-1}\, m^2 / s = N\, m /A\, s = J / C$ …..(2)

From equation (1) and (2) ε and ΔΦ / Δt have the same units.

Q.11 **When an electric motor, such as an electric drill, is being used, does it also act as a generator? If so what is the consequences of this?**

Ans. An electric motor produces induced emf due to its rotation inside the magnetic field which is also the property of the generator. Hence in this sense we can say that it acts like a generator. According to Lenz's Law the induce emf will reduce the speed of electric motor.

Q.12 **Can a D.C. motor be turned into a D.C. generator? What changes required to be done**?

Ans. Yes a d.c. motor can be turned into a d.c. generator. For this purpose, two changes are required; (i) some arrangement should be made to rotate the armature (ii). disconnect the voltage source and use these terminals for output of d.c. generator.

Q.13 **Is it possible to change both the area of the loop and the magnetic field passing through the loop and still not have an induced emf in the loop?**

Ans. Yes, if the flux remains constant. From the equation; $\Delta\varphi = \mathbf{\Delta B \bullet \Delta A}$. If we increase the area and equally decrease magnetic field and vice versa so that product remains constant.

Q.14 **Can an electric motor be used to drive an electric generator with the output from the generator being used to operate the motor?**

Ans. No. An electric motor cannot be used to drive an electric generator. It is against the law of conservation of energy as it becomes self perpetuating machine.

Q.15 **A suspended magnet is oscillating freely in horizontal plane. Oscillations are strongly damped when a metal plate is placed under the magnet. Explain why this occurs?**

Ans. The metal plate produces an induced emf due to oscillations in the suspended magnet. This induced emf produces current, which produces its own magnetic field that will oppose the motion of the suspended magnet. So oscillations are strongly damped.

Q.16 **Four unmarked wires emerge from a transformer. What steps would you take to determine the turns ratio?**

Ans. We will separate primary and secondary coils with ohmmeter by checking their continuity. Connecting primary coil with a.c. supply of known voltage Vp we will measure the voltage induced Vs by voltmeter. Then we can calculate turns ratio from the formula; $Vs / Vp = Ns / Np$

Q.17 **a) Can a step-up transformer increase the power level?**

b) In a transformer, there is no transfer of charge from the primary to the secondary. How is, then the power transferred?

Ans. a) No. A step up transformer cannot increase the power level. As for ideal case;

Power input = Power out

It can increase or decrease alternating voltage but power, P = VI, will remain same.

b) Primary and secondary coils are connected magnetically but not electrically. Therefore power is transferred due to induced emf.

Q.18 **When the primary of a transformer is connected to a.c. mains the current in it (a) is very small if the secondary circuit is open, but (b) increases when the secondary circuit is closed. Explain these facts.**

Ans. a) The output power is zero, if the secondary circuit is open. Hence a very small current is drawn by the primary coil from a.c. mains.

b) When output circuit is closed then output power will increase and primary coil has to draw a larger current from the a.c. mains to equalize the power output as we know that

Power input = Power output