Instructions

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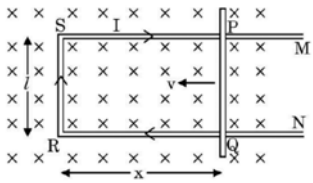
Q1. A photocell connected in an electrical circuit is placed at a distance 'd' from a source of light. As a result, current I flows in the circuit. What will be the current in the circuit, when the distance is reduced to $\frac{d}{3}$? **1 Mark**

A I
B 6I
C 9I
D $\frac{I}{3}I$

Q2. Figure shows a rectangular conductor PSRQ in which movable arm PQ has a resistance 'r' and resistance of PSRQ is negligible. The magnitude of emf induced when PQ is moved with a velocity $\vec{v}$ does not depend on: **1 Mark**



A magnetic field $(\vec{B})$
B velocity $(\vec{v})$
C resistance (r)
D length of PQ

Q3. For Questions two statements are given — one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. **1 Mark**
Assertion (A): The mutual inductance between two coils is maximum when the coils are wound on each other.
Reason (R): The flux linkage between two coils is maximum when they are wound on each other.

A Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
B Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
C Assertion (A) is true, but Reason (R) is false.
D Assertion (A) is false and Reason (R) is also false.

Q4. An airplane with wingspan 50m is flying horizontally with a speed of 360kmhr^{-1} over a place where the vertical component of the earth's magnetic field is 2×10^{-2}. The potential difference between the tips of the wings would be **1 Mark**

A 100V
B 1.0V
C 0.2V
D 0.01V

Q5. A metal rod moves at a constant velocity in a direction perpendicular to its length. A constant uniform magnetic field exists in space in a direction perpendicular to the rod as well its velocity. Select correct statements (s) from the following. **1 Mark**

A the entire rod is at the same potential
B there is an electric field in the rod
C the electric potential is highest at the centre
D the electric potential is lowest at its centre and increases towards its ends

Q6. The area of the coil must be._____ **1 Mark**

A 1.8m^2
B 18m^2
C 8m^2
D none of these

Q7. Two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. **1 Mark**
Assertion (A): An aircraft flies along the meridian, the potential develops at the ends of its wings.
Reason (R): Whenever there is change in the magnetic flux e.m.f. induces.

A Both A and R are true and R is the correct explanation of A.
B Both A and Rare true but R is NOT the correct explanation of A.
C A is true but R is false.
D A is false and R is also false.

Q8. Given below are the symbols of a few electronic components. Which of these components denote a variable inductor? **1 Mark**

A 
B 
C 
D 

Q9. The value of mutual inductance can be increased by. **1 Mark**

A decreasing N
B increasing N
C winding the coil on wooden frame
D winding the coil on china clay

Q10. Two identical cycle wheels (geometrically) have different number of spokes connected from center to rim. One is having 20 spokes and the other having only 10 (the rim and the spokes are resistanceless). One resistance of value R is connected between center and rim. The current in R will be. **1 Mark**

A double in the first wheel than in the second wheel
B four times in the first wheel than in the second wheel
C will be double in the second wheel than that of the first wheel
D will be equal in both these wheels
E answer required

Q11. State Lenz's Law. **2 Marks**
A metallic rod held horizontally along east-west direction, is allowed to fall under gravity. Will there be an emf induced at its ends? Justify your answer.

Q12. Consider an induced magnetic field due to changing electric field and an induced electric field due to changing magnetic field. Which one is more easily observed? Justify your answer. **2 Marks**

Q13. The energy stored in a solenoid of inductance L is U. The number of turns per unit length of the solenoid is doubled. Keeping the current and all other factors same, find: **2 Marks**

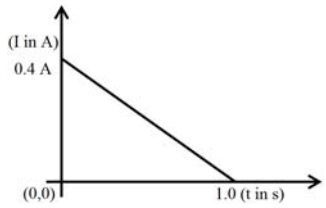
1. Change in inductance of the solenoid.
2. The final energy stored in the inductor.

Q14. Two identical loops, one of copper and the other of aluminium, are rotated with the same angular speed in the same magnetic field. Compare (i) the induced emf and (ii) the current produced in the two coils. Justify your answer. **2 Marks**

Q15. A 0.5m long solenoid of 10 turns/ cm has area of cross-section $1cm^2$. Calculate the voltage induced across its ends if the current in the solenoid is changed from 1A to 2A in 0.1s. **2 Marks**

Q16. Draw the circuit diagram of a full wave rectifier using two p-n junction diodes. Explain its working and show input and output voltage variations. **3 Marks**

Q17. When a conducting loop of resistance 10Ω and area $10cm^2$ is removed from an external magnetic field acting normally, the variation of induced current in the loop with time is shown in the figure. **3 Marks**



Find the:

1. Total charge passed through the loop.
2. Change in magnetic flux through the loop.
3. Magnitude of the magnetic field applied.

Q18. The primary and the secondary coils of an ideal step-down transformer consist of 650 and 25 turns respectively. When the primary coil of this transformer is connected to 240 V mains, the current in the primary coil is 1.5A. Calculate: **3 Marks**

1. The voltage across the secondary coil.
2. The current in the secondary coil.
3. The average power delivered to the output circuit.

Q19. A long solenoid of radius r consists of n turns per unit length. A current $I = I_0 \sin \omega t$ flows in the solenoid. A coil of N turns is wound tightly around it near its centre. What is: **3 Marks**

1. the induced emf in the coil?
2. the mutual inductance between the solenoid and the coil?

Q20. Draw the circuit diagram of a full wave rectifier. Explain its working showing its input and output waveforms. **3 Marks**

Q21. 1. Describe, with the help of a suitable diagram, the working principle of a step-up transformer. Obtain the relation between input and output voltages in terms of the number of turns of primary and secondary windings and the currents in the input and output circuits. **5 Marks**

2. Given the input current 15 A and the input voltage of 100 V for a step-up transformer having 90% efficiency, find the output power and the voltage in the secondary if the output current is 3 A.

Q22. 1. Draw a labelled diagram of a step-up transformer and describe its working principle. Explain any three causes for energy losses in a real transformer. **5 Marks**

2. A step-up transformer converts a low voltage into high voltage. Does it violate the principle of conservation of energy? Explain.

3. A step-up transformer has 200 and 3000 turns in its primary and secondary coils respectively. The input voltage given to the primary coil is 90V. Calculate:

- The output voltage across the secondary coil
- The current in the primary coil if the current in the secondary coil is 2·0 A.

Q23. 1. A conductor of length 'l' is rotated about one of its ends at a constant angular speed $'\omega'$ in a plane perpendicular to a uniform magnetic field B. Plot graphs to show variations of the emf induced across the ends of the conductor with: **5 Marks**

1. Angular speed ω.
2. Length of the conductor l.

2. Two concentric circular loops of radius 1cm and 20cm are placed coaxially:

1. Find mutual inductance of the arrangement.
2. If the current passed through the outer loop is changed at a rate of 5A/ ms, find the emf induced in the inner loop. Assume the magnetic field on the inner loop to be uniform.