

# ANGEL'S PUBLIC SCHOOL

## SAMPLE PAPER

HALF YEARLY EXAMS SESSION 2024 – 25

CLASS – XII

TIME: 3 HRS

SUBJECT: PHYSICS CODE - 042

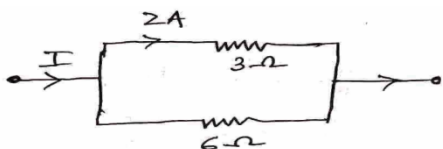
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General instructions.

- There are 35 questions in all. All questions are compulsory.
- This questions paper has five sections A,B,C, D and E.
- Section – A contains 18 MCQs of one mark each. Section –B contain 7 questions of 2 marks each. Section – C contains 5 questions of 3 marks each. Section – D contains 3 long questions of 5 mark each. Section – E contains two case study based questions of 4 marks each.
- There is no overall choice whomever some internal choices are in there in section.

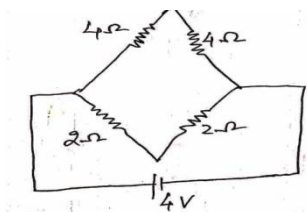
### SECTION – A

- A metallic sphere has a charge of  $10 \mu\text{c}$ . A unit negative charge is brought from A to B both 100 cm away from the sphere, but A being east of it while B being on the west. The network done is \_\_\_\_\_.  
(a) zero (b)  $\frac{2}{10}$  joule (c)  $-\frac{2}{10}$  joule (d)  $-\frac{1}{10}$  joule
- A parallel plate air capacitor having a capacitance C. When it is half filled with a dielectric of dielectric constant 5, the percentage increase in the capacitance will be \_\_\_\_\_.  
(a) 200 % (b) 33.3 % (c) 400 % (d) 66.6 %
- The terminal potential difference of a cell is greater than its EMF, when it is \_\_\_\_\_.  
(a) being discharge (b) in an open circuit  
(c) being charged (d) being either charged or discharged
- Kirchhoff's 2nd law is based on the law of conservation of \_\_\_\_\_.
- The current in the given circuit is \_\_\_\_\_.  
(a) 1 A (b) 3 A (c) 6 A (d) 12 A

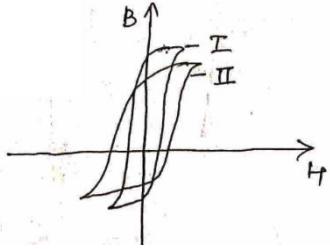


- Calculate the current in the given circuit.

- (a)  $\frac{3}{2}$  A (b)  $\frac{3}{4}$  A (c) 0.5 A (d) 1 A



7. The deflection produced in a galvanometer, when a unit current flows through it is known as \_\_\_\_\_.
8. In a circular coil of radius  $r$ , the magnetic field at the centre is proportional to \_\_\_\_\_.
- (a)  $r^2$  (b)  $r$  (c)  $\frac{I}{r}$  (d)  $\frac{I}{2r}$
9. Two curves are shown in the figure. What magnetic substance do they represent?
- (a) Dia (b) Para (c) Ferro (d) None of these



10. If a 10 A ammeter has a resistance of  $0.09\Omega$ . What resistance of the shunt will enable it to read up to 100 A ?
- (a)  $0.01\Omega$  (b)  $0.1\Omega$  (c)  $0.9\Omega$  (d)  $0.09\Omega$
11. A circular coil of radius  $a$  carries an electric current. The magnetic field due the coil at a point on the axis of the coil located at a distance  $r$  from centre of the coil, such that  $r \gg a$ , varies.
- (a)  $\frac{1}{r}$  (b)  $\frac{1}{r^2}$  (c)  $\frac{1}{r^3}$  (d)  $\frac{1}{3/2r}$
12. A solenoid has 1000 turns per metre length. If a current of 5 A is flowing through it, then magnetic field inside the solenoid is.
- (a)  $2\text{ A} \times 10^{-3}\text{ T}$  (b)  $2\text{ A} \times 10^{-3}\text{ T}$  (c)  $4\text{ A} \times 10^{-3}\text{ T}$  (d)  $2\text{ A} \times 10^{-5}\text{ T}$
13. Currents of 10 A and 2 A are flowing in opposite directions through two parallel wires A and B respectively. If the wire A is infinitely long and wire B is 2m long, then force on wire B which is situated at 10 cm from A, is.
- (a)  $8 \times 10^{-5}\text{ N}$  (b)  $6 \times 10^{-5}\text{ N}$  (c)  $4 \times 10^{-5}\text{ N}$  (d)  $2 \times 10^{-5}\text{ N}$
14. If distance between two current – carrying wires is doubled, the force between them is.
- (a) halved (b) doubled (c) tripled (d) quadrupled
15. Which of the following is weakly repelled by a magnet field:
- (a) Iron (b) Cobalt (c) Steel (d) Copper

### ASSERTION REASON

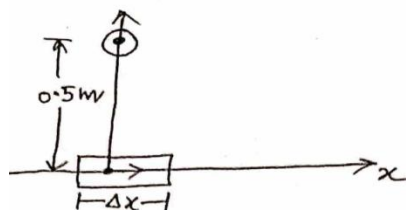
Direction : These questions consists of two statements. Each printed as Assertion (A) and Reason (R). While answering these questions you are required to choose any one of the following four responses.

- (a) If both Assertion (A) and Reasons (R) are true and the Reason (R) is the correct explanation of the Assertion (A).
- (b) If both Assertion (A) and Reason (R) are true and the Reason (R) is not a correct explanation of the Assertion (A).
- (c) If Assertion (A) is true but Reason (R) is false.
- (d) If both Assertion (A) and Reason (R) are false

16. Assertion. If a proton and an  $\alpha$  particle enter a uniform magnetic field perpendicularly, with the same speed, then time period of revolution of the  $\alpha$  -particle is double that that of proton.  
Reason . In a magnetic field, the time period of revolution of a charged particle is directly proportional to mass of particle and is inversely proportional to charge of particle.
17. Assertion. If two long parallel wires, hanging freely are connected to a battery in series, they come closer to each other.
18. Reason. Force of attraction acts between the two parallel wires in series carrying current.  
Assertion. When a magnetic dipole is placed in a non uniform magnetic field, only a torque acts on the dipole.  
Reason. Force would also act on dipole of magnetic field were uniform.

### SECTION – B

19. Two capacitors of capacitance  $0.3 \mu\text{F}$  and  $0.6 \mu\text{F}$  are connected in series with 6 volt. Find the ratio of their energy stores.
20. Prove that voltage and current always vary in the same phase in an circuit contain resistance only.
21. A conducting rod of length 'l' with one end pivoted is rotated with a uniform angular speed  $\omega$  in a vertical plane normal to a uniform magnetic field B. Deduce the expression for the EMF produced in the rod.
22. An element  $\Delta l$  is placed at the origin and carries a current  $I = 2 \text{ A}$ , as shown in the figure. Find out the magnetic field at point P on the y – axis at a distance of 1 m to the element  $\Delta l$ . Also, give the direction of the field produced.



23. (a) An iron bar magnet is heated to  $1000^\circ \text{C}$  and then cooled. Will it retain its magnetism?  
(b) Write two basic differences between dia, para and ferromagnetic substances.
24. Using Biot Savart's Law, obtain an expression for the magnetic field at the centre of the coil bent in the form of a square of side  $2a$  carrying current  $I$ .
25. A resistor is connected to a battery of emf  $10 \text{ V}$  and internal resistance  $0.3 \Omega$ . What is the resistor of resistance to be inserted in the circuit for the circuit  $1.2 \text{ A}$ ?

**OR**

The copper wire is stretched to make it  $0.2 \%$  longer. What is the  $\%$  change in its resistance?

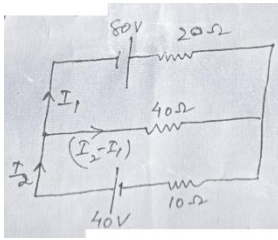
### SECTION – C

26. Plot the graph showing the variation of magnetic flux and induced EMF with time  $t$ . Derive an expression for the torque, acting on a current carrying loop, placed inside the magnetic field.
27. A charged particle having a charge of  $3 \mu\text{C}$  is placed close to a sheet of charge having a surface charge density  $5 \times 10^{-6} \text{ cm}^{-2}$ . Find the force of attraction between the particles and the sheet of charge.

**OR**

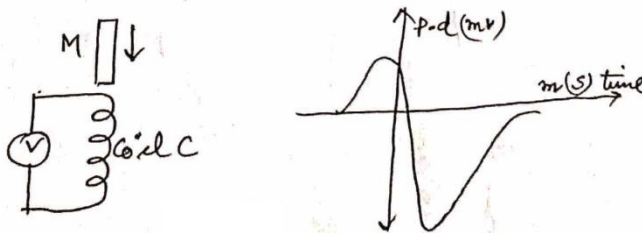
Calculate the electric field strength required to support a water drop of mass  $10^{-7} \text{ kg}$  and has a charge of  $1.6 \times 10^{-19} \text{ C}$ .

28. With the schematic diagram, show how can a galvanometer be converted into an ammeter.
29. What do you mean by sharpness of resonance in series circuit? Find expression for Q – factor of the circuit.
30. Using kirchhoff's law find the value of  $I_1$  and  $I_2$ .



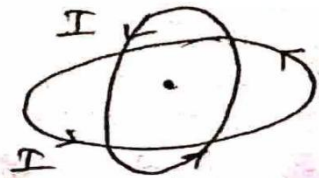
### SECTION – D

31. (a) What are eddy currents? How can they be minimized?
- (b) A bar magnet M is dropped so that it falls vertically through the coil C. The graph obtained for voltage produced across the coil versus time is as shown in the given figure.
- (i) Explain the shape of the graph. (ii) Why is the negative peak longer than the positive peak?



**OR**

- (a) Using the Amperis Circuital Law, find an expression for the magnetic field for a long solenoid.
- (b) Find the magnitude and the direction of the net magnitude field at the common centre of the two coils.



32. Discuss the Principal and working of a moving coil galvanometer. Explain two application for it.

**OR**

- (a) An electric dipole is placed in a uniform external electric field E. Show that torque on the dipole is given by  $\tau = P \times E$ .
- (b) A cylinder is placed in a uniform electric field E with its axis parallel to the field. Show that the total electric flux through the cylinder is zero.
33. Explain with the help of leveled diagram the principle construction and working transformers. Why is its core laminated?

**OR**

The two capacitors  $C_1$  &  $C_2$  are charged to potential  $V_1$  &  $V_2$ , then connected in a parallel. Calculate the loss of energy sharing of the charges.

### SECTION – E

### CASE BASED

34. According to Gauss's theorem in electrostatics, total electric flux over a closed surface S in vacuum is  $1/\epsilon_0$  times the total charge (Q) contained inside i.e.,

$$\phi_E = \frac{Q}{\epsilon} = \frac{Q}{K \epsilon_0}$$

The charges enclosed may be distributed any way. If the medium surrounding the charge has a dielectric constant K. then.

$$\phi_E = \oint_{SS} \vec{E} \cdot d\vec{s} = \frac{Q}{\epsilon_0}$$

Charges situated outside the surface make no contribution to electric flux.

(a) Charges  $+6q$ ,  $-2q$  and  $+3q$  are enclosed by a surface in vacuum. The total electric flux over the surface is.

- (i)  $6q/\epsilon_0$       (ii)  $-2q/\epsilon_0$       (iii)  $\frac{3q}{\epsilon_0}$       (iv)  $7q/\epsilon_0$

(b) A charge  $-7q$  is situated outside the surface in the above questions. What will be the total electric flux in that case?

- (i) Zero      (ii)  $-7q/\epsilon_0$       (iii)  $7q/\epsilon_0$       (iv)  $14q/\epsilon_0$

(c) Charges  $+2q$ ,  $-5q$  and  $8q$  are enclosed by a surface in a medium of dielectric constant 6. The total electric flux over the surface will be.

- (i)  $\frac{5q}{6\epsilon_0}$       (ii)  $\frac{6q}{5\epsilon_0}$       (iii) zero      (iv)  $\frac{15q}{6\epsilon_0}$

(d) A cube of side 1 metre encloses a charge of 1 coulomb in vacuum. What is the electric flux from any one surface of the cube?

- (i)  $\frac{1}{\epsilon_0}$       (iii)  $\frac{1}{6\epsilon_0}$       (iii)  $\frac{6}{\epsilon_0}$       (iv)  $\frac{\epsilon_0}{6}$

### CASE BASED

35. A wire of length 12 cm; resistance  $12\ \Omega$  and of uniform area of cross-section is cut into twelve equal parts, which are connected to form a skeleton cube, A cell of emf 2 V is connected across the two diagonally opposite corners of the cube. Using kirchhoff's laws of junction and loop.

Answer the following questions.

(a) The effective resistance of the circuit is.

- (a)  $4/5\ \Omega$       (b)  $5/6\ \Omega$       (c)  $6/7\ \Omega$       (d)  $7/12\ \Omega$

(b) The current drawn from the battery is.

- (a) 2.5 A      (b) 2.4 A      (c) 2.3 A      (d) 3.4 A

(c) The maximum current flowing in an arm of network is.

- (a) 0.4 A      (b) 0.8 A      (c) 1.2 A      (d) 2.4 A

(d) The minimum potential differences across an arm of network is.

- (a) 0.4 V      (b) 0.8 V      (c) 1.2 V      (d) 2.4 V