**TWELFTH PHYSICS** **GRAND TEST-BOOK 1**

**CONDUCTED ON 16TH FEBRUARY 2020**

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**TIME ALLOWED: 3 Hrs** **MAXIMUM PARKS: 70**

**GENERAL INSTRUCTIONS:**

- **There are 37 questions in all. All questions are compulsory.**
- **This question paper has four sections: Section A, Section B, Section C and Section D.**
- **Section A contains twenty questions of 1 mark each, section B contains seven questions of 2 marks each, Section C contains seven questions of 3 marks each and section D contains three questions of 5 marks each.**

# SECTION A

1. **Ohm's law is true.**
   (a) **For metallic conductors at low temperature.**
   (b) **For conductors at high temperature.**
   (c) **For electrolytes when current passes through them.**
   (d) **For diode when current flows.**
2. **If the length of the potentiometer wire is increased, then the length of the previously obtained balance point will**
   (a) **Increase**
   (b) **Decrease**
   (c) **Remains unaffected**
   (d) **Becomes two times**
3. **When there is an electric current through a conducting wire along its length, then an electric field must exist**
   (a) **Outside the wire but parallel to it.**
   (b) **Outside the wire but normal to it**
   (c) **Inside the wire but parallel to it**
   (d) **Inside the wire but normal to it.**
4. **A cylinder of radius R and length L is placed in a uniform electric field E parallel to the cylinder axis. The total flux for the surface of the cylinder is given by**
   (a) $2\pi R^2 E$
   (b) $\pi R^2$
   (c) $\frac{\pi R^2 - \pi R}{E}$
   (d) **Zero**

5. **Total electric flux coming out of a unit positive charge kept in air is**
   - **(a)** $\varepsilon_0$
   - **(b)** $\varepsilon_0^{-1}$
   - **(c)** $1/4\pi\varepsilon_0$
   - **(d)** $4\pi\varepsilon_0$
6. **Which of the following statement is correct?**

   **If** $\int \vec{E}.\overrightarrow{dS} = 0$, **Over a surface, then**
   - **(a) The electric field inside the surface and on it is zero.**
   - **(b) The uniform electric field inside the surface is necessarily uniform**
   - **(c) The number of field lines entering the surface must be equal to the number of field lines leaving it.**
   - **(d) All charges must not necessarily be outside the surface.**
7. **A magnetic needle suspended parallel to a magnetic field requires 3 J of work to turn it through 60°. the torque needed to maintain the needle in this position will be**
   - **(a)** $3\sqrt{3}$ **J**
   - **(b)** $2\sqrt{3}$ **J**
   - **(c)** $\sqrt{3}$ **J**
   - **(d) 3 J**
8. **Domain formation is the necessary feature of**
   - **(a) Diamagnetism**
   - **(b) Paramagnetism**
   - **(c) Ferromagnetism**
   - **(d) All of these**
9. **A magnet can be completely demagnetized by**
   - **(a) Breaking the magnet into small pieces**
   - **(b) Heating it slightly**
   - **(c) Dropping it into ice cold water**
   - **(d) A reverse field of appropriate strength.**
10. **A positively charged particle is released from rest in an uniform electric field. The electric potential energy of the charge**
    - **(a) Remains constant because field is uniform**
    - **(b) Increases because the charge moves along the electric field**
    - **(c) Decreases because the charge moves along the electric field**
    - **(d) Decreases because the charge moves opposite to the electric field**

**11. The radii of two metallic spheres A and B are $r_1$ and $r_2$ respectively ($r_1 > r_2$). They are connected by a thin conducting wire and the system is given a certain charge. The charge will be greater**

**(a) On the surface of the sphere B.**

**(b) On the surface of the sphere A.**

**(c) Equal on both.**

**(d) Zero on both.**

**12. A parallel plate capacitor is connected with the terminals of a battery. The distance between the plates is 6 mm. if a glass plate (dielectric constant K = 9) of 4.5 mm is introduced between them, then the capacity will become**

**(a) 2 times**

**(b) The same**

**(c) 3 times**

**(d) 4 times**

**13. Two charges 5 nC and – 3 nC are located 16 cm apart. Electric potential will be zero at**

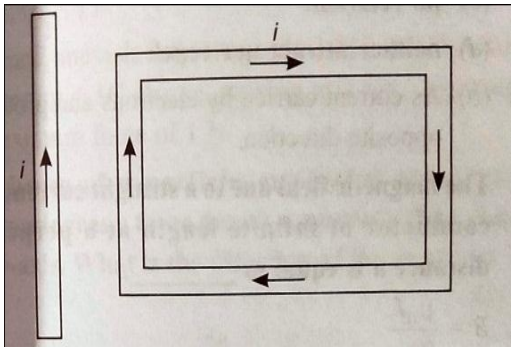
**(a) Only 10 cm from 5 nC**

**(b) Only 40 cm from 5 nC**

**(c) Both 10 cm and 40 cm from 5 nC**

**(d) Only 6 cm from -3 nC**

**14. In the figure shown, the loop will**




**(a) Rotate about an axis parallel to the wire.**

**(b) Move away from the wire or towards right.**

**(c) Move towards the wire.**

**(d) Remain stationary.**

**15. A solenoid is connected to a battery so that a steady current flows through it. If an iron core is inserted into the solenoid, The current will**

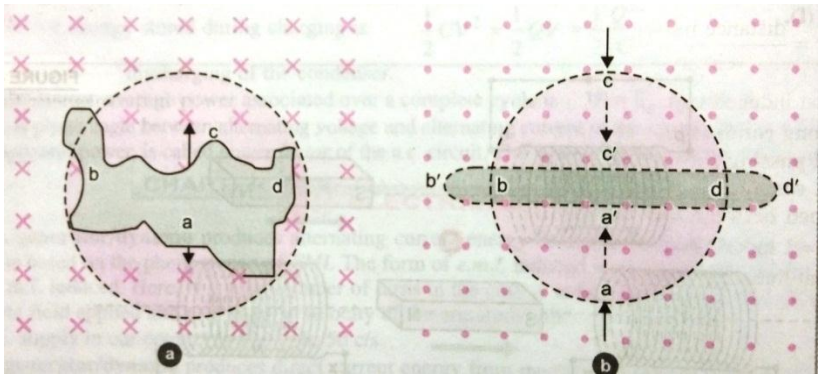
**(a) Increase**

**(b) Decrease**

**(c) Remain same**

**(d) First increase then decrease**

**16.**




**In the figures shown,**

**(a) A wire of irregular shape turning into a circular shape**

**(b) A circular loop being deformed into a narrow straight wire.**

**The direction of induced current in the coils a and b respectively are**

**(a) Clockwise in both**

**(b) Anticlockwise in both**

**(c) Clockwise in a and anticlockwise in b**

**(d) anticlockwise in a and clockwise in b**

**17. To reduce the resonant frequency in an LCR series circuit with a generator**

**(a) The generator frequency should be reduced**

**(b) Another capacitor should be added in parallel to the first**

**(c) The iron core of the inductor should be removed**

**(d) Dielectric in the capacitor should be removed**

**18. Which quantity is increased in a step down transformer?**

**(a) Current**

**(b) Voltage**

**(c) Power**

**(d) Frequency**

**19. In electromagnetic waves, the phase difference between electric and magnetic field vectors are**

**(a) Zero**

**(b) $\pi/4$**

**(c) $\pi$**

**(d) $\pi/2$**

**20. According to Maxwell, a changing electric field gives rise to**

**(a) An electric field**

**(b) An induced emf**

**(c) A magnetic field**

**(d) A magnetic dipole.**

# SECTION B

21. A conductor of length l is connected to a dc source of potential V. if the length of the conductor is tripled by gradually stretching it keeping V constant. How will

    (i) Drift speed of electrons,

    (ii) Resistance of the conductor be affected.

22. Justify your answer.

    (i) Define the term magnetic susceptibility and write its relation in terms of relative magnetic permeability.

    (ii) Two magnetic materials A and B have relative magnetic permeabilities of 0.96 and 500. Identify the magnetic materials A and B.

23. An electrical technician requires a capacitance of 2 µF in a circuit across a potential difference of 1 kV. A large number of 1 µF capacitors are available to him each of which can withstand a potential difference of not more than 400 V. Suggest a possible arrangement that requires the minimum number of capacitors.

24. Depict equipotential surfaces due to an isolated point charge. Why do the equipotential surfaces get closer as the distance between the equipotential surface and the source charge decreases?

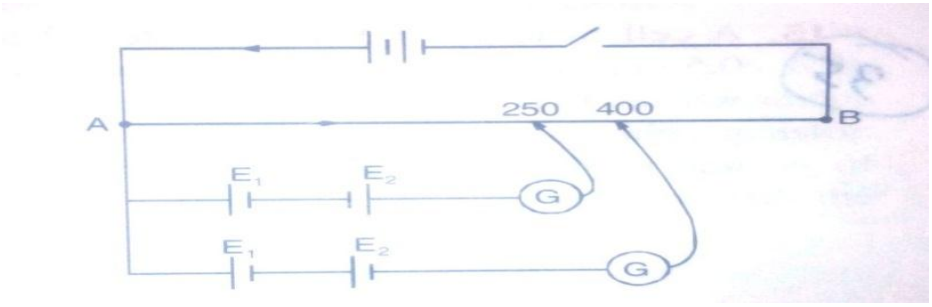
25. Describe briefly how a galvanometer can be converted into an ammeter.
    A galvanometer with a coil of resistance 15 $\Omega$ shows full scale deflection for a current of 4 mA. How will you convert the meter into an ammeter of range 0 to 6 A.

26. A lamp is connected in series with a capacitor. Predict your observations for dc and ac connections. What happens in each case if the capacitance of the capacitor is reduced?

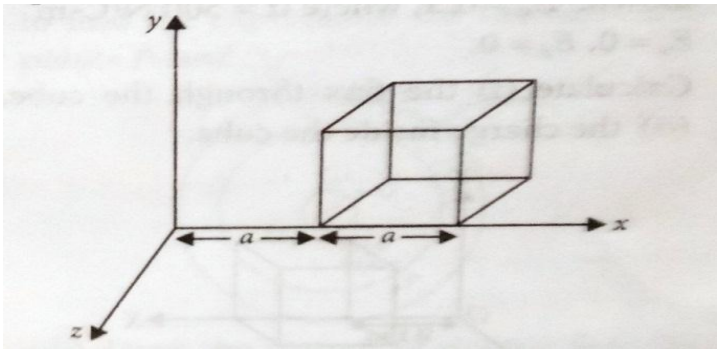
27. Light with an energy flux of 18 W/cm$^2$ falls on a non- reflecting surface at normal incidence. If the surface has an area of 20 cm$^2$, find the average force exerted on the surface during a 30 minute time span.

# SECTION C

28. A circuit using a potentiometer and battery of negligible internal resistance is set up as shown in figure. Two cells of emfs $E_1$ and $E_2$ are connected in series as shown in combinations 1 and 2. The balance points are obtained at 400 cm and 240 cm from the point A. Find
    i. The ratio $E_1/E_2$
    ii. Balancing length for the cell $E_1$ only.




29. State Gauss's law in electrostatics. A cube with each side 'a' is kept in an electric field given by $\vec{E} = 10x\hat{\imath}$. Find out
    (i) Electric flux through the cube.
    (ii) The net charge inside the cube. (Take a = 100 cm)




30. A proton, a deuteron and an alpha particle, are accelerated through the same potential difference and then subjected to a uniform magnetic field, perpendicular to the direction of their motions. Compare (i) their kinetic energies and (ii) if the radius of the circular path described by proton is 5 cm, determine the radii of the path followed by deuteron and alpha particle.
31. Derive an expression for the emf induced in a conductor of length l when it moves at v m/s perpendicular to a uniform magnetic field B.

A jet plane is travelling towards west at a speed of 1800 km/h. What is the voltage difference developed between the ends of the wing having a span of 25 m, if the Earth's magnetic field at the location has a magnitude of $5 \times 10^{-4}$ T and the dip angle is 30°.

32. Define the term 'eddy currents. State the main undesirable effect of these currents and give the method used to minimize this undesirable effect.
33. State the underlying principle of a moving coil galvanometer.
    Give two reasons to explain why a galvanometer cannot as such be used to measure the value of current in a given circuit.
34. Two identical metallic spherical shells A and B having charges +4Q and -10Q are kept at 3m apart. A third identical uncharged sphere C is first placed in contact with sphere A and then with sphere B, then spheres A and B are brought in contact and then separated to the same distance. Find
    (i) the final charge on the spheres A and B.
    (ii) initial and final force between A and B.(TAKE Q = 1μC)

# SECTION D

**35.**

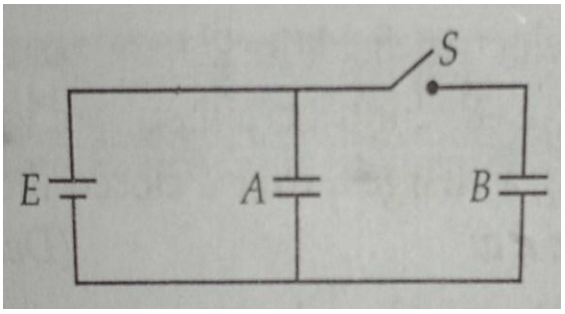
(a) Define EMF and terminal potential difference of a cell. Derive an expression for equivalent EMF and internal resistance of a combination of two cells connected in parallel.

(b) Define the term current density of a metallic conductor. Deduce the relation connecting current density and conductivity of the conductor, when an electric field is applied to it.

OR

(a) Obtain the expression for the energy stored per unit volume in a charged parallel plate capacitor.

*(b)* Two identical parallel plate capacitors A and B are connected to a battery of E volt with the switch S closed. The switch is now opened and the free space between the plates of the capacitors is filled with a dielectric of dielectric constant K. Find the ratio of the total electrostatic energy stored in both capacitors before and after the introduction of the dielectric.




36.

(a) Use biot savart's law to derive the expression for the magnetic field on the axis of a current carrying circular loop of radius R. Draw the magnetic field lines due to circular wire carrying current.

(b) Two identical coils, P and Q each of radius R, carrying currents 1 A and $\sqrt{3}$ A respectively, are placed concentrically and perpendicular to each other lying in XY and YZ planes. Find the magnitude and of the net magnetic field at the centre of the coils.

OR

(a) With the help of a labelled diagram, explain the principle and working of a transformer.

(b) A small town with a demand of 800kW of electric power at 220V is situated 15km away from an electric plant generating power at 440V. The resistance of the two wire line carrying power is 0.5Ω per km. The town gets power from the line through a 4000 – 220V step down transformer at a substation in the town.

(1) Estimate the line power loss,

(2) How much power must the plant supply,

Characterize the step up transformer at the plant.

37.

(a) An AC source is connected across a device X the voltage is found to lead current by π/2. When same source is connected across another device Y, the current is found to lead voltage by π/2. When both X and Y are connected together with the same source, then again voltage is found to lead current by π/2.

(i) Identify device X and Y.

(ii) Draw phasor diagram of all three situations.

(iii) Which out of X and Y have larger impedance?

(b) What do you mean by resonance in LCR circuit? Show the variation of impedance with frequency of applied source in LCR circuit.

OR

A- A coil is rotated with the help of a rotor with angular velocity w in a uniform magnetic field B.

B- A current carrying coil is placed in a uniform magnetic field.

(i) What will you observe in A and B?

(ii) Name the devices working of which is based on A and B.

(iii) Derive necessary expressions to discuss briefly the working of both devices.

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