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APJ PHYSICS TUITION POINT

SUBJECT: PHYSICS   **HALF TEST**   **MAX. MARKS: 70**

CLASS   : XII   **LESSON 1 to 5**   **TIME ALLOWED: 3.00 hrs**

PART-I

I. ANSWER ALL THE QUESTIONS.   [15X1=15]

1. Two points A and B are maintained at a potential of 7 V and -4 V respectively. The work done in moving 50 electrons from A to B is
   (a) 8.80×10^{-17} J   (b) -8.80×10^{-17} J   (c) 4.40×10^{-17} J   (d) 5.80×10^{-17} J

2. The force between two charges situated in air is F. The force between same charges if the distance between them is reduced to half and they are situated in a medium having dielectric constant 4 is
   (a) F/4   (b) 4F   (c) 16F   (d) F

3. If voltage applied on a capacitor is increased from V to 2V, choose the correct conclusion.
   (a) Q remains the same, C is doubled   (b) Q is doubled, C doubled
   (c) C remains same, Q doubled   (d) Both Q and C remain same

4. A piece of copper and another of germanium are cooled from room temperature to 80 K. The resistance of
   a) each of them increases   b) each of them decreases
   c) copper increases and germanium decreases   d) copper decreases and germanium increases

5. A wire of resistance 4 Ω is stretched to twice its original length. The resistance of stretched wire would be
   (a) 4 Ω   (b) 8 Ω   (c) 16 Ω   (d) 2 Ω

6. The internal resistance of a 2.1 V cell which gives a current of 0.2 A through a resistance of 10 Ω is   (a) 1.0 Ω   (b) 0.8 Ω   (c) 0.5 Ω   (d) 0.2 Ω

7. A thin insulated wire forms a plane spiral of N = 100 tight turns carrying a current I = 8 m A (milli ampere). The radii of inside and outside turns are a = 50 mm and b = 100 mm respectively. The magnetic induction at the center of the spiral is
   (a) 5 μT   (b) 7 μT   (c) 8 μT   (d) 10 μT

8. The current carrying power line carries current from west to east. The direction of magnetic field 1 m above the power line will be
   (a) east to west   (b) west to east   (c) south to north   (d) north to south

9. Two parallel wires each of length 0.1 m are lying at a distance of 1 m. If the current flowing in each wire is 1 A, then the force between them will be
   (a) 10^{-7} N   (b) 10^{-8} N   (c) 10^{-9} N   (d) 2 x 10^{-9} N

10. In a series resonant RLC circuit, the voltage across 100 Ω resistor is 40 V. The resonant frequency ω is 250 rad/s. If the value of C is 4 μF, then the voltage across L is
    (a) 600 V   (b) 4000 V   (c) 400V   (d) 1 V

11. An inductor 20 mH, a capacitor 50 μF and a resistor 40 Ω are connected in series across a source of emf v = 10 sin 340 t. The power loss in AC circuit is
    (a) 0.76 W   (b) 0.89 W   (c) 0.46 W   (d) 0.67 W

12. The unit of inductance is equivalent to
    (a) $\dfrac{\text{volt x ampere}}{\text{second}}$ (b) $\dfrac{\text{ampere}}{\text{volt x second}}$ (c) $\dfrac{\text{volt}}{\text{ampere x second}}$ (d) $\dfrac{\text{volt x second}}{\text{ampere}}$

13. Which of the following laws asserts that the electric field lines cannot from closed loops
    (a) Gauss's law   (b) Faraday's laws
    (c) Unmodified Ampere's law   (d) Modified ampere's law

14. An electric field $\overrightarrow{E}$ and magnetic field $\overrightarrow{B}$ exist in a region. If these fields are not perpendicular to each other, then the electromagnetic wave

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(a) will not pass through the region (b) will pass through region

(c) may pass through the region (d) nothing is definite

15. Which one of them is used to produce a propagating electromagnetic wave?.

 (a) an accelerating charge (b) a charge moving at constant velocity

 (c) a stationary charge (d) an uncharged particle

PART-II

II. ANSWER ANY SIX QUESTIONS. Q.No 18 is compulsory. **[6x2=12]**

16. Define 'electric flux'.

17. When two objects are rubbed with each other, approximately a charge of 50 nC can be produced in each object. Calculate the number of electrons that must be transferred to produce this charge.

18. In a meter bridge with a standard resistance of 15 Ω in the right gap, the ratio of balancing length is 3:2. Find the value of the other resistance.

19. Define temperature coefficient of resistance.

20. State Ampere's circuital law.

21. Compute the intensity of magnetisation of the bar magnet whose mass, magnetic moment and density are 200 g, 2 A m^2 and 8 g cm^{-3}, respectively.

22. State Lenz's law.

23. Mention the ways of producing induced emf.

24. Write a note on Infrared radiation.

PART-III

III. ANSWER ANY SIX QUESTIONS. Q. No 31 is compulsory. **[6x3=18]**

25. Obtain the expression for energy stored in the parallel plate capacitor.

26. Two conducting spheres of radius r_1 = 8 cm and r_2 = 2 cm are separated by a distance much larger than 8 cm and are connected by a thin conducting wire as shown in the figure. A total charge of Q = +100 nC is placed on one of the spheres. After a fraction of a second, the charge Q is redistributed and both the spheres attain electrostatic equilibrium.

27. Derive the expression for power P=VI in electrical circuit.

28. Two electric bulbs marked 20 W – 220 V and 100 W – 220 V are connected in series to 440 V supply. Which bulb will be fused?

29. Discuss the conversion of galvanometer into an ammeter.

30. State and explain Biot-Savart law.

31. The equation for an alternating current is given by i = 77 sin 314t. Find the peak value, frequency, time period and instantaneous value at t = 2 ms.

32. Mention the various energy losses in a transformer.

33. Discuss the source of electromagnetic waves.

PART-IV

IV. ANSWER ALL THE QUESTIONS. **[5X5=25]**

34. Explain how the emf of two cells are compared using potentiometer? [OR]

 Obtain an expression for the force on a current carrying conductor placed in a magnetic field.

35. What is an electric dipole? Derive an expression for electric field due to a dipole on its axial line.

 [OR] Define Hysterisis. Explain it with help of diagram.

36. Describe the microscopic model of current and obtain general form of Ohm's law. [OR]

 Explain the applications of eddy currents (or) Focault currents.

37. Write down the properties of electromagnetic waves. [OR]

 Show mathematically that the rotation of a coil in a magnetic field over one rotation induces an alternating emf of one cycle.

38. Explain the Maxwell's modification of Ampere's circuital law. [OR]

 State Gauss law. Obtain the expression for electric field due to an infinitely long charged wire.

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PART-I

I. ANSWER ALL THE QUESTIONS.   [15X1=15]

1. An electric dipole is placed at an alignment angle of 30° with an electric field of 2 x 10⁵ N C⁻¹. It experiences a torque equal to 8 N m. The charge on the dipole if the dipole length is 1 cm is

   (a) 4 mC   (b) 8 mC   (c) 5 mC   (d) 7 mC

2. The work done in moving 500 μC charge between two points on equipotential surface is

   (a) zero   (b) finite positive   (c) finite negative   (d) infinite

3. Two metallic spheres of radii 1 cm and 3 cm are given charges of -1 x 10⁻² C and 5 x 10⁻² C respectively. If these are connected by a conducting wire, the final charge on the bigger sphere is

   (a) 3×10^{-2} C   (b) 4×10^{-2} C   (c) 1×10^{-2} C   (d) 2×10^{-2} C

4. The temperature coefficient of resistance of a wire is 0.00125 per °C. At 300 K, its resistance is 1 Ω. The resistance of the wire will be 2 Ω at

   a) 1154 K   b) 1100 K   c) 1400 K   d) 1127 K

5. A toaster operating at 240 V has a resistance of 120 Ω. The power is

   a) 400 W   b) 2 W   c) 480 W   d) 240 W

6. In the case of insulators, as the temperature decreases, resistivity

   (a) decreases   (b) increases   (c) remains constant   (d) becomes zero

7. The period of revolution of a charged particle inside a cyclotron does not depend on

   (a) the magnetic induction   (b) the charge of the particle

   (c) the velocity of the particle   (d) the mass of the particle

8. A circular coil of radius 5 cm and 50 turns carries a current of 3 ampere. The magnetic dipole moment of the coil is

   (a) 1.0 amp – m²   (b) 1.2 amp – m²   (c) 0.5 amp – m²   (d) 0.8 amp – m²

9. An ideal voltmeter has

   (a) zero resistance   (b) finite resistance less than G but greater than Zero

   (c) resistance greater than G but less than infinity   (d) infinite resistance

10. The resonant frequency of a circuit of negligible resistance containing an inductance of 50 mH and a capacitance of 500 pF is

   (a) $\frac{10^5}{\pi}$ Hz   (b) $\frac{1}{\pi}$ (c) $\frac{100}{\pi}$ Hz   (d) $\frac{1000}{\pi}$ Hz

11. $\frac{20}{\pi^2}$ H inductor is connected to a capacitor of capacitance C. The value of C in order to impart maximum power at 50 Hz is

   (a) 50 μF   (b) 0.5 μF   (c) 500 μF   (d) 5 μF

12. Lenz's law is in accordance with the law of

   (a) conservation of charges   (b) conservation of flux

   (c) conservation of momentum   (d) conservation of energy

13. Which of the following is NOT true for electromagnetic waves?

   (a) it transport energy   (b) it transport momentum   (c) it transport angular momentum

   (d) in vacuum, it travels with different speeds which depend on their frequency

14. Which of the following is an electromagnetic wave?

   (a) α - rays   (b) β – rays   (c) γ - rays   (d) all of them

15. The dimensions of E/B are same as that of

   (a) charge   (b) current   (c) velocity   (d) acceleration

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PART-II

II. ANSWER ANY SIX QUESTIONS. Q.No 22 is compulsory.   [6x2=12]

16. What is electric dipole moment? Give its unit.

17. Consider a point charge +q placed at the origin and another point charge -2q placed at a distance of 9 m from the charge +q. Determine the point between the two charges at which electric potential is zero.

18. Distinguish between drift velocity and mobility.

19. State Joule's law of heating.

20. Define one ampere.

21. How the current sensitivity of galvanometer can be increased?

22. A closed coil of 40 turns and of area 200 cm^2, is rotated in a magnetic field of flux density 2 Wb m^{-2}. It rotates from a position where its plane makes an angle of 30° with the field to a position perpendicular to the field in a time 0.2 sec. Find the magnitude of the emf induced in the coil due to its rotation.

23. A capacitor blocks DC but it allows AC. Why?

24. What is meant by Fraunhofer lines?

PART-III

III. ANSWER ANY SIX QUESTIONS. Q. No 30 is compulsory.   [6x3=18]

25. List the properties of electric field lines.

26. A parallel plate capacitor filled with mica having εr = 5 is connected to a 10 V battery. The area of the parallel plate is 6 m^2 and separation distance is 6 mm. (a) Find the capacitance and stored charge.

27. An electric heater of resistance 10 Ω connected to 220 V power supply is immersed in the water of 1 kg. How long the electrical heater has to be switched on to increase its temperature from 30°C to 60°C. (The specific heat of water is s = 4200 J kg^{-1})

28. State and explain Kirchhoff's voltage rule.

29. Define Lorentz force. Give the properties of Lorentz magnetic force.

30. A coil of a tangent galvanometer of diameter 0.24 m has 100 turns. If the horizontal component of Earth's magnetic field is 25 × 10^{-6} T then calculate the current which gives a deflection of 60°.

31. Obtain an expression for Self-inductance of a long solenoid.

32. Define quality factor. Obtain an expression for it.

33. Write down the properties of electromagnetic waves.

PART-IV

IV. ANSWER ALL THE QUESTIONS.   [5X5=25]

34. Obtain the condition for bridge balance in Wheatstone's bridge.   [OR]
    Explain in detail the emission spectra and absorption spectra.

35. Explain in detail the construction and working of a Van de Graaff generator.   [OR]
    Deduce the relation for the magnetic induction at a point due to an infinitely long straight conductor carrying current.

36. Explain the determination of the internal resistance of a cell using voltmeter.   [OR]
    Derive an expression for phase angle between the applied voltage and current in a series RLC circuit.

37. Explain Maxwell equations in integral form.   [OR]
    Explain the working of a single-phase AC generator with necessary diagram.

38. What is an electric dipole? Derive an expression for electrostatic potential due to an electric dipole.
    [OR] Explain the principle and working of a moving coil galvanometer.