PHYSICS (054) (E)

QUESTION PAPER - 2

MARCH 2018

PHYSICS | STD. 12th | Time : 3 Hours | Total Mark : 100

PART - A : 50 Marsk • Part - B : 50 Marks

Time : 1 Hour | PART - A | Maximum Marks : 50

Instructions :

1. There are 50 objective type (M.C.Q.) question in Part-A and all questions are compulsory.
2. The questions are serially numbered from 1 to 50 and each carries 1 marks.
3. Read each question carefully, select proper alternative and answere in the O.M.R. Sheet.
4. The OMR sheet is given for answereing the questions. The answer of each question is represented by (A) ○, (B) ○, (C) ○, (D) ○. Darken the cricle ● of the correct answere with ball-pen.
5. Rough work is to be done in the space provided for this purpose in the Test Booklet only.
6. Set No. of Question paper on the upper-most right side of the Question paper is to be written in the column provided in the OMR sheet.
7. Student may use a calculator and log table, if necessary.

1. The dimension of permittivity $[\varepsilon_0]$ are _____. Take Q as the dimension of charge.

(A) $M^1 L^{-2} T^{-2} Q^{-2}$ (B) $M^{-1} L^2 T^{-3} Q^{-1}$ (C) $M^{-1} L^{-3} T^2 Q^2$ (D) $M^{-1} L^3 T^{-2} Q^{-2}$

2. When two spheres having 5Q and -Q charge are placed at a certain distance, the force acting between them is F. Now they are connected by a conducting wire and again separated from each other. How much force will act between them if the separation now is the same as before?

(A) F (B) $\frac{4}{5}$F (C) $\frac{5}{4}$F (D) $\frac{F}{8}$

3. When 10^{20} electrons are removed from a neutral metal plate through some process, the charge on it becomes _____

(A) −1.6 C (B) + 1.6 C (C) + 16 C (D) 10^{-19} C

4. What will be the magnitude of torque on an electric dipole having dipole moment of 4×10^{-9} cm placed in a uniform electric field of intensity of $5 \times 10^4 NC^{-1}$ making an angle 180^0 with the field.

(A) 10^{-4} N-m (B) 0 (zero) (C) 2×10^{-4} N-m (D) 10^{-6} N-m

5. A particle having mass 1 g and electric charge 10^{-8} C travels from a point A having electric potential zero to the point B having 600V electrical potential. What would be the change in its kinetic energy.

(A) -6×10^{-6} erg (B) -6×10^{-6} J (C) 6×10^{-6} J (D) 6×10^{-6} erg

6. Energy of a charged capacitor is U. Now it is removed from a battery and then is connected to another identical uncharged capacitor in parallel. What will be the total energy of two capacitors now ?

(A) $\frac{3U}{2}$ (B) U (C) $\frac{U}{4}$ (D) $\frac{U}{2}$

7. If a capacitor having capacitance of 1200 μF is charged at a uniform rate of 100 μC/s, what is the time required to increase its potential by 20 volts ?

(A) 500 S (B) 6000 S (C) 240 S (D) 120 S

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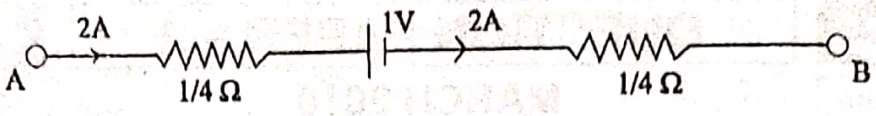
8. Figure shows a part of a closed circuit. If the current flowing through it is 2A. What will be the potential difference between points B to A ?



(A) + 2V (B) + 1V (C) −1V (D) −2V

9. The resistance of a 10m long potentiometer wire is 50Ω . It is connected in series with a 3V battery and 10Ω resistor. The potential difference between two points separated by distance 40 cm is equal to _____

(A) 0.02 V (B) 0.06 V (C) 0.1 V (D) 1.2 V

10. A wire is uniformly stretched to make its area of cross section $\frac{1^{th}}{n}$ times ($n > 0$). What will be its new resistance ?

(A) n^2 times (B) $\frac{1}{n^2}$ times (C) $\frac{1}{n}$ times (D) n times

11. If the current in an electric bulb increses by 2%, what will be the change in the power of a bulb? (Assume that the resistance of the filament of a bulb remains constant).

(A) decreases by 2% (B) decreases by 4% (C) increases by 2% (D) increases by 4%

12. An electron performs circular motion of radius r, perpendicular to a uniform magnetic field B The kinetic energy gained by this electron in one revolution is _____

(A) $\frac{1}{2}mv^2$ (B) $\frac{1}{4}mv^2$ (C) zero (D) $\pi rBeV$

13. There are 1000 turns per 5 cm length in a very long solenoid. It carries a current of 5A. The magnetic field at its centre on the axis is _____ T.

(A) 3.14×10^{-2} (B) 6.28×10^{-2} (C) 9.42×10^{-2} (D) 12.56×10^{-2}

14. The angular speed of the charged particle is independent of _____

(A) its mass (B) its linear speed (C) charge of particle (D) magnetic field

15. A charged particle is moving with velocity $\vec{v}$ in a uniform magnetic field $\vec{B}$. The magnetic force acting on it, will be maximum when _____

(A) $\vec{v}$ and $\vec{B}$ are in same direction

(B) $\vec{v}$ and $\vec{B}$ are in opposite direction

(C) $\vec{v}$ and $\vec{B}$ are mutually perpendicular

(D) $\vec{v}$ and $\vec{B}$ make an angle of 45^0 with each other.

16. Magnetic meridian is a plane _____

(A) Perpendicular to magnetic axis of Earth

(B) Perpendicular to geographic axis of Earth

(C) Passing through the magnetic axis of Earth

(D) Passing through the geographic axis

17. A straight steel wire of length l has magnetic moment m. If the wire is bent in the form of a semicircle, the new value of the magnetic dipole moment is _____

(A) m (B) $\frac{m}{\pi}$ (C) $\frac{m}{2}$ (D) $\frac{2m}{\pi}$

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18. A bar magnet of length l, pole strength 'p' and magnetic moment '$\vec{m}$' is split $\frac{l}{2}$ into two equal pieces each of length. The magnetic moment and pole strength of each piece is respectively _____ and _____

(A) $\vec{m}, \frac{p}{2}$ (B) $\frac{\vec{m}}{2}, p$ (C) $\frac{\vec{m}}{2}, \frac{p}{2}$ (D) $\vec{m}, p$

19. A toroid wound with 100 turns/m of wire carries a current of 3A. The core of toroid is made of iron having relative magnetic permeability of $\mu_r = 5000$ under given conditions. The magnetic field inside the iron is _____

(A) 0.15 T (B) 0.47 T (C) 1.5×10^{-2} T (D) 1.88 T

20. The radii of curvature of both the sides of a convex lens are 15 cm and if the refractive index of the material of the lens is 1.5. Then focal length of lens in air is _____ cm.

(A) 10 (B) 15 (C) 20 (D) 30

21. If the tube length of astronomical telescope is 105 cm and magnifying power is 20 for normal setting, then the focal length of the objective is _____ cm.
(Hint : Optical length of astronomical telescope is given by $L \geq f_0 + f_e$)

(A) 10 (B) 20 (C) 25 (D) 100

22. Stokes and antistokes lines observed in Raman scattering is due to _____ of light.
(A) reflection (B) elastic scattering
(C) inelastic scattering (D) dispersion

23. Energy of photon is $E = hf$ and its momentum is $P = \frac{h}{\lambda}$, where λ is the wavelength of photon with this assumption speed of light wave is _____

(A) $\frac{P}{E}$ (B) $\frac{E}{P}$ (C) EP (D) $\left(\frac{E}{P}\right)^2$

24. Photons of energy 1eV and 2.5 eV successively illuminate a metal whose work function is 0.5eV, the ratio of maximum speed of emitted electron is _____

(A) 1 : 2 (B) 2 : 1 (C) 3 : 1 (D) 1 : 3

25. The uncertainty in position of a particle is same as it's de Broglie wavelength, uncertainty in its momentum is _____

(A) $\frac{h}{\lambda}$ (B) $\frac{2h}{3\lambda}$ (C) $\frac{\lambda}{h}$ (D) $\frac{3\lambda}{2h}$

26. The mutual inductance of the system of two coils is 5mH. The current in the first coil varies accroding to the equation $I = I_0 \sin\omega t$, where $I_0 = 10A$ and $W = 100\pi$ rad/s. The value of maximum induced emf in the second coil is _____

(A) 2π V (B) 5π V (C) πV (D) 4π V

27. Current of 2A passing through a coil of 100 turns gives rise to a magnetic flux of 5×10^{-3} Wb Wb per turn. The magnetic energy associated with coil is _____

(A) 5×10^{-3} J (B) 0.5×10^{-3} J (C) 5 J (D) 0.5 J

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28. The flux linked per each turn of a coil of N turns changes from ϕ_1 and ϕ_2. If the total resistance of the circuit including the coil is R, the induced charge in the coil.

(A) $N\frac{(\phi_2-\phi_1)}{t}$ (B) $N\frac{(\phi_2-\phi_1)}{R}$ (C) $N\frac{(\phi_2-\phi_1)}{Rt}$ (D) $N(\phi_2-\phi_1)$

29. Current of $\frac{50}{\pi}$ Hz Hz frequency is passing through an A.C. circuit having series combination of resistance R = 100Ω and inductor L=1H, then phase difference between voltage and current is _____

(A) 60^0 (B) 45^0 (C) 30^0 (D) 90^0

30. A coil of inductance L and resistance R is connected to an A.C. source of V volt. If the angular frequencey of the A.C. source is equal to W rad s^{-1}, then the current in the circuit will be _____

(A) $\frac{V}{R}$ (B) $\frac{V}{L}$ (C) $\frac{V}{R+L}$ (D) $\frac{V}{\sqrt{R^2+W^2L^2}}$

31. For L-C-R A.C. circuit resonance frequency is 600 Hz and frequencies at half power points are 550 Hz and 650 Hz. What will be the Q-factor ?

(A) $\frac{1}{6}$ (B) $\frac{1}{3}$ (C) 6 (D) 3

32. In an A.C. circuit current is 2A and voltage is 220 V and power is 44 W power factor is _____

(A) 0.10 (B) 0.09 (C) 1.80 (D) 0.18

33. Two opposite charged particles oscillate about their mean equilibrium position in free space, with a frequency of 10^9 Hz. The wavelength of the corresponding electromagnetic wave produced is _____

(A) 0.3 m (B) $3\times10^{17}m$ (C) 10^9 m (D) 3.3 m

34. In the region closer to the oscillating charges, the phase difference between $\vec{E}$ and $\vec{B}$ fields is _____ and their magnitude quickly decreases as _____ with distance *r* from the source.

(A) $0, r^{-1}$ (B) $\frac{\pi}{2}, r^{-3}$ (C) $\frac{\pi}{2}, r^{-1}$ (D) $0, r^{-3}$

35. At room temperature, if the relative permittivity of water be 80 and the relative permeability be 0.0222, then the velocity of light in water is _____ ms^{-1}.

(A) 3×10^8 (B) 2.5×10^8 (C) 2.25×10^8 (D) 3.5×10^8

36. To determine the positions of a point like object precisely _____ light should be used.

(A) polarized (B) long wavelength
(C) short wavelength (D) intense

37. The angular spread of central maximum, in diffraction pattern, does not depend on _____

(A) the distance between the slit and sources (B) wavelength of light
(C) width of slit (D) frequency of light

38. A person finds that the sun rays reflected by the still surface of water in a lake are polarized. If the refractive index of water is 1.327, the sun will be seen at the angle of _____ with the horizon.

(A) 57^0 (B) 75^0 (C) 37^0 (D) 53^0

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39. The ratio of resolving power of telescope, when lights of wavelengths 4000 Å and 5000 Å are used, is _____
(A) 16 : 25 (B) 5 : 4 (C) 4 : 5 (D) 9 : 1

40. The radius of second orbit in an atom of hydrogen is R. What is its radius in third orbit ?
(A) 3 R (B) 2.25 R (C) 9 R (D) $\frac{R}{3}$

41. For the first orbit of hydrogen atom the minimum excitation potential is _____ V.
(A) 13.6 (B) 3.4 (C) 10.2 (D) 3.6

42. The operating voltage in coolidge tube is 10^5V. The speed of X-Rays produced is _____ ms^{-1}.
(A) 2×10^8 (B) 10^5 (C) 10^6 (D) 3×10^8

43. Out of Cd, molten Na - metal and graphite, which can be used respectively, as moderator, coolant and the material for control rods in a reactor ?
(A) molten Na-metal, graphite, Cd (B) graphite, molten Na-metal, Cd
(C) Cd, molten Na-metal, graphite (D) graphite, Cd, molten Na-metal

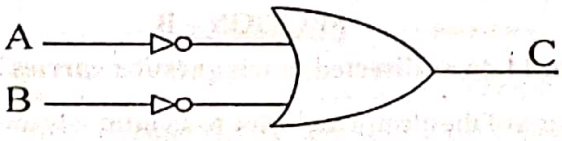
44. In the radioactive transformation ${}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}X_1 \rightarrow {}^{A-4}_{Z-1}X_2 \rightarrow {}^{A-4}_{Z}X_3$
Which are the successively emitted radioactive radiations ?
(A) β^-, α, β^- (B) α, β^-, β^- (C) β^-, β^-, α (D) α, α, β^-

45. The band gaps of a conductor, semiconductor and insulator are respectively Eg_1, Eg_2 and Eg_3. The relationship between them can be given as.
(A) $Eg_1 = Eg_2 = Eg_3$ (B) $Eg_1 > Eg_2 > Eg_3$ (C) $Eg_1 < Eg_2 < Eg_3$ (D) $Eg_1 < Eg_2 > Eg_3$

46. For detecting the light _____
(A) The photodiode has to be forward biased
(B) The photodiode has to be reverse biased
(C) The LED has to be connected in forward bias mode
(D) The LED has to be connected in a reverse bias mode.

47. A potential barrier of 0.50 V exists across of PN Junction. If the depletion region is 5.0×10^{-7} m wide, the intensity of the electric field in this region is _____
(A) 1.0×10^9 V/m (B) 1.0×10^6 V/m (C) 2.0×10^5 V/m (D) 2.0×10^6 V/m

48. The logic circuit shown in the figure represents characteristic of which logic gate ?



(A) OR gate (B) AND gate (C) NOR gate (D) NAND gate

49. For an efficient transmission of 100 MHz frequency, the minimum required length of antenna should be _____
(A) 3 m (B) $\frac{3}{4}$ m (C) 10 m (D) 100 m

50. The energy radiated from the antenna is proportional to _____
(A) λ (B) $\frac{1}{\lambda}$ (C) $\frac{1}{\lambda^2}$ (D) λ^2

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PART - B

Time : 2 Hours | MARCH-2018 - (054) (G) | Maximum Marks : 50

Instructions :

1. Write in a clear legible handwriting.
2. There are three section in part - B of the question paper and total 1 to 18 question are there.
3. All the questions are compulsory. Internal option are given.
4. The number at right side represent the marks of the question.
5. Start new section on new page.
6. Maintain sequence.
7. Pupils can use a calculator and log table, if necessary.

SECTION - A

• **Question Nos. 1 to 8 do as directed. Each question carries 2 marks.** [16]

1. Derive the formula for the electric potential energy of an electric dipole in a uniform electric field. [2]

2. Deduce the principle of potentiometer with the help of necessary circuit diagram. [2]

OR

2. Derive the expression to find the unknown resistance in the balanced condition of wheastone bridge.

3. Derive Newton's formula for thin lens. [2]

4. Explain Einstein's explanation for photoelectric effect. [2]

5. Deduce an equation $U = \frac{1}{2} LI^2$ for an inductor. [2]

OR

5. A conducting loop of radius r is placed concentric with another loop of a much larger radius R so that both the loops are coplanar. Find the mutual inductance of the system of the two loops. Take R >> r.

6. Give uses of polarization. [2]

7. What is meant by the average lfie of a radioactive element ? Obtain its formula. Write an equation of relation mean life time of radioactive element. [2]

8. Write a short note on P-type semiconductor. [2]

SECTION - B

• **Question Nos. 9 to 14 do as directed. Each question carries 3 marks.** [18]

9. Obtain the expression of the electric field due to an infinitely long linear charged wire along the perpendicular distance from the wire. [3]

10. Q amount of electric charge is residing on a conducting sphere having radius equal to R_1. This sphere is connected to another charge less conducting sphere of radius R_2 by a conducting wire. Calculate the electric charge on each of the spheres the two spheres are separated by a large distance. [3]

11. Obtain the formula for the Lorentz force on a moving electric charge. [3]

OR

11. A proton and a deuteron ion having the same kinetic energies enter a region of uniform magnetic field perpendicularly. Deuteron's mass is twice that of proton. Calculate the ratio of the radii of their circular paths.

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12. In Young's experiment a beam of light of wavelength 6500Å and 5200Å is used. Find the minimum distance from the central bright frings where bright frings produced by both the wavelength get superposed. The distance between two slits is 0.5 mm and the distance between the slits and the screen is 100 cm. [3]

13. Using Bohr's atomic model, derive an equation for radius of orbit of an electron. [3]

OR

13. Calculate the maximum wavelength of Balmer series in the hydrogen spectrum. Calculate the corresponding wave number.
$R = 1.097 \times 10^7 m^{-1}$

14. In a sphere of 10^2m radius, radioactive material emits β^- particles at the rate of $5 \times 10^7 s^{-1}$. If 40% of these emitted β^- particles escape from the sphere, how long would it take to raise the potential of the sphere from 0 to 16 V ? [3]
(Take $K = 9 \times 10^9$ SI unit)

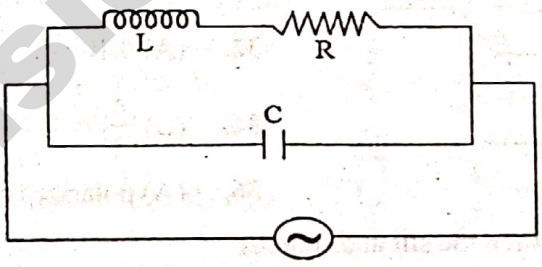
SECTION – C

• **Question Nos. 15 to 18 do as directed. Each question carries 4 marks.** [16]

15. A Battery having an emf of 12 volt and an internal resistance of 2Ω is connected is another battery having an emf of 18 volt and an internal resistance of 2Ω is such a way that they are opposing each other and the circuit is closed. Calculate the following. [4]
a. Current flowing in the circuit
b. Electrical power in the two batteries
c. Terminal voltage of the two batteries
d. Electrical power consumed in the batteries.

16. A real image obtained by a concave mirror is 4 times bigger than the object. If the object is displaced by 3 cm away from the mirror, the image size becomes 3 times the object size. Find the focal length of the mirror. [4]

17. Obtain the resonance angular frequency for the circuit shown in the figure. [4]



18. A change of 0.02 V takes place between the base and emitter when an input signal is connected to the CE transistor amplifier. As a result, 20μA change takes place in the base current and a change of 2mA takes place in the collector current. Calculate the following quantities : [4]
a. Input resistance
b. A.C. current gain
c. Transconductance
d. If the load resistance is 5Ω. What will be the voltage gain.

OR

18. Draw the circuit diagram of a half wave rectifier and full wave rectifier and explain the working of the circuit.

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QUESTION PAPER - 2 - SOLUTION (MARCH - 2018)

PART - A

1. (C) $M^{-1} L^{-3} T^2 Q^2$
2. (B) $\frac{4}{5}F$
3. (C) + 16 C
4. (B) 0
5. (B) -6×10^{-6} J
6. (D) $\frac{U}{2}$
7. (C) 240 S
8. (D) −2V
9. (C) 0.1 V
10. (A) n^2 times
11. (D) increases by 4%
12. (C) zero
13. (D) 12.56×10^{-2}
14. (B) its linear speed
15. (C) $\vec{v}$ and $\vec{B}$ are mutually perpendicular
16. (C) Passing through the magnetic axis of Earth
17. (D) $\frac{2m}{\pi}$
18. (B) $\frac{\vec{m}}{2}, p$
19. (D) 1.88 T
20. (B) 15
21. (D) 100
22. (C) inelastic scattering
23. (B) $\frac{E}{P}$
24. (A) 1 : 2
25. (A) $\frac{h}{\lambda}$
26. (B) 5π V
27. (D) 0.5 J
28. (B) $N\frac{(\phi_2 - \phi_1)}{R}$
29. (B) 45^0
30. (D) $\frac{V}{\sqrt{R^2 + W^2L^2}}$
31. (C) 6
32. (A) 0.10
33. (A) 0.3 m
34. (B) $\frac{\pi}{2}, r^{-3}$
35. (C) 2.25×10^8
36. (A) polarized
37. (A) the distance between the slit and sources
38. (C) 37^0
39. (B) 5 : 4
40. (B) 2.25 R
41. (C) 10.2
42. (D) 3×10^8
43. (B) graphite, molten Na-metal, Cd
44. (A) β^-, α, β^-
45. (C) $Eg_1 < Eg_2 < Eg_3$
46. (B) The photodiode has to be reverse biased
47. (B) 1.0×10^6 V/m
48. (D) NAND gate
49. (B) $\frac{3}{4}$ m
50. (C) $\frac{1}{\lambda^2}$

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