This Question Paper contains 20 printed pages.
(Part - A & Part - B)
Sl.No.

054 (E)

(FEBRUARY-MARCH, 2025)
(SCIENCE STREAM)
(CLASS - XII)

પ્રશ્ન પેપરનો સેટ નંબર બૉ-ની સામેનું વર્તુળ OMR શીટમાં ઘટ્ટ કરવાનું રહે છે.
Set No. of Question Paper, circle against which is to be darken in OMR sheet.

15

Part - A : Time : 1 Hour / Marks : 50
Part - B : Time : 2 Hours / Marks : 50

(Part - A)

Time : 1 Hour] *[Maximum Marks : 50*

Instructions :

1) **There are 50 objective type (M.C.Q.) questions in Part - A and all questions are compulsory.**
2) **The questions are serially numbered from 1 to 50 and each carries 1 mark.**
3) **Read each question carefully, select proper alternative and answer in the OMR sheet.**
4) **The OMR sheet is given for answering the questions. The answer of each question is represented by (A) O, (B) O, (C) O, (D) O. Darken the circle ● of the correct answer 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 printed on the upper-most right side of the Question Paper is to be written in the column provided in the OMR sheet.**
7) **Students may use a simple calculator and log-table, if necessary.**
8) **Notations used in this question paper have proper meaning.**
9) **For diagram/chart based questions, separate questions are given for visually impaired students. Only they have to attend them.**

1) Which wave is used in television communication system?

(A) Microwave

(B) Infrared wave

(C) Radio wave

(D) Ultraviolet

2) A radio can tune into any station in the 7.5 MHz to 12 MHz band. What is the corresponding wavelength band?

(A) 30m to 45m

(B) 15m to 30m

(C) 25m to 40m

(D) 20m to 35m

3) When light travelling from denser medium (n_2) to rarer medium(n_1). Where i is incidence angle & r is refracted angle which option is correct?

(A) $n_{21} > 1, r < i$

(B) $n_{21} < 1, r < i$

(C) $n_{21} > 1, r > i$

(D) $n_{21} < 1, r > i$

4) A small telescope has an objective lens of focal length 132 cm and the eye piece of focal length 6 cm. What is the magnifying power of the telescope?

(A) 24

(B) 32

(C) 22

(D) 20

5) In a Young's double slit experiment the slit are separated by 0.28mm and the screen is placed 2.5m away. The distance between the central bright fringe & the second bright fringe is measured to be 1.2cm. Determine the wavelength of light used in the experiment.

(A) 600 nm

(B) 500 nm

(C) 486 nm

(D) 672 nm

6) If unpolarized light is incident on polaroid, then intensity of emergent light is _____ of the intensity of incident light.

(A) Double

(B) Half

(C) Four times

(D) One fourth

7) Which phenomena cannot be explain by wave theory of light?

(A) Interference

(B) Polarisation

(C) Diffraction

(D) Photo-electric effect

8) The work function of Caesium is 2.14 eV. Find the threshold cut-off frequency for Caesium.

[$h = 6.63 \times 10^{-34}$ Js]

(A) 3.22×10^{33} Hz

(B) 3.22×10^{14} Hz

(C) 5.16×10^{15} Hz

(D) 5.16×10^{14} Hz

9) The photoelectric cut-off voltage in a certain experiment is 2V. What is the maximum kinetic energy of photoelectron emitted?

(A) 2.4×10^{-19} J

(B) 4×10^{-19} J

(C) 3.2×10^{-19} J

(D) 2×10^{-19} J

10) Which condition is satisfied for photoelectric effected in metal given below?

(A) Energy of incident photon ($h\nu$) is lesser than work function (ϕ_0) of metal

(B) Wavelength of incident light(λ) is greater than threshold wavelength (λ_0) of metal

(C) Frequency of incident light(ν) is greater than threshold frequency (ν_0) of metal

(D) $\lambda > \frac{hc}{\phi_0}$

11) Monochromatic light of frequency 6×10^{14} Hz is produced by a laser. The power emitted 2×10^{-3}W. How many photons per second on an average are emitted by the source?

[$h = 6.63 \times 10^{-34}$ Js]

(A) 3.98×10^{19}

(B) 1.99×10^{15}

(C) 3×10^{15}

(D) 5×10^{15}

12) In Geiger-Marsden experiment, when an α-particles is incident on thin gold foil. How much percentage of α-particles will be scattered more than 1°?

(A) 10%

(B) 90%

(C) 2.62%

(D) 0.14%

13) Ratio of radius of third and second orbits of Hydrogen atom is _____.

(A) 2/3

(B) 4/9

(C) 3/2

(D) 9/4

14) Potential energy of an electron in first excited state in hydrogen atom is _____eV.

(A) –3.4

(B) –6.8

(C) –10.2

(D) –13.6

15) A difference of 2.3 eV separates two energy levels in an atom. What is frequency of radiation emitted when the atom make a transition from the upper level to the lower level?

[$h = 6.63 \times 10^{-34}$ Js]

(A) 1.2×10^{14} Hz

(B) 5.6×10^{14} Hz

(C) 3.8×10^{14} Hz

(D) 1.6×10^{6} Hz

16) Chlorine has two isotopes having mass 34.98u & 36.98u. The relative abundances of these isotopes are _____ and _____ percentage respectively. The average mass of chlorine atom is 35.47u.

(A) 24.6, 75.4

(B) 70.5, 29.5

(C) 26.4, 73.6

(D) 75.4, 24.6

17) Complete the Nuclear fission equation given below.

$^{1}_{0}n + {}^{235}_{92}U \rightarrow {}^{236}_{92}U \rightarrow$ _____ + $^{94}_{38}Sr$ +_____.

(A) $^{144}_{56}Ba, 3\,^{1}_{0}n$

(B) $^{140}_{54}Xe, 2\,^{1}_{0}n$

(C) $^{133}_{51}Sb, 4\,^{1}_{0}n$

(D) $^{140}_{54}Xe, 3\,^{1}_{0}n$

18) The nuclides $^{3}_{1}H$ and $^{3}_{2}He$ are _____.

(A) Isotopes

(B) Isobar

(C) Isotones

(D) Isomer

19) When Atomic mass number (A) increase, then nuclear density is _____.

(A) Increase

(B) Remain constant

(C) Decrease

(D) Decrease for light element & increase for heavier element

20) Obtain approximately the ratio of the nuclear radii of the gold isotope $^{197}_{79}Au$ and the silver isotope $^{107}_{47}Ag$.

(A) 1.23

(B) 1.83

(C) 1.32

(D) 2.06

21) When a forward bias is applied to a p-n junction, it

(A) Raises the potential barrier

(B) Reduces the majority carrier current to zero

(C) Lower the potential barrier

(D) None of the above

22) Carbon, Silicon and Germanium have four valence electrons each. These are characterised by valence & conduction band separated by energy band gap respectively equal to $(Eg)_C$, $(Eg)_{Si}$ and $(Eg)_{Ge}$. Which of the following statement is true?

(A) $(Eg)_{Si} < (Eg)_{Ge} < (Eg)_C$

(B) $(Eg)_C > (Eg)_{Si} > (Eg)_{Ge}$

(C) $(Eg)_C < (Eg)_{Ge} > (Eg)_{Si}$

(D) $(Eg)_C = (Eg)_{Si} = (Eg)_{Ge}$

23) The approximate range of resistivity (ρ) in the metal is _____.

(A) 10^{-2} - 10^{-8} Ωm

(B) 10^{-5} - 10^{6} Ωm

(C) 10^{2} - 10^{8} Ωm

(D) 10^{11} - 10^{19} Ωm

24) For pure semiconductor, the energy required for electron to jump the forbidden band in Silicon(Si) is about _____ at room temperature.

(A) 1.1 eV

(B) 0.01 eV

(C) 0.72 eV

(D) 0.05 eV

25) Suppose a pure Si crystal has 5×10^{28} atom m^{-3}. It is doped by 1 ppm concentration of pentavalent As. The number of electron density is _____.
(Given that $n_i = 1.5 \times 10^{16}\ m^{-3}$)

(A) $5 \times 10^{28}\ m^{-3}$

(B) $4.5 \times 10^{9}\ m^{-3}$

(C) $5 \times 10^{16}\ m^{-3}$

(D) $5 \times 10^{22}\ m^{-3}$

26) An electron fall through a distance 2 cm in uniform electric field vertically upward & magnitude 2×10^4 N/C. What is the acceleration of electron in _____ m/s^2.

[$m_e = 9.11 \times 10^{-31}$ kg]

(A) 3.51×10^{15}

(B) Zero

(C) 1.9×10^{15}

(D) 2.9×10^{15}

27) Consider a uniform electric field $\vec{E} = 3 \times 10^3 \hat{i}$ N/C. What is the flux of this field through a square of 10cm on a side whose plane is parallel to the xy plane?

(A) 30 Nm^2/C

(B) Zero

(C) 15 Nm^2/C

(D) 60 Nm^2/C

28) An electric dipole is placed in non-uniform electric field $\vec{E}$. Electric dipole moment $\vec{P}$ is anti-parallel to electric field $\vec{E}$ then

(A) No net force on the dipole

(B) The net force on the dipole is in the direction of increasing field

(C) The dipole has a net force in the direction of decreasing field

(D) Force on dipole is perpendicular to electric field

29) A charge q placed at the center of one of the face of the cube, then electric flux linked with the cube is _____.

(A) q/ε_0

(B) $q/6\varepsilon_0$

(C) $q/2\varepsilon_0$

(D) $q/4\varepsilon_0$

30) The electrostatic force on a small sphere of charge $0.4\mu C$ due to another small sphere of charge $-0.8\mu C$ in air is 0.2 N. What is the distance between the two spheres?

(A) 12 m

(B) 0.12 m

(C) 1.2 m

(D) 0.012 m

31) If a body contains n_1 protons & n_2 electrons, the total amount of charge on the body is _____.

(A) $(n_1 - n_2)\, e$

(B) $n_1\, n_2\, e$

(C) $(n_2 - n_1)\, e$

(D) $(n_1 + n_2)\, e$

32) Dimension formula of capacitance

(A) $[M^1 L^2 T^4 A^{-2}]$

(B) $[M^{-1} L^{-2} T^{-4} A^2]$

(C) $[M^{-1} L^{-2} T^4 A^2]$

(D) $[M^1 L^2 T^{-4} A^{-2}]$

33) Which of the option is incorrect, when a charge is placed on conductor in the static situation?

(A) Inside the conductor electrostatic field is zero

(B) At the surface of charged conductor electrostatic field is normal to the surface at every point

(C) The interior of the conductor can have no excess charge

(D) Electrostatic potential is zero inside the conductor

34) Calculate the potential at a point P due to a charge of 4×10^{-7} C located 9 cm away.

(A) 4×10^{4} V

(B) 4×10^{-4} V

(C) 4×10^{5} V

(D) 4×10^{3} V

35) A 900 pF capacitor is charged by 100 V battery. The capacitor is disconnected from the battery & connected by another uncharge 900 pF capacitor. How much electrostatic energy is lost in this process?

(A) 2.25×10^{-6} J

(B) 1.125×10^{-6} J

(C) 4.5×10^{-6} J

(D) Zero

36) Three capacitors of capacitances 2μF, 3μF and 4μF are connected in parallel. What is the equivalent capacitance?

(A) $\frac{13}{12}\mu$F

(B) $9\,\mu$F

(C) $\frac{12}{13}\mu$F

(D) $12\,\mu$F

37) Option given below, who's resistivity decrease with increase in temperature.

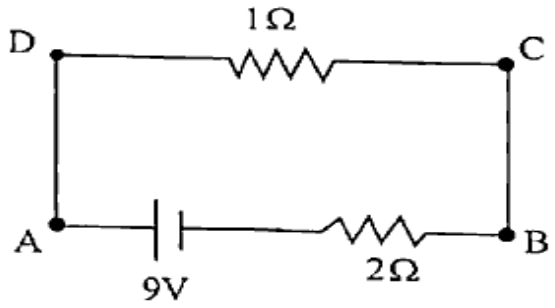
(A) Metal

(B) Alloy

(C) Semiconductor

(D) Insulator

38) As circuit shown in figure, potential difference between points A & B is $V_A - V_B =$ _____.



(A) 3V

(B) 6V

(C) –3V

(D) –6V

(Only for Blind Students)

38) A battery of emf 10V and internal resistance 3Ω is connected to a resistor of 17Ω. What is the current in the circuit?

(A) 0.5 A

(B) 0.5 μA

(C) 0.5 mA

(D) 5 A

39) A wire is stretch and its length is increase 100%. What is the increase in resistance?

(A) 100%

(B) 300%

(C) 200%

(D) 400%

40) Magnetic field intensity at any point on the axis of very long wire carrying current I is _____. (Radius of wire is 'r')

(A) $\frac{\mu_0 I}{2r}$

(B) $\frac{\mu_0 NI}{\pi r}$

(C) $\frac{\mu_0 I}{2\pi r}$

(D) Zero

41) Which physical quantity is derived with the ratio of current sensitivity to voltage sensitivity of a moving coil galvanometer?

(A) Electric current

(B) Resistance

(C) Energy

(D) Force

42) An electron entering with speed of 3×10^7m/s in uniform magnetic field : 6×10^{-4} T with an angle of 60°. What is the pitch of the helical path?

($m_e = 9.1\times10^{-31}$kg, $e = 1.6\times10^{-19}$C)

(A) 0.12 cm

(B) 100 m

(C) 89.3 cm

(D) 20 m

43) Two long and parallel straight wires A and B carrying current of 8A and 5A in the same direction are separated by a distance of 4cm Estimate the force on a 20cm section of wire A.

(A) 2×10^{-5} N

(B) 3×10^{-5} N

(C) 4×10^{-5} N

(D) 5×10^{-5} N

44) What is the correct relation between permeability of Ferromagnetic material(μ) and permeability of free space(μ_0)?

(A) $\mu < \mu_0$

(B) $\mu >> \mu_0$

(C) $\mu > \mu_0$

(D) $\mu + 1 < \mu_0$

45) Which one is incorrect unit for self-inductance?

(A) JA^{-2}

(B) WbA^{-1}

(C) VsA^{-1}

(D) NmA^{-1}

46) A pair of adjacent coil has a mutual inductance of 1.5H. If the current in one coil changes from 0 to 20A in 0.5sec. the induced emf in other coil is _____ V.

(A) 60

(B) 20

(C) 30

(D) 10

47) A closed loop with radius r is held stationary in the magnetic field between 10cm length of magnet north & south pole of two permanent magnets held fixed. Induced emf produced in ring is _____V.

(A) Bvl

(B) $10r$

(C) $\frac{\mu_0 I}{2r}$

(D) Zero

48) Magnetic field inside a current carrying long solenoid is 2×10^{-4}T. Magnetic energy stored per unit volume is _____.

(A) 3×10^{-2} Jm^{-3}

(B) 9.1×10^{-2} Jm^{-3}

(C) 1.6×10^{-2} Jm^{-3}

(D) 5.8×10^{-2} Jm^{-3}

49) In an AC circuit having only inductor, i is connected to v then

(A) Current lags behind the voltage by $\pi/2$

(B) Current lead the voltage by π

(C) Current lead the voltage by $\pi/2$

(D) Current lags the voltage by π

50) A light bulb is rated at 100W for a 220V supply. The resistance of the bulb is _____Ω.

(A) 242

(B) 222

(C) 184

(D) 311

054 (E)

(FEBRUARY-MARCH, 2025)
(SCIENCE STREAM)
(CLASS - XII)

(Part - B)

Time : 2 Hours] *[Maximum Marks : 50*

Instructions :

1) **Write in a clear legible handwriting.**
2) **There are three sections in Part - B (A, B & C) of the question paper and total 1 to 27 questions are there.**
3) **All the questions are compulsory. Internal options are given.**
4) **The numbers at right side represent the marks of the question.**
5) **Start new section on new page.**
6) **Maintain sequence.**
7) **Students may use a simple calculator and log-table, if necessary.**
8) **For diagram/chart based questions, separate questions are given for visually impaired students. Only they have to attend them.**

SECTION - A

■ **From the question nos. 1 to 12 given below, answer any 8 questions. (Each question carries 2 marks.)** **[16]**

1) Write any four general properties of electric field lines. **[2]**

2) Derive the formula of electrostatic potential energy of an electric dipole placed in uniform external electric field. **[2]**

(Only for Blind Students)

2) Explain and derive formula of electrostatic potential energy of system of two charges placed in external electric field. **[2]**

3) The resistance of the platinum wire of a platinum resistance thermometer at the ice point is 5Ω and at steam point is 5.23Ω. When the thermometer is inserted in a hot bath the resistance of the platinum wire is 5.795Ω. Calculate the temperature of the bath. **[2]**

4) A solenoid has a core of a material with relative permeability 400. The winding of the solenoid are insulated from the core and carry current of 2A. Calculate Magnetic field & Magnetisation. There are 1000 turns per meter in solenoid. **[2]**

5) A circular coil of radius 10cm, 500 turns and resistance 2Ω is placed with its plane perpendicular to the horizontal component of the earth's magnetic field. It is rotated about its vertical diameter through 180° in 0.5 s. Estimate the magnitudes of the emf and current induced in the coil. Horizontal component of the earth's magnetic field at the place is 3×10^{-5}T. **[2]**

6) In actual transformers, small energy losses do occur. Give reason for it. [2]

7) In a plane electromagnetic wave, the electric field oscillates sinusoidally at a frequency of 2×10^{10} Hz and amplitude 39V/m. [2]
   a) What is the wavelength of the wave?
   b) What is the amplitude of the oscillating magnetic field?

8) Using Huygen's principle, explain reflection of a plane wave by a plane reflecting surface. [2]

(Only for Blind Students)

8) Obtain the formula of intensity if the path difference at a point from two coherent sources is ϕ. [2]

9) What is the de Broglie wavelength associated with [2]
   a) an electron moving with a speed of 5.4×10^6 m/s
   b) a ball of mass 150g travelling at 30 m/s?

10) State any two postulates of Bohr model of atom. [2]

11) Write the equation of Proton-Proton cycle with energy value occur in Sun. [2]

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

(Only for Blind Students)

12) Write any two differences between P-type & N-type semiconductors. [2]

SECTION - B

■ **From the question nos. 13 to 21 given below, answer any 6 questions. (Each question carries 3 marks.)** [18]

13) Derive the equation of capacitance for parallel plate capacitor. [3]

(Only for Blind Students)

13) When dielectric is inserted between the parallel plate capacitor then explain the effect of dielectric of capacitance of capacitor. [3]

14) Obtain the formula for equivalent emf and equivalent internal resistance of a parallel combination of two cells of emf ε_1 and ε_2 and internal resistance r_1 and r_2 respectively. [3]

15) The magnetic moment of the coil is $10Am^2$. The coil is placed in a vertical plane and is free to rotate about a horizontal axis which coincides with its diameter. A uniform magnetic field of 2T in the horizontal direction exists such that initially the axis of the coil is in the direction of the field. The coil rotates through an angle of 90° under the influence of the magnetic field. [3]
   a) What are the magnitudes of the torque on the coil in the initial & final position?
   b) What is the angular speed acquired by the coil when it has rotated by 90°? The moment of inertia of the coil is 0.1 kg m^2.

16) Draw the figure of AC generator. Explain the construction & working procedure. Derive induced emf. [3]

(Only for Blind Students)

16) What is self-inductance? Derive the emf of self-inductance. Why it is known as Back emf? [3]

17) A series LCR circuit connected to a variable frequency 230V source L = 5H, C = 80μF and Resistance R = 40Ω. [3]
   a) Determine the source frequency which drive the circuit in resonance.
   b) Obtain the impedance of the circuit & amplitude of current at the resonating frequency.
   c) Determine the rms potential drop across the three elements of the circuit.

18) Derive Lensmaker's formula for a thin convex lens with appropriate ray diagram. [3]

(Only for Blind Students)

18) A tank is filled with water to a height of 12.5cm. The apparent depth of a needle lying at the bottom of the tank is measured by a microscope to be 9.4cm. What is the refractive index of water? If water is replaced by a liquid to refractive index 1.63 up to the same height, by what distance would the microscope have to be moved to focus on the needle again? [3]

19) In Young's double slit experiment using monochromatic light of wavelength λ, the intensity of light at a point on the screen where path difference is λ, is K units. What is the intensity of light at a point where path difference is λ/3? [3]

20) What is Photon? Write the characteristics of Photons. [3]

21) It is found experimentally that 13.6eV energy is required to separate a hydrogen atom into a proton and an electron. Compute the orbital radius and the velocity of the electron in a hydrogen atom. [3]

SECTION - C

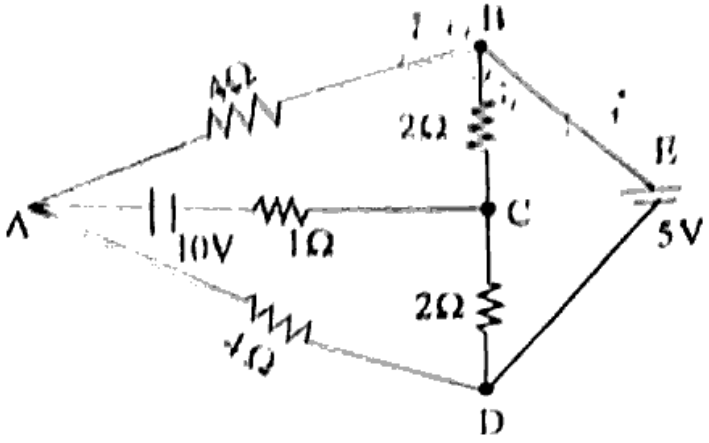
■ **From the question nos. 22 to 27 given below, answer any 4 questions. (Each question carries 4 marks.)** **[16]**

22) a) A polythene piece rubbed with wool is found to have a negative charge of 3×10^{-7}C. [4]
   i) Estimate the number of electrons transferred (from which to which)
   ii) Is there a transfer of mass from wool to polythene?

   b) i) Two insulated charged copper sphere A & B have their centres separated by a distance 50cm. What is the mutual force of electrostatic repulsion if the charge on each is 6.5×10^{-7}C? The radii of A & B are negligible compared to the distance of separation.

   ii) What is the force of repulsion if each sphere is charged double the above amount and the distance between them is halved?

(23) Determine the current in each branch of the network as shown in figure. [4]



(Only for Blind Students)

23) Estimate the average drift speed of conduction electron in a copper wire of length 3m and a cross-section area $1.0\times10^{-7}m^2$ carrying a current 1.5A. Assume that each copper atom contributes roughly one conduction electron. The density of copper is $9\times10^3kg/m^3$ & its atomic mass is 63.5u. How much time does an electron take to drift from one end of a wire to its other end. [4]

24) For AC circuit with only capacitor, derive the equation of current & also find average power. [4]

25) An object is placed at (i) 10cm (ii) 5cm in front of a concave mirror of radius of curvature 15cm. Find the position, nature and magnification of the image in each case. [4]

26) The fission properties of $^{239}_{94}Pu$ are very similar to those of $^{235}_{92}U$. The average energy released per fission is 180 MeV. How much energy in MeV is released if all the atoms in 1 kg of pure $^{239}_{94}Pu$ undergo fission. [4]

27) Explain half wave rectification with the help of proper circuit diagram and draw the waveform of input AC and output voltage. [4]

(Only for Blind Students)

27) Difference between Forward bias & Reverse bias for p-n junction diode. [4]
[write four points each]