This Question Paper contains 20 printed pages.
(Part - A & Part - B)

Sl.No.

054 (E)

(MAY, 2021)
SCIENCE STREAM
(CLASS - XII)
(New Course)

પ્રશ્ન પેપરનો સેટ નંબર જેની સામેનું વર્તુળ OMR શીટમાં ઘટ્ટ કરવાનું રહે છે.

Set No. of Question Paper, circle against which is to be darken in OMR sheet.

01

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 O.M.R. 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 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.

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1) Electric force between electron and proton separated by a distance of 1 mm is, $F_e =$ _____ N. $\left[K=\frac{1}{4\pi\varepsilon_0}\right]$

Rough Work

(A) $-10^6\ Ke^2$

(B) $-10^{-6}\ Ke^2$

(C) $-10^{-3}\ K^2e$

(D) $-10^{-3}\ Ke^2$

2) Dimension of electric-Flux is _____.

(A) $M^1 L^{-3} T^3 A^{-1}$

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

(C) $M^1 L^{-3} T^{-3} A^{-1}$

(D) $M^1 L^3 T^{-3} A^{-1}$

3) If a body contains n_1 protons and 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) $(n_1 + n_2)\, e^2$

4) From which of the following molecules given below have a permanent electric dipole moment, even in the absence of an electric field?

(A) CO_2

(B) CH_4

(C) H_2O

(D) O_2

5) For any charge configuration equipotential surface through a point is _____ to the electric field at that point.

(A) Normal

(B) Parallel

(C) In a direction making an angle of 45°

(D) In a direction making an angle of 60°

Rough Work

6) A particle having charge 'q' is accelerated by a potential difference ΔV, it would gain energy of _____.

(A) $q\,\Delta V$

(B) $q^2\,\Delta V$

(C) $q\,\Delta V^2$

(D) $q^2\,\Delta V^2$

7) Resultant force and resultant torque acting on a electric dipole kept in a uniform electric field are $\vec{F}$ and $\vec{\tau}$ then;

(A) $\vec{F}=0;\ \vec{\tau}=0$

(B) $\vec{F}=0;\ \vec{\tau}\neq 0$

(C) $\vec{F}\neq 0;\ \vec{\tau}=0$

(D) $\vec{F}\neq 0;\ \vec{\tau}\neq 0$

8) In a parallel plate capacitor, area of each plate $A = 1m^2$ and the distance between two plates d = 1mm, then capacitance of a capacitor C = _____ F.

(A) 8.85×10^{-6}

(B) 8.85×10^{-9}

(C) 8.85×10^{-12}

(D) 8.85×10^{-15}

9) According to Ohm's law, Electric current (I), passing through the conductor is increasing in such a way that dimension of conductor and temperature remains constant, then Resistance of conductor (R) _____.

(A) Increases

(B) Decreases

(C) Remains constant

(D) Initially decreases then after increases

Rough Work

10) Resistance of conducting wire is 'R', it is divided into 10 equal parts. Now, All these parts are connected in parallel. Effective resistance of the connection is _____ .

(A) 10 R

(B) $\frac{R}{10}$

(C) 100 R

(D) $\frac{R}{100}$

11) The device having power 'P' and voltage 'V'. The connecting wires from the power station to the device has a finite resistance R_c. The power dissipated in the connecting wires P_c = _____.

(A) $\frac{P^2 R_c}{V^2}$

(B) $\frac{P R_c^2}{V}$

(C) $\frac{V^2 R_c}{P}$

(D) $\frac{V R_c}{P^2}$

12) _____ is used to measure electromotive force (emf) of a cell.

(A) Ammeter

(B) Voltmeter

(C) Potentiometer

(D) Wheatstone bridge

13) Dimension of mobility (μ) is _____.

(A) $M^1 L^3 T^{-4} A^{-1}$

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

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

(D) $M^1 L^4 T^{-3} A^{-1}$

Rough Work

14) There is a coil of 100 turns having radius 10cm and carrying a current of 1A. The magnitude of magnetic field at the centre of a coil is _____ T.

(A) $\pi \times 10^{-4}$

(B) $\frac{\pi}{2} \times 10^{-4}$

(C) $2\pi \times 10^{-4}$

(D) $4\pi \times 10^{-4}$

15) A solenoid of length 0.5m has a radius of 1cm and is made up of 500 turns. If the magnitude of magnetic field inside the solenoid is 6.28×10^{-3} T then it carries a current of _____ A.

(A) 2

(B) 5

(C) 4

(D) 10

Rough Work

16) Parallel currents _____ and antiparallel currents _____

(A) attract, repel

(B) repel, attract

(C) attract, attract

(D) repel, repel

17) In the magnetic meridian of a certain place, the horizontal component of the earth's magnetic field is 0.26G and the magnetic field of the earth at this location is 0.52G. Then the dip angle is _____ .

(A) 30°

(B) 45°

(C) 60°

(D) 90°

18) According to Gauss's law for magnetism, the net magnetic flux through any closed surface is _____ .

(A) Zero

(B) Infinite

(C) Equal to ε_0

(D) Equal to μ_0

19) The materials, which are used to make permanent magnets _____ retentivity and _____ coercivity.

(A) low, high

(B) low, very low

(C) high, very low

(D) high, high

Rough Work

20) Unit of Induced emf is _____.

(A) Weber/Second

(B) Volt/Second

(C) Tesla

(D) Henry

21) One conducting wire of length 50cm is moving perpendicular to uniform magnetic field of 0.2 T, with constant velocity of $10ms^{-1}$. emf induced between two ends of a wire is _____ V.

(A) 0.01

(B) 0.1

(C) 1.0

(D) 10

22) AC Generator converts _____ energy into _____ energy.

(A) Electrical, Mechanical

(B) Light, Mechanical

(C) Mechanical, Electrical

(D) Electrical, Light

Rough Work

23) A light bulb is rated at 100W for a 220V supply. The resistance of the bulb is _____ Ohm.

(A) 220

(B) 440

(C) 484

(D) 2200

24) Formula of Q-factor (Quality factor) is Q = _____ .

(A) $\frac{\omega_0 R}{L}$

(B) $\frac{R}{\omega_0 L}$

(C) $\frac{L}{\omega_0 R}$

(D) $\frac{\omega_0 L}{R}$

25) For Ideal step down transformer,

(A) $V_S > V_P$ and $I_S < I_P$

(B) $V_S > V_P$ and $I_S > I_P$

(C) $V_S < V_P$ and $I_S < I_P$

(D) $V_S < V_P$ and $I_S > I_P$

Rough Work

26) _____ waves are sometimes referred to as heat waves.

(A) Infrared

(B) Ultraviolet

(C) Gamma

(D) Radio

27) The amplitude of the magnetic field of electromagnetic wave is 510 nT, then amplitude of the electric field of this wave is _____ Vm^{-1}.

(A) 1.7×10^{-6}

(B) 153

(C) 1.53×10^{-7}

(D) 170

28) Lower half of the concave mirror's reflecting surface is covered with an opaque (non-reflective) material. The intensity of the image of an object placed in front of the mirror becomes _____ .

(A) One fourth

(B) Half

(C) Four times

(D) Double

Rough Work

29) The refractive index of the material of the core in an optical fibre is _____ that of the cladding.

(A) less than

(B) half to

(C) equal to

(D) higher than

30) If the focal length of converging lens is 0.25m then power of this lens is _____ dioptre.

(A) +4

(B) −4

(C) +2

(D) −2

31) The earth takes 24 h to rotate once about its axis. How much time does the sun take to shift by 2° when viewed from the earth?

(A) 4 min

(B) 8 min

(C) 2 min

(D) 1 min

32) In Young's double slit experiment, as the width of the source slit is increased,

(A) There is no effect on interference fringe pattern

(B) Interference fringe pattern gets more and more sharp

(C) Interference fringe pattern gets less and less sharp

(D) Intensity of interference fringe pattern increases

Rough Wor

33) In a two slit experiment, screen is placed one meter away. When light of wavelength 500nm is used the fringe separation is 0.5mm. The distance between two slit is _____ mm.

(A) 1

(B) 5

(C) 2

(D) 0.2

34) If the phase difference between two waves is 6π radian, then corresponding path difference is _____ .

(A) 2λ

(B) λ

(C) 6λ

(D) 3λ

35) Intensity of a resultant wave obtained by superposition of two waves is _____ amplitude of resultant wave.

(A) directly proportional to square of

(B) directly proportional to

(C) directly proportional to cube of

(D) directly proportional to square root of

36) Electron emission from metals like zinc, cadmium, magnesium responded only to _____ light.

(A) Infrared

(B) Ultraviolet

(C) Visible

(D) Yellow

Rough Work

37) For a given frequency of incident radiation, stopping potential _____ .

(A) is directly proportional to intensity

(B) is inversely proportional to intensity

(C) does not depend on intensity

(D) is inversely proportional to square of intensity

38) The slope of a graph of stopping potential versus frequency of incident radiation is _____

(A) $\frac{h}{e}$

(B) h

(C) e

(D) $\frac{e}{h}$

(where h = Planck's constant and e = charge of an electron)

39) Which of the following physical quantity is having same unit as Planck's constant?

(A) Linear momentum

(B) Angular momentum

(C) Moment of Inertia

(D) Rotational kinetic energy

40) De- Broglie wavelength of a bullet of mass 0.040kg travelling at the speed of 1km/s is _____ m.

(A) 1.1×10^{-32}

(B) 4.04×10^{-24}

(C) 1.7×10^{-35}

(D). 3×10^{-32}

41) The energy equivalent to 1gram (g) substance is _____ J.

(A) 9×10^{13}

(B) 9×10^{10}

(C) 9×10^{7}

(D) 9×10^{8}

Rough Work

42) Total energy and kinetic energy of an electron in hydrogen atom are E and K respectively then,

(A) $K = \frac{E}{2}$

(B) $K = -E$

(C) $K = 2E$

(D) $K = E$

43) Which of the following series is not seen in Infra-red region for hydrogen spectrum?

(A) Bracket

(B) Pfund

(C) Lyman

(D) Paschen

44) Ionisation energy of an electron in third excited state for hydrogen atom is _____ eV

(A) 0.85

(B) 1.51

(C) 13.6

(D) 3.4

Rough Work

45) $^{198}_{80}Hg$ and $^{197}_{79}Au$ are examples of

(A) Isobars

(B) Isomers

(C) Isotopes

(D) Isotones

46) 1 mCi = _____ Bq

(A) 3.7×10^{10}

(B) $\frac{1}{3.7} \times 10^{-10}$

(C) 3.7×10^{4}

(D) 3.7×10^{7}

47) Half life of certain radioactive element is 12 years. If its initial activity is I_0, what is it's activity after 48 years?

(A) $\frac{I_0}{2}$

(B) $\frac{I_0}{4}$

(C) $\frac{I_0}{8}$

(D) $\frac{I_0}{16}$

Rough Work

48) In a curve of binding energy per nucleon versus mass number (A), the maximum value of E_{bn} is 8.75MeV/nucleon the value of corresponding atomic mass number is _____.

(A) 238

(B) 235

(C) 56

(D) 171

49) In intrinsic semi conductor, the number density of free electron is n_e and the number density of holes is n_h then _____.

(A) $n_e = n_h$

(B) $n_e = 2n_h$

(C) $n_e >> n_h$

(D) $n_e << n_h$

50) In an unbiased p-n junction, holes diffuse from the p-region to n-region because,

(A) Free electrons in the n-region attract them

(B) They move across the junction by the potential difference

(C) Hole concentration in p-region is more as compared to n-region

(D) All the above

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(Part - B)

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

Instructions :

1) Write in a clear legible handwriting.
2) There are three sections in Part - B of the question paper and total 1 to 27 questions are there.
3) Separate instruction is given in each section. Read it carefully and answer accordingly.
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.

SECTION - A

■ Answer any eight questions from the following question No. 1 to 12. (2 marks each) [16]

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

2) Obtain the equation of energy stored in capacitor, $W=\frac{Q^2}{2C}$ [2]

3) Write only statements of Kirchhoff's Junction rule and loop rule. [2]

4) Define magnetisation. Write its formula. Also write its unit and dimension. [2]

5) Write Lenz's law. Explain in brief that it is a specific statement of law of conservation of energy. [2]

6) By Drawing LC circuit diagram, obtain the differential equation for LC oscillations. [2]

7) Write four characteristics of Electromagnetic waves. [2]

8) Obtain the equation of effective focal length for combination of thin lenses in contact. [2]

9) Explain Huygens principle for plane wavefront. [2]

10) The photoelectric cut-off voltage in a certain experiment is 1.5V. What is the maximum kinetic energy of photoelectrons emitted? [2]

11) Write two postulates of Bohr's theory. [2]

12) Suppose a pure Si crystal has 5×10^{28} atoms m^{-3}. It is doped by 1ppm concentration of pentavalent As. Calculate the number of electrons and holes. Given that, $n_i = 1.5 \times 10^{16} m^{-3}$. [2]

SECTION - B

■ **Answer any six questions from the following question No. 13 to 21. (3 marks each)** [18]

13) Two charges 3×10^{-8} C and -2×10^{-8}C are located 15cm apart. At what point on the line joining the two charges is the electric potential zero? Take the potential at infinity to be zero. [3]

14) Drift velocity of an electron passing through conductor is given by equation,

$v_d = -\frac{eE}{m}\tau$. By accepting this equation obtain the equation of conductivity,

$\sigma = \frac{ne^2}{m}\tau$. [3]

15) The moving coil meters, M_1 and M_2 have the following particulars : [3]

$R_1 = 10\Omega, N_1 = 30$
$A_1 = 3.6 \times 10^{-3} m^2, B_1 = 0.25T$
$R_2 = 14\Omega, N_2 = 42$
$A_2 = 1.8 \times 10^{-3} m^2, B_2 = 0.50T$
(The spring constants are identical for the two meters)
Determine the ratio of

a) Current sensitivity and
b) Voltage sensitivity of M_2 and M_1

16) Show that in the free oscillations of an LC circuit, the sum of energies stored in the capacitor and the inductor is constant in time. [3]

17) A beam of light converges at a point P. Now lens is placed in the path of the convergent beam 12cm from P. At what point does the beam converge if the lens is [3]

a) a convex lens of focal length 20cm and
b) a concave lens of focal length 16cm?

18) In a double-slit experiment the angular width of a fringe is found to be 0.2° on a screen placed 1m away. The wavelength of light used is 600nm. What will be the angular width of the fringe if the entire experiment apparatus is immersed in water? Take refractive index of water to be $\frac{4}{3}$. [3]

19) It is found experimentally that 13.6 eV 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]

20) How long can an electric lamp of 100W be kept glowing by fusion of 2kg of deuterium? Take the fusion reaction as

$${}_1^2H + {}_1^2H \rightarrow {}_2^3He + n + 3.27\,MeV\,.$$ [3]

21) Explain Half wave rectifier with necessary circuit diagram. Draw the graphs of Input and Output voltage versus time. [3]

SECTION - C

■ **Answer any four questions from the following question No. 22 to 27. (Each question carries 4 marks)** [16]

22) For Electric dipole,
   a) At any point on the axis
   b) At any point on the equatorial plane
   obtain the equations of an electric field. [4]

23) Obtain the equation of magnetic field on the axis of a circular current loop at a distance 'x' from the centre of the loop. Also, write the equation of magnetic field at the centre of the loop. [4]

24) Discuss AC voltage applied to a capacitor in details. Also obtain an equation of instantaneous power supplied to the capacitor. [4]

25) In case of a triangular glass prism, obtain $\delta = i + e - A$. Mention the condition of minimum deviation angle and obtain the equation of refractive index of the material of prism. [4]

26) For diffraction by a single slit obtain the conditions of maxima and minima in terms of path difference. [4]

27) For radioactive decay, obtain exponential law. Draw the graph of number of undecayed nuclei versus time. [4]