

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

Sl.No.

054 (E)

(MARCH / APRIL, 2015)

Part - A : Time : 1 Hour / Marks : 50

Part - B : Time : 2 Hours / Marks : 50

ગ્રાન્ટ પેપરનો સેટ નંબર Set No. of Question Paper:
09

(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 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) Pupil's are use a calculator and log table as necessary.

-
- 1) Find equivalent force constant of series combination of two springs having force constant K_1 and K_2 .

Rough Work

(A) $\frac{K_1 K_2}{K_1 + K_2}$

(B) $K_1 + K_2$

(C) $\frac{K_1 + K_2}{K_1 K_2}$

(D) $\frac{K_1}{K_2}$

- 2) The amplitude of an oscillator performing damped oscillation becomes $1/e$ times of the initial amplitude in time _____.

Rough Work

- (A) $2m/b$
- (B) $m/2b$
- (C) $e^{-bt/2m}$
- (D) $e^{2m/b}$

- 3) The maximum velocity and maximum acceleration of a particle performing S.H.M. are 1m/s and 3.14 m/s^2 respectively. The Frequency of oscillation for this particle is _____.

- (A) 3.14 s^{-1}
- (B) 0.5 s^{-1}
- (C) 0.25 s^{-1}
- (D) 2 s^{-1}

- 4) The speed of the component waves is 800 m/s . If the distance between consecutive antinode and node is 0.5m then frequency of standing wave will be

- | | |
|----------------------|-----------------------|
| (A) 400 Hz | (B) 300 Hz |
| (C) 600 Hz | (D) 1200 Hz |

- 5) When the temperature of an ideal gas is increased by 800K , the velocity of sound in the gas becomes $\sqrt{3}$ times the initial velocity in it. The initial temperature of the gas is = _____.

- (A) 27°C
- (B) -73°C
- (C) 127°C
- (D) 327°C

6) Mechanical waves carry _____.

Rough Work

- (A) matter
- (B) energy
- (C) both energy and matter
- (D) neither energy nor matter

7) An empty vessel is partially filled with water then the frequency of vibration of air column, in the vessel

- (A) Increases <http://www.gsebonline.com>
- (B) Remains same
- (C) Decreases
- (D) First increases then decreases

8) The speed of the component waves of a stationary wave represented by $y = 10 \sin (100 t) \cos (0.01 x)$ is _____ where x and y are in metre and t is in second.

- (A) 10^3 ms^{-1}
- (B) 10^4 ms^{-1}
- (C) 10^2 ms^{-1}
- (D) 1 ms^{-1}

9) If a source is moving away from a stationary observer with velocity of sound, what frequency will be observed?

- (A) Half
- (B) 2 times
- (C) 3 times
- (D) 4 times

10) A transverse wave is described by the equation

$y = A \sin 2\pi \left(\frac{t}{T} - \frac{x}{\lambda} \right)$. For which wavelength of a wave maximum particle velocity is two times the wave velocity?

(A) $\lambda = \frac{\pi A}{2}$

(B) $\lambda = \frac{\pi A}{4}$

(C) $\lambda = \pi A$

(D) $\lambda = 2\pi A$

Rough Work

11) A bird of 3kg is flying with a constant velocity of $(2\hat{i} - 4\hat{j})$ m/s

and another bird of 2kg with $(2\hat{i} + 6\hat{j})$ m/s. Then, the velocity of centre of mass of the system of two birds is ——— m/s.

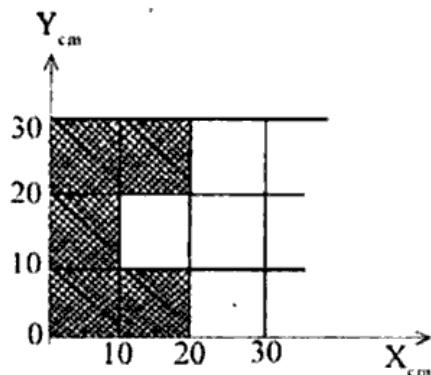
(A) $2\hat{i} + 2\hat{j}$

(B) $2\hat{i} + 0\hat{j}$

(C) $2\hat{i} - 2\hat{j}$

(D) $10\hat{i} + 10\hat{j}$

12) As shown in figure, the centre of mass of a thin metal sheet of uniform density is ——— cm.



(A) (11.67, 16.67)

(B) (9, 15)

(C) (8.75, 12.50)

(D) (7.78, 11.11)

13) The centre of mass of a ring of uniform mass distribution lies

Rough Work

- (A) outside of ring material
- (B) at centre of Ring
- (C) at the ring centre but inside the material
- (D) at the ring centre, but outside the material

14) A shell following a parabolic path explodes some where in its flight. The centre of mass of Fragments will continue to move in _____.

- (A) Any direction
- (B) Vertical direction
- (C) Horizontal direction
- (D) Same parabolic path

15) A bomb of mass 60kg moving uniformly with a velocity of 10m/s explodes spontaneously into two fragments of 40kg and 20kg. If the velocity of the larger fragment is zero, then calculate the velocity of the smaller fragment _____.

- | | |
|------------|------------|
| (A) 20 m/s | (B) 30 m/s |
| (C) 50 m/s | (D) 40 m/s |

16) The moment of inertia of a disc of uniform density about an axis co-inciding with its diameter

- | | |
|------------------------|------------------------|
| (A) MR^2 | (B) $\frac{1}{2} MR^2$ |
| (C) $\frac{1}{4} MR^2$ | (D) $\frac{2}{5} MR^2$ |

Rough Work

- 17) A wheel initially at rest acquires an angular velocity of 128 rad s^{-1} in 4s. Hence its constant angular acceleration is = _____.

- (A) 128 rad s^{-2} (B) 64 rad s^{-2}
 (C) 16 rad s^{-2} (D) 32 rad s^{-2}

- 18) A circular disc of radius r and mass m rotates about the axis passing through the centre and perpendicular to its plane. The kinetic energy is = _____.

- $$(A) \frac{1}{2}mrw^2$$

- $$(B) \frac{1}{2}mr^2w^2$$

- $$(C) \quad \frac{1}{4}mr^2w^2$$

- (D) $\frac{1}{4}mrw^2$

- 19) A solid sphere rolls (about geometrical axis) without slipping on an inclined plane of angle θ . Find its linear acceleration in the direction parallel to the surface of the inclined plane.

- $$(A) \frac{7}{5}g \sin \theta$$

- $$(B) \frac{1}{2}g \sin \theta$$

- $$(C) \frac{3}{5}g \sin \theta$$

- (D) $\frac{5}{7}g \sin \theta$

- 20) What is moment inertia in terms of angular momentum (L) and kinetic energy (K)?**

- $$(A) \frac{L^2}{2K}$$

- $$(B) \frac{L^2}{K}$$

- (C) $\frac{L}{2K^2}$

- (D) $\frac{L}{2K}$

- 29) Radii of two planets are r_1 and r_2 respectively and their densities are ρ_1 and ρ_2 respectively. The gravitational acceleration on their surface are g_1 and g_2 respectively.

Rough Work

$$\frac{g_2}{g_1}$$

(A) $\frac{r_2 \rho_2}{r_1 \rho_1}$

(B) $\frac{r_1 \rho_1}{r_2 \rho_2}$

(C) $\frac{r_1}{r_2} \cdot \frac{\rho_2}{\rho_1}$

(D) $\frac{r_2}{r_1} \cdot \frac{\rho_1}{\rho_2}$

- 30) _____ are the constituent particles of ionic solids.

(A) Atoms <http://www.gsebonline.com>

(B) Molecules

(C) Ion

(D) Electron

- 31) Young's modulus of a rigid body is _____.

(A) 1

(B) 0

(C) ∞

(D) 0.5

- 32) When 200N force is applied on an object, its length increases by 1mm. So potential energy stored in it due to this change is

(A) 20 J

(B) 0.1 J

(C) 10 J

(D) 0.2 J

- 33) Cross-sectional area of a wire of length L is A. Young's modulus of material is Y. If this wire acts as a spring what is the value of force constant?

(A) $\frac{YA}{2L}$

(B) $\frac{YA}{L}$

(C) $\frac{2YA}{L}$

(D) $\frac{YL}{A}$

- 34) A mass is suspended (tied) at the end of a steel wire. A force acting on the wire due to the mass is 162 N. The cross-sectional area of the wire is $6 \times 10^{-6} \text{ m}^2$. Find the produced stress of the wire.

(A) $27 \times 10^3 \text{ Nm}^{-2}$

(B) $27 \times 10^6 \text{ Nm}^{-2}$

(C) $27 \times 10^6 \text{ Nm}^{-2}$

(D) $27 \times 10^3 \text{ Nm}^{-2}$

35) 1 Torr = _____ Pascal.

Rough Work

- (A) 133.28
- (B) 123.28
- (C) 128.23
- (D) 128.33

36) A disc of area 10^{-2} m^2 is placed over a layer of oil having thickness $4 \times 10^{-3} \text{ m}$. If the coefficient of viscosity of the oil is 1.55 Ns m^{-2} , find the horizontal (tangential) force required to move the disc with velocity of $3 \times 10^{-2} \text{ ms}^{-1}$.

- (A) $1.32 \times 10^{-1} \text{ N}$
- (B) $2.32 \times 10^{-1} \text{ N}$
- (C) $2.16 \times 10^{-1} \text{ N}$
- (D) $1.16 \times 10^{-1} \text{ N}$

37) A liquid will not wet the surface of solid if its angle of contact is _____.

- (A) less than 90°
- (B) 0°
- (C) more than 90°
- (D) 90°

38) Work done to increase the area of the surface of fluid by 1 unit is equal to _____.

- (A) mechanical energy
- (B) kinetic energy
- (C) surface energy
- (D) surface tension

Rough Work

- 39) Particles of liquid P, Q and R are on free surfaces, within the surface and below the surface respectively. If their potential energies are U_p , U_q and U_r then

- (A) $U_p < U_r < U_q$
- (B) $U_p < U_q < U_r$
- (C) $U_r < U_p < U_q$
- (D) $U_r < U_q < U_p$

- 40) In equation, $\frac{p^2}{\rho g} + \frac{v^2}{2g} + y = \text{constant}$. Each term has a dimension of _____.

- (A) Velocity
- (B) Time
- (C) Pressure
- (D) Length

- 41) Water is used to cool radiator of engine because _____.

- (A) it is easily available
- (B) of its lower density
- (C) it is cheap
- (D) it has high specific heat

- 42) During same process on an ideal gas $dW = 0$ and $dQ < 0$ then for this gas _____.

- (A) Pressure will remain constant
- (B) Temperature will decrease
- (C) Volume will increase
- (D) Temperature will increase

- 43) The density of water at 20°C is 998 kg/m^3 and it is 992 kg/m^3 at 40°C . Then co-efficient of volume expansion of water is $\text{--- } ^{\circ}\text{C}^{-1}$

(A) $\frac{998}{992 \times 20}$

(B) $\frac{992}{998 \times 20}$

(C) $\frac{6}{992 \times 20}$

(D) $\frac{6}{998 \times 20}$

- 44) The relation betⁿ Temperature and Volume of an ideal gas during Adiabatic process is

(A) $T'V'^{-1} = \text{constant}$

(B) $TV'^{-1} = \text{constant}$

(C) $T'^{-1}V = \text{constant}$

(D) $TV' = \text{constant}$

- 45) A certain amount of Heat Q increases the temperature of 1g of material 'A' by 4°C and 1g of material B by 3°C . Which material has greater specific Heat?

(A) B

(B) A

(C) A and B have same

(D) Nothing can be said

- 46) A refrigerator has a coefficient of performance equal to 5. Assuming that the refrigerator absorbs 120 J of energy from a cold reservoir in each cycle. Find the work required in each cycle

(A) 24 J

(B) 12 J

(C) 36 J

(D) 48 J

47) A system can possess _____ but cannot possess _____.

Rough Work

- (A) Heat energy, Heat
- (B) Heat, Heat energy
- (C) Heat, mechanical energy
- (D) Work, Heat energy

48) The displacement of a simple Harmonic oscillator is given by $y = 0.40 \sin(440t + 0.61)$. For this what is the value of time period _____.

- (A) 0.0443 sec
- (B) 0.0643 sec
- (C) 0.0343 sec
- (D) 0.0143 sec

49) 0.2m compressed spring produces a restitution force of 10N in it. The force constant of the spring is _____ Nm^{-1} .

- | | |
|---------|---------|
| (A) 100 | (B) 50 |
| (C) 150 | (D) 200 |

50) For a particle executing S.H.M. when the potential energy of the oscillator becomes $\frac{1}{8}$ the maximum potential energy, the displacement of the oscillator in terms of amplitude A will be _____.

- | | |
|---------------------------|---------------------------|
| (A) $\frac{A}{2\sqrt{2}}$ | (B) $\frac{A}{\sqrt{2}}$ |
| (C) $\frac{A}{2}$ | (D) $\frac{A}{3\sqrt{2}}$ |

054 (E)

(MARCH / APRIL, 2015)

(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 18 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) Pupil's are use a calculator and log table as necessary.

SECTION-A

■ Question numbers 1 to 8 are short answer. Each carries 2 marks.

- 1) Write down the expression for the centre of mass of a system of n-particles in three dimensions and obtain the expression $M \vec{V}_{cm} = \vec{P}$. [2]
- 2) With help of geometrical Representation explain the law of conservation of Angular momentum. gsebonline.com [2]
- 3) Prove that the ratio of the rate of change of g at a height equal to the Earth's radius from the surface of the Earth to the value of g at the surface of the Earth is equal to $-\frac{1}{4R_e}$. [2]

OR

Prove that "the square of the orbital time period of the satellite is directly proportional to the cube of the orbital radius".

- 4) Depending on the types of the constituent particles, write the names of four types of crystalline solids and explain covalent solids. [2]

OR

With the help of example of rectangular cross-section rod, explain the buckling.

- 5) Derive an equation of continuity for steady incompressible fluid. [2]

- 6) Average temperature of the Earth was 300 K when the Earth came into existence. At present its average temperature is 3000K. What would be the radius of the Earth at the time of its birth? For the material of the Earth $\gamma = 3 \times 10^{-5} \text{ K}^{-1}$. At present, radius of the Earth = 6400 km. [2]

- 7) With help of the Force law, derive the Formula of time period of the Simple Harmonic Motion. <http://www.gsebonline.com>

$$T = 2\pi \sqrt{\frac{m}{K}}. \quad [2]$$

- 8) Show that the velocity of sound in a gas at temperature t is given by,

$$V_t = V_0 \left(1 + \frac{t}{546} \right)$$

Where, V_0 is speed of sound in air at 0°C ($t \ll 273$). [2]

SECTION - B

- Answer the following question as asked. Question numbers 9 to 14 carries 3 marks each. [gsebonline.com](http://www.gsebonline.com)

- 9) The particles of mass $m_1 = 1\text{kg}$, $m_2 = 2\text{kg}$ and $m_3 = 3\text{kg}$ are placed on the vertices of an equilateral triangle of sides "a = 1m". Find the centre of mass of this system with respect to the position of particle of mass m_1 . [3]

SECTION - C

- Answer the question as asked. Question numbers 15 to 18. Each carries 4 marks.

- 15) Find the moment of inertia of a uniform circular disc about an axis passing through its geometrical centre and perpendicular to its plane and also find its radius of gyration. [4]
- 16) What is capillary action? Derive the formula for rise of liquid in a capillary tube immersed vertically in liquid. [4]
- 17) Explain the [4]
 a) Specific Heat at Constant Volume (C_V)
 b) Specific Heat at Constant Pressure (C_p).
 Derive relation $C_p - C_V = R$.

OR

What will be the mass and temperature of water obtained by giving 210 kJ heat to ice of 1kg lying at -10°C ($C_{ice} = 2220 \text{ J kg}^{-1} \text{ K}^{-1}$)

- 18) The speed of sound in dry air at STP is 332 ms^{-1} . Assume air as composed of 4 part of nitrogen and one part of oxygen. Calculate speed of sound in oxygen under similar condition when the density of nitrogen and oxygen at STP are in the ratio of 14:16. [4]



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

SI No.

Sl.No. 0400517

054 (E)

(MARCH, 2016)
(SEMESTER - IV)

Part - A : Time : 1 Hour / Marks : 50

Part - B : Time : 2 Hours / Marks : 50

પ્રશ્ન પેપરનો રોટ નંબર જેની
સામેનું વર્તુળ OMR શીટમાં
ઘણું કરવાનું રહે છે.

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

04

(Part - A)

Time : 1 Hour

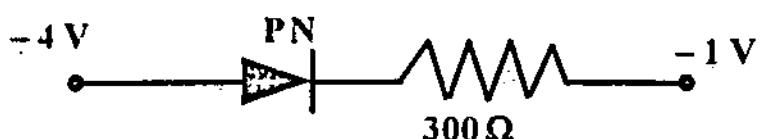
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- 1) What is the current in the circuit shown below.

Rough Work



- (A) 10^{-2} A (B) zero
 (C) 1 A (D) 0.10 A

2) The Integrated Circuit (IC) made from only one type of semiconductor (Si or Ge) is called _____ IC.

(A) Monolithic

(B) Film circuit

(C) Hybrid

(D) Simple

3) Which type of semiconductor device does not need any bias voltage?

(A) Varactor diode

(B) Photodiode

(C) Solar cell

(D) Transistor

The Boolean Equation of OR gate is _____.

(A) $Y = \bar{A}$

(B) $Y = A \cdot B$

(C) $Y = \overline{A \cdot B}$

(D) $Y = A + B$

- 5) The value of current gain α of a transistor is 0.98. The value of β will be _____.

Rough Work

(A) 59

(B) 49

(C) 490

(D) 4.9

- 6) In p-type semiconductor _____.

(A) $n_e > n_h$ (B) $n_e = n_h$ (C) $n_e < n_h$ (D) $n_e^2 = n_h$

- 7) If the height of a TV transmitter tower is increased four times, then the region covered by this transmitter.

(A) becomes four times

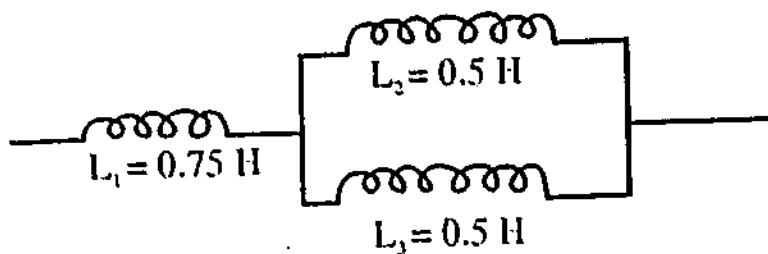
(B) becomes double

(C) becomes thrice

(D) no change

- 8) In which section of communication system, the noise signal get admixed with the information signal.
- (A) Transmitter
(B) Communication channel
(C) Receiver
(D) Source of information
- 9) The energy radiated from the antenna is proportional to _____.
- (A) $\frac{1}{\lambda}$
(B) λ
(C) $\frac{1}{\lambda^2}$
(D) λ^2
- 10) The device which transforms one form of energy into another form of energy is generally called a _____.
- (A) Transformer
(B) Transistor
(C) Transponder
(D) Transducer

11) The equivalent inductance of the following circuit is _____.



- (A) 1.75 H
- (B) 1.0 H
- (C) 0.75 H
- (D) 0.25 H

12) The phenomenon in which electric current is induced in conductor by varying magnetic field is called _____.

- (A) Electric Induction
- (B) Magnet Induction
- (C) Electro-Magnetic Induction
- (D) Induced emf

13) The dimensional formula for self inductance is _____.

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

Rough Work

- 18) For L-C-R. A.C. circuit the resonant frequency is 800 Hz and the frequencies at half power point are 400 Hz and 600 Hz. The Q factor will be _____.

- 19) Which device is used to increase or decrease A.C. voltage?

- (A) Voltmeter
 - (B) Oscillator
 - (C) Transformer
 - (D) Rectifier

- 20) In an a.c. circuit the peak value of voltage is 141.4 Volt, then the rms value of voltage is _____ Volt.

- (A) 199.5
 - (B) 100
 - (C) 70.55
 - (D) 141.4

- 21) In an A.C. circuit direction of electric current gets reversed after every 2×10^{-2} second. What is the frequency of A.C.?

- (A) 100 Hz
 - (B) 3.14 Hz
 - (C) 314 Hz
 - (D) 25 Hz

22) The maximum value of \vec{E} in an electro-magnetic wave is equal to 27 V m^{-1} . Thus the maximum value of \vec{B} is _____.

- (A) $6 \times 10^{-8} \text{ T}$
- (B) $3 \times 10^{-6} \text{ T}$
- (C) $9 \times 10^{-8} \text{ T}$
- (D) $2 \times 10^{-10} \text{ T}$

23) An electromagnetic wave passing through the space is given by equation $E = E_0 \sin(\omega t - kx)$ and $B = B_0 \sin(\omega t - kx)$. Which of the following is true?

- (A) $E_0 w = B_0 k$
- (B) $E_0 B_0 = w k$
- (C) $E_0 k = B_0 w$
- (D) $\frac{E_0}{B_0} = \frac{1}{w k}$

24) At large distance from the source, \vec{E} and \vec{B} are in phase and the decrease in their magnitude with distance r as per _____, and these components are called _____ components.

- (A) r^{-1} , radiated
- (B) r^{-3} , inductive
- (C) r^{-3} , radiated
- (D) r^{-1} , inductive

Rough Work

- 25) If \vec{E} is the electric field and \vec{B} is the magnetic field then the dimensions of $\frac{E}{B}$ is _____.
- (A) $M^1 L^1 T^{-1}$ (B) $M^0 L^1 T^{-1}$
 (C) $M^0 L^{-1} T^1$ (D) $M^1 L^0 T^{-1}$
- 26) At a short distance from a point like source, a wave propagating from it in three dimensional homogeneous and isotropic medium, the shape of wave front is _____.
- (A) Circular (B) Cylindrical
 (C) Plane (D) Spherical
- 27) In Young's experiment if the distance between two slits is doubled then the width of fringes will be _____.
- (A) Doubled (B) Halved
 (C) Tripled (D) Unchanged
- 28) For Coherent sources of light, their
- (A) frequency is same and initial phase difference is not constant
 (B) frequency is same and initial phase difference is constant
 (C) frequency is different and initial phase difference is constant
 (D) frequency is different and initial phase difference is not constant

29) Nicol prism is made up of two _____ crystals.

- (A) Quartz
- (B) Glass
- (C) Calcite
- (D) Graphite

30) In LCD (Liquid Crystal Display) _____ light is used.

- (A) Polarised
- (B) Unpolarised
- (C) Diffracted
- (D) Scattered

31) To determine the position of a point like object precisely.
_____ light should be used.

- (A) Long wavelength
- (B) Polarised
- (C) Short wavelength
- (D) Intense

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

- (A) Wavelength of light
- (B) The distance between slit and source
- (C) Width of slit
- (D) Frequency of light

33) The diameter of the lens of a telescope is 1.22m. The wavelength of light is 5000 Å. The resolving power of telescope is _____.

(A) 2×10^6

(B) 2×10^5

(C) 2×10^2

(D) 2×10^4

34) For a transparent medium the angle of polarisation is 60° . The refractive index for this medium is _____.

(A) 1.330

(B) 1.500

(C) 1.732

(D) 1.650

35) According to Bohr's hypothesis, the angular momentum of the electron in any stationary orbit of radius r is proportional to _____.

(A) $\frac{1}{r}$

(B) r

(C) \sqrt{r}

(D) r^2

36) The ratio of energies of electron in the first excited state to its second excited state in H-atom is _____.

(A) 4 : 9

(B) 1 : 4

(C) 9 : 4

(D) 4 : 1

Rough Work

37) The wavelength of the first line of Lyman series is λ . The wavelength of first line in Balmer series is _____.

(A) $\frac{5}{27}\lambda$

(B) $\frac{27}{5}\lambda$

(C) $\frac{9}{2}\lambda$

(D) $\frac{2}{5}\lambda$

38) The frequency of characteristic X - ray determines _____ property of the target.

(A) atomic number

(B) atomic weight

(C) melting point

(D) conductivity

39) Which spectral series of hydrogen atom lies in the visible region?

(A) Balmer series

(B) Lyman series

(C) Paschen series

(D) Brackett series

40) In Moseley's Experiment the nature of graph $\sqrt{f} \rightarrow Z$ is _____.

(A) Parabolic

(B) Circle

(C) Elliptical

(D) Straight line

41) The unit of Rydberg constant is _____.

- (A) m
- (B) Ryd
- (C) m^{-1}
- (D) eV

42) An accelerated charge emits _____.

- (A) Heat
- (B) Charge
- (C) Energy
- (D) Angular Momentum

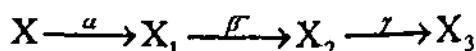
43) Which is the necessary and sufficient condition for an element to be naturally radioactive.

- (A) $z > 70$
- (B) $z > 83$
- (C) $z > 60$
- (D) $z > 50$

44) Half life of a radio-active element is 10 min. At the end of 20 min, its _____ % quantity will remain undisintegrated.

- | | |
|--------|-----------|
| (A) 75 | (B) 93.73 |
| (C) 25 | (D) 6.25 |

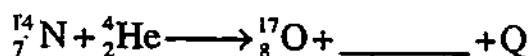
45) A radioactive element X disintegrates successively as under :



If the atomic number and the atomic mass number of X are respectively 72 and 180, what are the corresponding values for X_3 .

- (A) 69, 172
- (B) 69, 176
- (C) 71, 172
- (D) 71, 176

46) Complete the following nuclear reaction,



by selecting appropriate option.

- (A) $_{1}^{2}\text{H}$
- (B) $_{1}^{1}\text{H}$
- (C) $_{2}^{4}\text{He}$
- (D) $_{2}^{3}\text{He}$

47) The half life of a radioactive substance is 6.93 hr then its average life is _____.

- (A) 10 hr
- (B) 1 hr
- (C) 5 hr
- (D) 3.69 hr

Rough Work

48) In common base circuit of a transistor, $\alpha_{dc} = \underline{\hspace{2cm}}$

(A) $\frac{I_E}{I_C}$

(B) $\frac{I_C}{I_B}$

(C) $\frac{I_B}{I_E}$

(D) $\frac{I_C}{I_E}$

49) The frequency of the output signal becomes $\underline{\hspace{2cm}}$ times by doubling the value of the capacitance in the LC oscillator circuit.

(A) $\sqrt{2}$

(B) $\frac{1}{\sqrt{2}}$

(C) $\frac{1}{2}$

(D) 2

50) Which logic gate characteristic is represented by the truth table shown below

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

- (A) NAND Gate
 (C) AND Gate

- (B) NOR Gate
 (D) OR Gate

054 (E)

(MARCH, 2016)

(SEMESTER - IV)

(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 18 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) Attempt questions as per their order. (Maintain sequence).
 - 7) Pupil's are allowed to use simple calculator and log table as necessary.
-

SECTION-A

- Q.1 to Q.8, Do as directed, Each question carries 2 marks. [16]**

- 1) Find the value of self inductance of a very long solenoid of length l , having total number of turns equal to N and cross - sectional area A .
- 2) Obtain the expression for current in an A.C. circuit containing only capacitor (Draw necessary figure and graph).

OR

The value of the A.C. voltage of a generator is $v = 0$ Volt at time $t = 0$. At time

$t = \frac{1}{100\pi}$ second, the voltage $v = 2$ Volt. The voltage keeps on increasing upto 100 Volt. After that it starts decreasing. Determine the frequency of the voltage source.

- 3) Prove that the unit of $\frac{1}{\sqrt{\mu_0 \epsilon_0}}$ is that of velocity, using unit of μ_0 and ϵ_0 .
- 4) Give any four uses of polarization.

- 5) Write any four limitations of Bohr's model.
- 6) Define half-life of a radio-active element and obtain its formula.

OR

Half life of Ra²²⁶ is 4.98×10^{10} S. Find the activity of its 2g specimen. Take Avogadro number as 6.02×10^{23} mol⁻¹.

- 7) Write down two points of difference between P-Type and N-Type semiconductors.
- 8) What is modulation? Write 'three' types of modulation.

SECTION - B

■ Question Nos. 9 to 14. Do as directed. Each question carries 3 marks. [18]

- 9) Obtain an equation for motional emf produced in a conducting rod which is moving on the two arms of U-shaped conductor perpendicular to magnetic field.
- 10) L, C and R are connected in series to an A.C. voltage $V = V_m \cos \omega t$. Obtain the differential equation for the charge.

- 11) State and prove Brewster's law.

OR

In Young's double slit experiment, if the distance between two slits is twice the wave length of light used, prove that maximum 5 bright fringes will be obtained on the screen.

- 12) Calculate wavelength and energy in eV of a photon emitted when in a hydrogen atom an electron makes a transition from the third excited state to ground state. $R = 1.097 \times 10^7 \text{ m}^{-1}$, $C = 3 \times 10^8 \text{ ms}^{-1}$ and $h = 6.625 \times 10^{-34} \text{ Js}$.
- 13) The average radius of a nucleus is 6.6 fermi. If the average mass of the nuclear is 1.0088 u, find the average density of the nucleus.
 $(R_o = 1.1 \text{ fermi}, 1 \text{ u} = 1.66 \times 10^{-27} \text{ kg})$.

- 14) What is a transistor? Write down its types and show their construction and circuit symbol.

OR

In an N-P-N transistor about 10^{10} electrons enter the emitter in $1\mu s$, when it is connected to a battery. About 4% electrons recombine with the holes in the base. Calculate the values of I_E , I_B , I_C , α_{dc} and β_{dc} ($e = 1.6 \times 10^{-19} C$).

SECTION - C

- Q.15 to Q. 18. Do as directed. Each question carries 4 marks. [16]

- 15) Using $P = V_{rms} I_{rms} \cos \delta$, discuss the special cases for power consumed in A.C. circuit.

- 16) The ratio of intensities of rays emitted from two different coherent sources is α . For the interference pattern formed by them, prove that

$$\frac{I_{max} + I_{min}}{I_{max} - I_{min}} = \frac{1+\alpha}{2\sqrt{\alpha}} \text{ where}$$

I_{max} = Maximum of intensity in the interference fringes.

I_{min} = Minimum of intensity in the interference fringes.

- 17) Explain the rate of disintegration of a radioactive element and decay constant. Also obtain the exponential law of radio-active disintegration.

- 18) Draw the circuit of a CE amplifier using N-P-N transistor. Obtain the expression for input voltage and output voltage.

OR

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, $10\mu A$ change takes place in the base current and a change of 2 mA takes place in the collector current. Calculate the following quantities.

- 1) Input resistance.
- 2) A.C. current gain.
- 3) Transconductance.
- 4) If the load resistance is $6k\Omega$ what will be the voltage gain.



JULY 2017

PHYSICS

QUESTION PAPER - 12

Time : 3 Hours

054 (E)

STD. 12th

Total Mark : 100

PART - A : 50 Marks • 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 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) , (B) , (C) , (D) . 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 on the upper-most right side of the Question paper is to be written in the column provided in the OMR sheet.

2. When an electron and a proton are placed in an electric field _____.
(A) The electric forces acting on them are equal in magnitude as well as direction.
(B) Only the magnitudes of forces are same
(C) Accelerations produced in them are same
(D) Magnitudes of accelerations produced in them are same

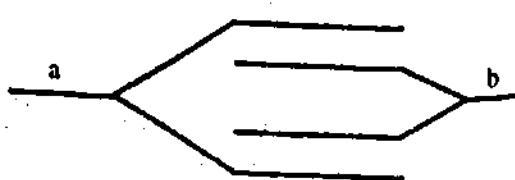
4. When two spheres having $2Q$ and $-Q$ are placed at a certain distance. The force acting between them is F . Now they are connected by a conducting wire and again separated from each other. How much, force will act between them if the separation, now is the same as before?

- (A) F (B) $\frac{F}{2}$ (C) $\frac{F}{4}$ (D) $\frac{F}{8}$

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

6. The area of every plate shown in figure is A and the separation between the successive plates is d . What is the capacitance between points a & b.

- (A) $\frac{\epsilon_0 A}{d}$ (B) $2 \frac{\epsilon_0 A}{d}$
 (C) $3 \frac{\epsilon_0 A}{d}$ (D) $4 \frac{\epsilon_0 A}{d}$



7. 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 energy of each capacitor now?

(A) $\frac{3U}{2}$

(B) U

(C) $\frac{U}{4}$

(D) $\frac{U}{2}$

8. The capacitance of a variable capacitor joined with the battery of 100 V is changed from $2\mu F$ to $10\mu F$. What is the change in the energy stored in it?

(A) $2 \times 10^{-2} J$

(B) $2.5 \times 10^{-2} J$

(C) $6.5 \times 10^{-2} J$

(D) $4 \times 10^{-2} J$

9. The distance between electric charges QC and $9QC$ is 4 m. What is the electric potential at a point of the line joining them where the electric field is zero?

(A) $4 kQ v$

(B) $10 kQ v$

(C) $2 kQ v$

(D) $2.5 kQ v$

10. A cell supplies a current of 0.9 A through a 2Ω resistor and current of 0.3 A through 7Ω resistor. What is the internal resistance of cell?

(A) 0.5Ω

(B) 1.0Ω

(C) 1.2Ω

(D) 2.0Ω

11. At what temperature would the resistance of a copper conductor be double its resistance at $0^\circ C$? Given α for copper is $3.9 \times 10^{-3} {}^\circ C^{-1}$

(A) $256.4 {}^\circ C$

(B) $512.8 {}^\circ C$

(C) $100 {}^\circ C$

(D) $256.4 K$

12. The resistance of 10 m long potentiometer wire is 20Ω . It is connected in series with a 3V battery and 10Ω resistor. The potential difference between two points separated by distance 30 cm is equal to _____.

(A) 0.02 V

(B) 0.06 V

(C) 0.1 V

(D) 1.2 V

13. The electron performs circular motion of radius r , perpendicular to a uniform magnetic field. The kinetic energy gained by this electron in half the revolution is _____.

(A) $\frac{1}{2}mv^2$

(B) $\frac{1}{4}mv^2$

(C) zero

(D) $\pi r BeV$

14. At a place an electric field and a magnetic field are in downward direction. There an electron moves in downward direction. Hence this electron

(A) Will bend towards left

(B) Will bend towards right

(C) Will gain velocity

(D) Will lose velocity

15. When a charged particle moves in a magnetic field its kinetic energy _____.

(A) remains constant

(B) increases

(C) can decrease

(D) become zero

16. 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} & \vec{B} are in same direction.

(B) \vec{v} & \vec{B} are in opposite direction.

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

(D) \vec{v} & \vec{B} make an angle of 45° with each other.

27. A square conducting coil of area 100 cm^2 is placed normally inside a uniform magnetic field of 10^3 Wbm^{-2} . The magnetic flux linked with the coil is _____ Wb.
 (A) 10 (B) 10^{-3}
 (C) 10^5 (D) 0
28. The self inductance of two solenoids A & B having equal length are same. If the number of turns in two solenoids A & B are 100 and 200 respectively. The ratio of radii of their cross-section will be _____.
 (A) 2 : 1 (B) 1 : 2 (C) 1 : 4 (D) 4 : 1
29. In an A.C. circuit in 1 second current reduces to zero value 120 times. Hence the frequency of A.c. current is _____ Hz.
 (A) 50 (B) 100
 (C) 60 (D) 120
30. What is the r.m.s. value of the current for A.C. current $I = 100 \cos(200t + 45^\circ)$ A.
 (A) $50\sqrt{2}$ A (B) 100 A
 (C) $100\sqrt{2}$ A (D) zero
31. In R-C circuit when charge on the plates of the capacitor is increasing, the energy obtained from the sources is stored in _____.
 (A) electric field (B) magnetic field
 (C) gravitational field (D) both magnetic field and gravitational field
32. The output power in a step-up transformer is _____.
 (A) greater than the input power (B) equal to the input power
 (C) maintained even during the power cut (D) less than the input power
33. An electromagnetic wave passing through the space is given by equations $E = E_0 \sin(\omega t - kx)$, $B = B_0 \sin(\omega t - kx)$ which of the following is true ?
 (A) $E_0 B_0 = \omega k$ (B) $E_0 \omega = B_0 k$
 (C) $E_0 k = B_0 \omega$ (D) $E_0 \omega k = B_0$
34. The frequency of electromagnetic wave in free space is 2 MHz. When it passes through a region of relative permittivity $\epsilon_r = 4.0$, the its wave length _____ & frequency _____.
 (A) becomes double, becomes half (B) becomes double, remains constant
 (C) becomes half, becomes double (D) becomes half, remains constant
35. In Hertz's experiment the _____ of the electromagnetic waves is equal to the kinetic energy of the charges oscillating between two spheres.
 (A) frequency (B) energy
 (C) wavelength (D) velocity
36. A plate of refractive index 1.5 is placed in the passage of one ray in Young's experiment. If the central fringe remains bright, the minimum thickness of the plate is _____.
 (A) 2λ (B) λ
 (C) $\lambda/3$ (D) $\frac{2}{3}\lambda$
37. A person find that the Sun rays reflected by the still 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° (B) 75°
 (C) 37° (D) 53°

38. The ratio of resolving power of telescope, when lights of wavelength 4000 \AA and 5000 \AA are used, is _____. (B) $5 : 4$
 (A) $6 : 5$ (D) $9 : 1$
 (C) $4 : 5$
39. The radius of second orbit in an atom of hydrogen is R . What is the radius in third orbit.
 (A) $3R$ (B) $2.25 R$
 (C) $9R$ (D) $R/3$
40. The wavelength of the first line of Lyman series is λ . The wavelength of first line in Balmer series is _____.
 (A) $\frac{27}{5}\lambda$ (B) $\frac{5}{27}\lambda$ (C) $\frac{9}{2}\lambda$ (D) $\frac{2}{5}\lambda$
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. An electron with energy 12.09 eV strikes hydrogen atom in ground state and gives its all energy to the hydrogen atom. Therefore hydrogen atom is excited to _____ state.
 (A) fourth (B) third
 (C) second (D) first
43. The frequency of characteristic X-ray determines _____ property of the target.
 (A) Atomic weight (B) Atomic number
 (C) melting point (D) conductivity
44. If the radii of $^{27}_{13}\text{Al}$ and $^{64}_{30}\text{Zn}$ nucleus are R_1 & R_2 , respectively, then $\frac{R_1}{R_2} = \dots$.
 (A) $\frac{27}{64}$ (B) $\frac{3}{4}$
 (C) $\frac{9}{16}$ (D) $\frac{13}{30}$
45. After a time interval equal to 3 half-lives, how many times would the activity of a radioactive element be of its initial activity?
 (A) 2^3 (B) 3^2
 (C) $\frac{1}{3^2}$ (D) $\frac{1}{2^3}$
46. A radioactive element X disintegrates successively as under:
 $X \xrightarrow{\alpha} X_1 \xrightarrow{\beta} X_2 \xrightarrow{\alpha} X_3 \xrightarrow{\gamma} X_4$
 If the atomic number and atomic mass number of X are 72 and 180. What are the corresponding values for X_4 .
 (A) 69, 176 (B) 69, 172
 (C) 71, 176 (D) 71, 172
47. 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 reverse bias mode

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.

SECTION - A

- Question Nos. 1 to 8 do as directed. Each question carries 2 marks. [16]
1. Draw the circuit diagram for n resistors connected in parallel and write the equation for equivalent resistance.
 2. A magnet has coercivity of 3×10^3 Am $^{-1}$. It is kept in a 10 cm long solenoid with a total of 50 turns. How much current has to be passed through the solenoid to demagnetize it ?
 3. An object lies on the principal axis of a concave mirror with radius of curvature 160 cm. Its vertical image appears at a distance 70 cm from it. Determine the position of the object and also the magnification.
 4. What is self inductance ? Name the factors on which self inductance depends.
 5. Give the condition for constructive and destructive interference in terms of phase difference and path difference.

OR

5. Write any four uses of polarization.
6. Write the two postulates Bohr's atomic model.
7. Write a short note on N type semiconductor.

OR

7. If an LED has to emit 662 nm wavelength of light then what should be the band gap energy of its semiconductor? $h = 6.62 \times 10^{-34}$ Js
8. Draw the block diagram of communication system and name its main components.

SECTION - B

- Question Nos. 9 to 14 do as directed. Each question carries 3 marks. [18]
9. A circle, having radius "r" has line charge distribution over its circumference having linear charge density $\lambda = \lambda_0 \cos^2 \theta$. Calculate the total electric charge residing on the circumference of the circle.

$$\left[\int_0^{2\pi} \cos^2 \theta d\theta = \pi \right]$$

10. Obtain the formula for the capacitance of a parallel plate capacitor.

OR

10. In a certain region the electric potential is given by the formula $V(x, y, z) = 2x^2y + 2y^3z - 4z^4x$. Find the components of electric field and the vector electric field at point (1, 1, 1) in this field.
11. A circular coil having N turns is made from a wire L meter long. If a current of I ampere is passed through this coil suspended in a uniform magnetic field of B tesla, find the maximum torque that can act on this coil.

Work function of Zn is 3.74 eV. If the sphere of Zn is illuminated by the X-rays of wavelength 12 Å, find the maximum potential production on the sphere. $h = 6.625 \times 10^{-34}$ Js

An electric current has both A.C. and D.c. components. The value of the D.C. component is equal to 12 A. While the A.c. component is given as $I = 9 \sin \omega t$ A. Determine the formula for the resultant current and also calculate the value of I_{rms} .

OR

- i. In an ideal step-up transformer input voltage is 110 V and current flowing in the secondary is 10 A. if transformation ratio is 10, calculate output voltage, current in primary input power and output power.
- ii. A plane polarized light is incident normally on the tourmaline plate. Its \vec{E} vectors, make an angle of 60° with the optic axis of the plate. Find the % difference between initial and final maximum values of \vec{E} vectors.

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 to another battery having an emf of 18 Volt and an internal resistance of 2Ω in such a way that they are opposing each other and the circuit is closed. Calculate the following.
 1. current flowing in the circuit.
 2. electrical power in the two batteries.
 3. terminal voltage of the two batteries.
 4. electric power consumed in the batteries.
 16. Using $\delta = i + e - A$ for an equilateral prism obtain an equation for refractive index (n) of material of prism.

OR

16. An object moves with uniform velocity (V_o) on the axis of concave mirror. If it moves towards the mirror. Show that when it is at a distance u from the mirror. The velocity of the image is given by $V_i = \left(\frac{R}{2u - R} \right)^2 \cdot V_o$ where R is the radius of mirror.
17. Obtain the exponential law of radioactive disintegration. Explain the decay curve.
18. A charge 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, $20 \mu\text{A}$ change takes place in the base current and a change of 2 mA takes place in the collector current. Calculate the following quantities.
 1. Input resistance
 2. A.C. current gain
 3. Transconductance
 4. If the load resistance is 5KΩ what will be the voltage gain.

QUESTION PAPER - 12 - SOLUTION**PART - A**

1. (D) 80
2. (B) Only the magnitudes of forces are same
3. (C) 4.0
4. (D) $\frac{F}{8}$
5. (C) $6 \times 10^{-6} \text{ J}$
6. (B) $2 \frac{\epsilon_0 A}{d}$
7. (C) $\frac{U}{4}$
8. (D) $4 \times 10^{-2} \text{ J}$
9. (A) 4 kQ v
10. (A) 0.5Ω
11. (A) 256.4°C
12. (B) 0.06 V
13. (C) zero
14. (D) Will lose velocity
15. (A) remains constant
16. (C) \vec{v} & \vec{B} are mutually perpendicular
17. (B) 45°
18. (D) are in direction from S - pole to N - pole
19. (C) both a force and a torque
20. (C) $3f$
21. (B) $\pi - 2C$
22. (C) Total internal reflection
23. (D) are electrons emitted by cathode and travelling towards anode.
24. (A) 1 : 2
25. (B) 0
26. (B) 0.1 A
27. (A) 10
28. (A) 2 : 1
29. (C) 60
30. (A) $50\sqrt{2} \text{ A}$
31. (A) electric field
32. (D) less than the input power
33. (C) $E_0 k = B_0 w$
34. (D) becomes half, remains constant
35. (B) energy
36. (A) 2λ
37. (C) 37°
38. (B) 5 : 4
39. (B) 2.25 R
40. (A) $\frac{27}{5}\lambda$
41. (C) 10.2
42. (C) second
43. (B) Atomic number
44. (B) $\frac{3}{4}$
45. (D) $\frac{13}{30}$
46. (B) 69, 172
47. (B) The photodiode has to be reversed biased
48. (C) V_m
49. (B) 990
50. (A) Transmitter, receiver

PHYSICS (054) (E)

PHYSICS

QUESTION PAPER - 2

STD. 12th

Time : 3 Hours

MARCH 2018

Total Mark : 100

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

Time : 1 Hour

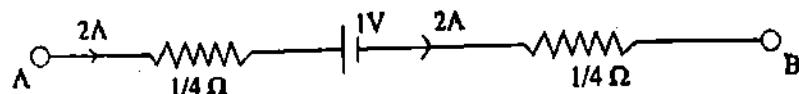
PART - A

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 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) , (B) , (C) , (D) . 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 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.

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) $+2\text{V}$ (B) $+1\text{V}$ (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 $\frac{1}{n}$ 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 increases by 2% , what will be the change in the power of the 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) $\pi r BeV$

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° 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) $\frac{2m}{\pi}$

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 $L \geq f_o + f_e$)
- (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 according to the equation $I = I_0 \sin \omega t$, where $I_0 = 10A$ and $\omega = 100\pi$ rad/s. The value of maximum induced emf in the second coil is _____
- (A) $2\pi V$ (B) $5\pi V$ (C) πV (D) $4\pi V$
27. Current of 2A passing through a coil of 100 turns gives rise to a magnetic flux of 5×10^{-3} Wb per turn. The magnetic energy associated with coil is _____
- (A) $5 \times 10^{-3} J$ (B) $0.5 \times 10^{-3} J$ (C) 5 J (D) 0.5 J

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 1Hz frequency is passing through an A.C. circuit having series combination of resistance $R = 100\Omega$ and inductor $L=1H$, then phase difference between voltage and current is _____
 (A) 60° (B) 45° (C) 30° (D) 90°
30. A coil of inductance L and resistance R is connected to an A.C. source of V volt. If the angular frequency 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) $\frac{V}{\sqrt{R^2 + W^2 L^2}}$
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 10¹⁰ Hz. The wavelength of the corresponding electromagnetic wave produced is _____
 (A) 0.3 m (B) $3 \times 10^{17} m$ (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° (B) 75° (C) 37° (D) 53°

39. The ratio of resolving power of telescope, when lights of wavelengths 4000 \AA and 5000 \AA 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 10^4 V. The speed of X-Rays produced is _____ ms^{-1} .
 (A) 2×10^8 (B) 10^3 (C) 10^6 (D) 3×10^4
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 ${}^A_z X \rightarrow {}^{A+1}_{z+1} X_1 \rightarrow {}^{A-4}_{z-1} X_2 \rightarrow {}^{A-4}_{z-2} X_3$
 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) $Eg_1 < Eg_3 > Eg_2$
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

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 wheatstone bridge. [2]
 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 $R \gg r$. [2]
 6. Give uses of polarization. [2]
 7. What is meant by the average life 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]

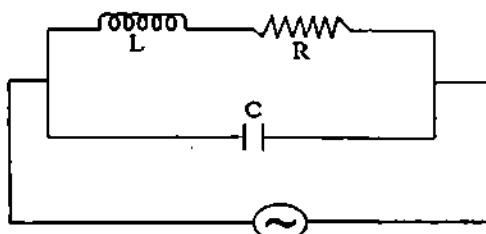
SECTION - B

- 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. [3]

12. In Young's experiment a beam of light of wavelength 6500\AA and 5200\AA 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.
 $R = 1.097 \times 10^7 \text{ m}^{-1}$
14. In a sphere of 10^2 m radius, radioactive material emits β^- particles at the rate of $5 \times 10^7 \text{ s}^{-1}$. 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 ? (Take $K = 9 \times 10^9 \text{ SI unit}$) [3]

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 in series with another battery having an emf of 18 volt and an internal resistance of 2Ω in such a way that they are opposing each other and the circuit is closed. Calculate the following. [4]
- Current flowing in the circuit
 - Electrical power in the two batteries
 - Terminal voltage of the two batteries
 - 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, $20\mu\text{A}$ change takes place in the base current and a change of 2mA takes place in the collector current. Calculate the following quantities : [4]
- Input resistance
 - A.C. current gain
 - Transconductance
 - 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.

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) $-6 \times 10^{-6} J$
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{r} 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) $5\pi V$
27. (D) 0.5 J
28. (B) $N \frac{(\phi_2 - \phi_1)}{R}$
29. (B) 45°
30. (D) $\sqrt{R^2 + W^2 L^2}$
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°
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) $1.0 \times 10^6 V/m$
48. (D) NAND gate
49. (B) $\frac{3}{4} m$
50. (C) $\frac{1}{\lambda^2}$

This Question Paper contains 20 printed pages.

(Part - A & Part - B)

SL.No.

054 (E)

(MARCH, 2019)

SCIENCE STREAM (CLASS - XII)

Part - A : Time : 1 Hour / Marks : 50

Part - B : Time : 2 Hours / Marks : 50

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

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

09

(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 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 Calculator and log-table, if necessary.

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

Rough Work

(A) 45° (B) 60°

(C) 30°

(C) 30° (D) 90°

(C) 30° (D) 90°

(C) 30° (D) 90°

Rough Work

Rough Work

- 6) The distance between two slits in Young's experiment is 0.2 mm. If the wavelength of light used is 5000\AA , the angular position of 3rd bright fringe from the central bright fringe is _____ rad.
- (A) 0.75
(B) 0.075
(C) 0.0075
(D) 0.057
- 7) To determine the position of a point like object precisely, _____ light should be used.
- (A) long wavelength
(B) polarized
(C) short wavelength
(D) intense
- 8) The ratio of resolving power of telescope, when lights of wavelengths 5000\AA and 4000\AA are used, is _____.
- (A) 5 : 4
(B) 16 : 25
(C) 4 : 5
(D) 9 : 1

- 9) If the potential energy of the electron in the hydrogen atom is

$\frac{-e^2}{4\pi\epsilon_0 r}$, then what is its kinetic energy?

(A) $\frac{e^2}{8\pi\epsilon_0 r}$

(B) $\frac{-e^2}{4\pi\epsilon_0 r}$

(C) $\frac{-e^2}{8\pi\epsilon_0 r}$

(D) $\frac{e^2}{4\pi\epsilon_0 r}$

Rough Work

- 10) What is the angular momentum of an electron of Li - atom in $n = 5$ orbit?

(A) 6.625×10^{-34} Js

(B) 5.27×10^{-34} Js

(C) 1.325×10^{-34} Js

(D) 16.56×10^{-34} Js

- 11) A hydrogen atom absorbs 12.1 eV of energy and gets excited to higher energy level. How many photons are emitted during downward transition. Assume during each downward transition, one photon is emitted.

(A) 2 or 3

(B) 1 or 3

(C) 1 or 2

(D) 5 or more

- 12) Which are the isotope, isobar and isotope nuclei respectively of $^{12}_6\text{C}$ from among $^{14}_6\text{C}$, $^{12}_5\text{B}$, $^{13}_7\text{N}$?

(A) $^{12}_5\text{B}$, $^{14}_6\text{C}$, $^{13}_7\text{N}$

(B) $^{14}_6\text{C}$, $^{13}_7\text{N}$, $^{12}_5\text{B}$

(C) $^{13}_7\text{N}$, $^{12}_5\text{B}$, $^{14}_6\text{C}$

(D) $^{14}_6\text{C}$, $^{12}_5\text{B}$, $^{13}_7\text{N}$

- 13) Half - life of a radioactive element is 5 min. At the end of 20 min. its _____% quantity will be disintegrated.

- (A) 75
- (B) 93.75
- (C) 25
- (D) 6.25

- 14) Which one of the following is true for the relative ionizing power of α , β , and γ ?

- (A) It is maximum for β particle
- (B) It is maximum for α particle
- (C) It is maximum for γ radiation
- (D) It is equal for α , β and γ

- 15) The half - life of a radioactive element is 2 hr and that of the other is 4 hr. Their initial activities are equal. After 4 hr what will be the ratio of their activities?

- (A) 1 : 3
- (B) 1 : 4
- (C) 1 : 2
- (D) 1 : 1

16) When will the conductivity of a Ge semiconductor decrease?

Rough Work

- (A) On adding acceptor impurity
- (B) On adding donor impurity
- (C) On making UV light incident
- (D) On decreasing the temperature

17) Given figure is the symbol of which logic gate?



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

18) For an N-P-N transistor in common base circuit about 7% of the electron entering the base from the emitter recombines with the hole. This results in the collector current being 18.6 mA. Calculate the emitter current.

- (A) 0.020 A
- (B) 20 μ A
- (C) 2 mA
- (D) 2 A

- 19) V_m is the maximum voltage between the ends of the secondary terminal of a transformer used in a half wave rectifier. When the P-N junction diode is reverse biased, what will be the potential difference between the two ends of the diode?

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

(B) Zero

(C) V_m

(D) $2V_m$

- 20) The emitter junction of the CE transistor amplifier is _____ biased, while the collector junction is _____ biased.

(A) forward, forward

(B) reverse, forward

(C) reverse, reverse

(D) forward, reverse

- 21) $\alpha = 0.99$ for a CE transistor amplifier circuit. The input resistance is equal to $1\text{ K}\Omega$ and the load resistance is equal to $100\text{ K}\Omega$. The voltage gain of the circuit is _____.

(A) 990

(B) 9.9

(C) 9900

(D) 99000

- 22) The liquid drop of mass 'm' has a charge 'q'. What should be the magnitude of electric field E to balance this drop?

(A) $\frac{E}{m}$

(B) $\frac{mg}{q}$

(C) mgq

(D) $\frac{mq}{g}$

Rough Work

- 23) The number of electric field lines emerged out from 1mC charge is _____. ($\epsilon_0 = 8.85 \times 10^{-12} \text{ MKS}$)

(A) 1.13×10^8

(B) 9×10^9

(C) 1.13×10^{11}

(D) 9×10^{-9}

- 24) For a uniform electric field $\vec{E} = E_0(\hat{j})$, if the electric potential at $y = 0$ is zero, then the value of electric potential at $y = +y$ will be _____.

(A) $-yE_0$

(B) yE_0

(C) y^2E_0

(D) $-y^2E_0$

- 25) 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 energy of each capacitor now?

(A) U

(B) $\frac{3U}{2}$

(C) $\frac{U}{4}$

(D) $\frac{U}{2}$

Rough Work

- 26) Two metallic spheres of radii R_1 and R_2 are charged. Now they are brought into contact with each other with a conducting wire and then are separated. If the electric fields on their surfaces

are E_1 and E_2 respectively, $\frac{E_1}{E_2} = \text{_____}$.

(A) $\frac{R_1}{R_2}$

(B) $\frac{R_2}{R_1}$

(C) $\frac{R_2^2}{R_1^2}$

(D) $\frac{R_1^2}{R_2^2}$

- 27) For a capacitor the distance between two plates is $4x$ and the electric field between them is E_0 . Now a dielectric slab having dielectric constant 3 and thickness x is placed between them in contact with one plate. In this condition what is the p.d. between its two plates?

(A) $\frac{11E_0x}{3}$

(B) $\frac{13E_0x}{3}$

(C) $\frac{10E_0x}{3}$

(D) $\frac{9E_0x}{3}$

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

(A) -60 erg

(B) $-6 \times 10^{-6} \text{ erg}$

(C) 60 erg

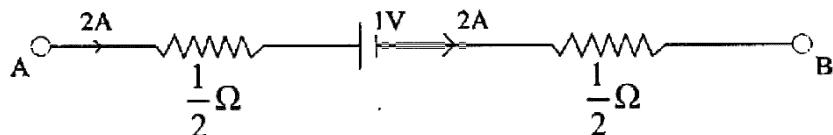
(D) $6 \times 10^{-6} \text{ erg}$

- 29) The unit of conductance of the material of the given conductor is _____.

- (A) volt
 (B) $\frac{\text{volt}}{\text{ampere}}$
 (C) $\frac{\text{volt}}{\text{metre}}$
 (D) $\frac{\text{ampere}}{\text{volt}}$

Rough Work

- 30) Figure shows a part of closed circuit. If the current flowing through it is 2A then $V_B - V_A$ is _____



- (A) + 2 V
 (B) + 3 V
 (C) - 3 V
 (D) - 2 V
- 31) The resistance of a 10m long potentiometer wire is $20\ \Omega$. It is connected in series with a 3 V battery and $10\ \Omega$ resistor. The potential difference between two points separated by distance 0.3 m is equal to _____.

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

- 32) Two bulbs of 220V and 100W are first connected in parallel and then in series with a supply of 220V. Total power in both the cases will be respectively.

(A) 100W, 50W (B) 50W, 100W

- 33) Two parallel long thin wires, each carrying current I are kept at a separation r from each other. Hence the magnitude of force per unit length of one wire due to the other wire is _____.

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

$$(B) \frac{\mu_0 I^2}{r^2}$$

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

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

- 34) Two concentric rings are kept in the same plane. Number of turns in both the rings is 20. Their radii are 40 cm and 80 cm and they carry electric currents of 0.4 A and 0.6 A respectively, in mutually opposite directions. The magnitude of the magnetic field produced at their centre is T.

(A) $2 \mu_0$

(B) $4 \mu_0$

$$(C) \quad \frac{10}{4} \mu_0$$

$$(D) \quad \frac{5}{4}\mu_0$$

- 35)** At a place a uniform electric field and a uniform magnetic field are in the upward direction. There an electron moves in the downward direction. Hence this electron .

(A) will bend towards right

(B) will bend towards left

(C) will gain velocity

(D) will lose velocity

- 36) When a charged particle moves in a uniform magnetic field its kinetic energy _____. | Rough Work

- (A) can increase
- (B) remains constant
- (C) can decrease
- (D) can increase or decrease

- 37) For superconductors, $\mu_r = \text{_____}$.

- (A) Zero
- (B) Infinite
- (C) positive
- (D) negative

- 38) A straight steel wire of length l has magnetic moment m . If the wire is bent in the form of a semicircle, what is the new value of the magnetic dipole moment ?

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

- 39) For plane mirror, value of magnification $m = 1$, then its focal length $f = \text{_____}$.

- | | |
|--------------|--------------|
| (A) zero | (B) positive |
| (C) negative | (D) infinite |

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

(A) $\frac{2\hbar}{3\lambda}$

(B) $\frac{\hbar}{\lambda}$

(C) $\frac{\lambda}{\hbar}$

(D) $\frac{3\lambda}{2\hbar}$

45) Which of the following physical quantity has the dimension of planck constant (\hbar)?

(A) Angular momentum

(B) Force

(C) Energy

(D) Power

46) If photoelectric effect is not seen with the ultraviolet radiations in a given metal, photo electrons may be emitted with the _____.

(A) radio waves

(B) infrared waves

(C) X - rays

(D) visible light

47) In AC generator, induced emf is zero at time $t = 0$. The induced

emf at time $\frac{\pi}{w}$ is _____.

(A) $-V_m$

(B) $+V_m$

(C) zero

(D) $+2V_m$

- 48) A small square loop of wire of side 1 mm is placed inside a large square loop of wire of side 10 m. The loops are coplanar and their centres coincide. Find the mutual inductance of the system. ($\mu_0 = 4\pi \times 10^{-7}$ S.I.).

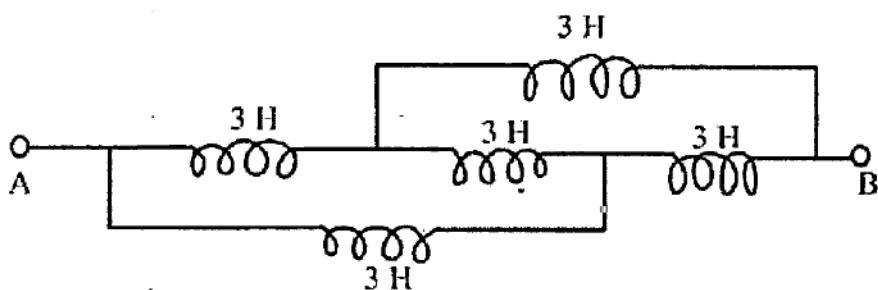
(A) $2\sqrt{2} \times 10^{-14}$ H

(B) $4\sqrt{2} \times 10^{-14}$ H

(C) $8\sqrt{2} \times 10^{-14}$ H

(D) $6\sqrt{2} \times 10^{-14}$ H

- 49) Five pure inductors each of 3H are connected as shown in figure. The equivalent inductance of this connection between points A and B is _____.



(A) 2 H (B) 1 H

(C) 3 H (D) 9 H

- 50) In an L - C oscillator circuit having a completely charged capacitor, with the passage of time _____.

(A) The energy of the circuit continuously increases.

(B) The electric current increases gradually.

(C) The energy of the circuit continuously decreases.

(D) There is a continuous absorption of the electromagnetic wave.

054 (E)
(MARCH, 2019)
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 of the question paper and total 1 to 18 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 Calculator and log-table, if necessary.
-

SECTION - A

- Question No. 1 to 8 do as directed. Each question carries 2 marks. [16]

- 1) Define surface charge density and volume charge density of an electric charge. Also state its unit.
- 2) Derive the expression to find the unknown resistance in the balanced condition of wheatstone bridge.

OR

A cylindrical wire having 10Ω resistance is stretched to increase its length by 10%. Calculate its new resistance.

- 3) State and explain Curie's law for paramagnetic materials and explain saturation magnetization for paramagnetic materials.

- 4) Calculate the energy of photon in eV for a radiation of wavelength 5000 Å.
($h = 6.625 \times 10^{-34}$ Js, $c = 3 \times 10^8$ ms $^{-1}$, $e = 1.6 \times 10^{-19}$ C).
- 5) Deduce an equation $U = \frac{1}{2}LI^2$ for an inductor.
- 6) Using $P = V_{rms} I_{rms} \cos \delta$, discuss any two special cases for power consumed in an AC circuit.

OR

In an ideal step - up transformer input voltage is 110 V and current flowing in the secondary is 10 A. If transformation ratio is 10 then calculate output voltage and current in primary.

- 7) State and prove Brewster's law.
- 8) A modulating signal of frequency 5 KHz and peak voltage of 5 V is used to modulate a carrier of frequency 10 MHz and peak voltage of 10 V. Determine
 a) Modulation index
 b) Frequency of LSB and USB.

SECTION - B

■ Question No. 9 to 14 do as directed. Each question carries 3 marks. [18]

- 9) A charge Q is uniformly distributed on the circumference of a circular ring of radius a . Find the intensity of electric field at a point at a distance x from the centre on the axis of the ring.
- 10) A capacitor consists of three parallel plates of equal area A. The distance between them is d_1 and d_2 . Dielectric material having permittivity ϵ_1 and ϵ_2 is present between the plates.
 a) Calculate the capacitance of such a system.
 b) Express this capacitance in terms of K_1 and K_2 .

OR

Derive the formula for the electric potential energy of an electric dipole in an uniform electric field. Discuss its stable and unstable equilibrium state.

- 11) Two rings X and Y are placed in such a way that their axes are along the X and Y axes respectively and their centres are at the origin. Both the rings X and Y have the same radii of 3.14 cm. If the current through X and Y rings are 0.3 A and 0.4 A respectively then find the value of the resultant magnetic field at the origin. $\mu_0 = 4\pi \times 10^{-7}$ SI.

- 12) Intensity of diffracted light at any point on the screen is given by the formula

$$I = I_0 \left(\frac{\sin \alpha}{\alpha} \right)^2, \text{ using this formula obtain condition for central maximum,}$$

minima and maxima. Where I_0 = maximum intensity and $\alpha = \frac{\pi d \sin \theta}{\lambda}$.

OR

In Young's experiment, the distances between two slits and that between slits and the screen are 0.05 cm and 1 m, respectively. Find the distance between 3rd bright and 5th dark fringes. Take the wavelength of light equal to 5000 Å.

- 13) Calculate the atomic number of the element which gives minimum X - ray wavelength of 0.1 nm of K - series. $R = 1.09737 \times 10^7 \text{ m}^{-1}$.
- 14) In a sphere of 10^2 m radius, radioactive material emits β^- - particles at the rate of $5 \times 10^7 \text{ s}^{-1}$. 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? (Take $K = 9 \times 10^9$ SI unit)?

SECTION - C

■ Question No. 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 to another battery having an emf of 20 Volt and an internal resistance of 2Ω in such a way that they are opposing each other and the circuit is closed. Calculate the following.
- Current flowing in the circuit.
 - Electrical power in the two batteries.
 - Terminal voltage of the two batteries.
 - electric power consumed in the two batteries.
- 16) Derive an equation $\delta = i + e - A$ for an equilateral prism and using it obtain an equation for refractive index (n) of material of prism.
- 17) Write the differential equation for charge in L-C-R series A.C. circuit and obtain equation for complex current from it.
- 18) Draw the circuit diagram of a full wave rectifier and explain the working of the circuit.

OR

In a N-P-N transistor about 10^{10} electrons enter the emitter in $1 \mu s$ when it is connected to a battery. About 2% electrons recombine with the holes in the base. Calculate the values of I_E , I_B , α_{dc} and β_{dc} ($e = 1.6 \times 10^{-19} C$).



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

Sl.No. 1101391

054 (E)
(MARCH, 2020)
SCIENCE STREAM
(CLASS - XII)
(New Course)

Part - A : Time : 1 Hour / Marks : 50

Part - B : Time : 2 Hours / Marks : 50

प्रश्न पेपरनो सेट नंबर ले-नी
सामेनुं वर्तुण OMR शीटमां
घृं करवानुं रहे छे।
Set No. of Question Paper,
circle against which is to be
darken in OMR sheet.

11

(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 O 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 Calculator and log-table, if necessary.

- 1) A magician during a show makes a glass lens with $n = 1.47$ disappear in a trough of liquid. What is the refractive index of the liquid?

Rough Work

- (A) ∞
(B) zero
(C) equal to refractive index of water
(D) 1.47

2) If a size of particle is a and wavelength of light is λ , for $a \ll \lambda$ scattering is directly proportional to _____.

(A) λ^4

(B) $\frac{1}{\lambda^4}$

(C) λ^2

(D) $\frac{1}{\lambda^2}$

3) In a Young's double - slit experiment, the width of the source slit is increased then _____

(A) Fringe pattern gets more and more sharp

(B) Instead of interference, diffraction appears

(C) Angular distance between fringes increased

(D) Fringe pattern gets less and less sharp

4) v_{radial} is considered _____ when the source moves away from the observer.

(A) positive

(B) negative

(C) zero

(D) infinite

- 5) Light of wavelength 6000\AA is coming from a star. What is the limit of resolution of a telescope whose objective has a diameter of 100 inch?
- 10^{-7} radian
 - 2.9×10^{-7} radian
 - 2.9×10^{-5} radian
 - 9.2×10^{-7} radian
- 6) Unpolarised light is incident on a plane glass surface. What should be the angle of incidence so that the reflected and refracted rays are perpendicular to each other?
- 37°
 - 33°
 - 53°
 - 57°
- 7) Work function of _____ is the lowest.
- Platinum
 - Caesium
 - Nickel
 - Copper
- 8) By applying electric field of the order of _____ Vm^{-1} to a metal, electrons can be pulled out of the metal.
- 10^6
 - 10^5
 - 10^8
 - 10^2

9) Value of stopping potential depends on _____ of incident light.

- (A) intensity
- (B) frequency
- (C) momentum
- (D) velocity

10) Monochromatic light of frequency 6×10^{14} Hz is produced by laser. Each photon has an energy = _____ J.

- (A) 6×10^{14}
- (B) 4×10^{-19}
- (C) 4×10^{-20}
- (D) 6×10^{-14}

11) 13.6 eV energy is required to separate a hydrogen atom into a proton and an electron. Compute the orbital radius of corresponding electron.

- (A) 5.3×10^{-11} m
- (B) 10.6×10^{-11} m
- (C) 2.65×10^{-11} m
- (D) 1.33×10^{-11} m

12) To excite the hydrogen atom from its ground state to second excited state _____ eV energy is required.

- (A) 12.09
- (B) 3.4
- (C) 1.51
- (D) 13.6

13) What is the shortest wavelength present in the Paschen series of spectral lines?

- (A) 820 nm
- (B) 6563 Å
- (C) 911 nm
- (D) 656 mm

14) In case of head on collision, when the impact parameter is minimum, $\theta = \text{_____ rad}$ (where θ = scattering angle for α - particle)

- (A) 0
- (B) $\frac{\pi}{2}$
- (C) $\frac{\pi}{4}$
- (D) π

15) Chlorine has two isotopes having masses 34.98 u and 36.98 u. The relative abundances of these isotopes are 75.4 and 24.6 percent. Then average mass of chlorine atom is u.

- (A) 35
- (B) 34.91
- (C) 35.47
- (D) 34.01

16) The binding energy per nucleon is almost constant for the nuclei having atomic mass number _____

- (A) $30 < A < 240$
- (B) $30 < A < 170$
- (C) $170 < A < 230$
- (D) $156 < A < 192$

17) Tritium has half life of 12.5 years undergoing beta decay. What fraction of sample of tritium will remain undecayed after 50 years?

- (A) $\frac{1}{2}$
- (B) $\frac{1}{8}$
- (C) $\frac{1}{16}$
- (D) $\frac{1}{4}$

18) In an n-type silicon, which of the following statement is true:

- (A) Electrons are majority carriers and trivalent atoms are the dopants.
- (B) Electrons are minority carriers and pentavalent atoms are the dopants.
- (C) Holes are minority carriers and pentavalent atoms are the dopants.
- (D) Holes are majority carriers and trivalent atoms are the dopants.

19) 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) lowers the potential barrier
- (D) none of the above

20) In half wave rectification, what is the output frequency if the input frequency is 50 Hz.

- (A) 0
- (B) 100 Hz
- (C) 50 Hz
- (D) 25 Hz

21) _____ as a impurity, when added in Si or Ge P-type semiconductor is obtained.

- (A) Antimony
- (B) Arsenic
- (C) Phosphorus
- (D) Boron

22) The charge equivalent to 6×10^{18} electrons is _____.

- (A) -1 C
- (B) 1 C
- (C) 1 mC
- (D) -1 mC

(P.T.O.)

23) The ratio of electric force and gravitational force between a proton and an electron at a certain distance is ____

M - 305
Rough Work

- (A) 2.4×10^{41}
- (B) 10^{41}
- (C) 2.4×10^{39}
- (D) 3.9×10^{24}

24) Unit of surface charge density (σ) is ____

- (A) $\frac{C}{m^3}$
- (B) $\frac{C}{m^2}$
- (C) $\frac{C}{m}$
- (D) Cm

25) Electric field due to dipole at large distance (r) falls off as ____

- (A) $\frac{1}{r}$
- (B) $\frac{1}{r^2}$
- (C) $\frac{1}{r^3}$
- (D) $\frac{1}{r^4}$

26) Value of dielectric strength for air is _____ Vm^{-1} .

- (A) 3×10^6
- (B) 3×10^4
- (C) 6×10^3
- (D) 4×10^3

27) Three capacitors of 2 pF, 3 pF and 4 pF are connected in parallel. What is the total capacitance of a network?

- (A) $\frac{12}{13} \text{ pF}$
- (B) 9 pF
- (C) $\frac{13}{12} \text{ pF}$
- (D) $\frac{1}{9} \text{ pF}$

28) Equipotential Surface through a point is _____ to the electric field at that point.

- (A) normal
- (B) parallel
- (C) at an angle of 45°
- (D) at an angle of 30°

29) According to Ohm's law $\left(R = \frac{V}{I} \right)$, as current flowing through a conductor increases, resistance of conductor _____

- (A) Increases
- (B) Decreases
- (C) Remains constant
- (D) Nothing can be said

30) Kirchhoff's junction rule represents _____

- (A) Conservation of energy
- (B) Conservation of linear momentum
- (C) Conservation of angular momentum
- (D) Conservation of charge

31) Two resistors when connected in series net resistance is $5\ \Omega$ and when they are connected in parallel net resistance is $1.2\ \Omega$. What are these resistors?

- (A) $1\ \Omega, 4\ \Omega$
- (B) $2\ \Omega, 3\ \Omega$
- (C) $0.6\ \Omega, 0.6\ \Omega$
- (D) $1\ \Omega, 0.2\ \Omega$

32) A straight wire of mass 200 g and length 1.5 m carries a current of 2 A. To suspend it in air by a uniform horizontal magnetic field, value of required magnetic field is _____ T.

- (A) 0.45
- (B) 6.5
- (C) 0.65
- (D) 4.5

33) Unit of Bohr magneton is _____

- (A) Cm^2
- (B) Am
- (C) Am^{-2}
- (D) Am^2

34) Current sensitivity of galvanometer is inversely proportional to _____

- (A) Torsional constant
- (B) Number of turns
- (C) Area
- (D) Magnetic field

35) Frequency of cyclotron is independent of ____.

M - 305

- (A) Charge of a particle
- (B) Radius of its trajectory
- (C) Applied magnetic field
- (D) Mass of a particle

Rough Work

36) A circular coil of a wire consisting 100 turns, each of radius 2 cm carries a current of 0.20 A. The magnetic field at the centre of the coil is ____ T.

- (A) $\pi \times 10^{-4}$
- (B) $2\pi \times 10^{-4}$
- (C) $3\pi \times 10^{-4}$
- (D) 10^{-4}

37) Which one of the following represent Curie's law?

(A) $M = \frac{CB_0}{T}$

(B) $M = \frac{C\chi}{T}$

(C) $M = \frac{C\chi}{T - T_c}$

(D) $M = \frac{CT}{B_0}$

38) At the place, on the surface of the earth, ratio of horizontal and vertical component of the magnetic field is $\sqrt{3}$, then angle of dip at this place is _____ rad.

(A) $\frac{\pi}{6}$

(B) $\frac{\pi}{3}$

(C) $\frac{\pi}{4}$

(D) zero

39) Meissner effect is observed in _____ substances.

(A) Paramagnetic

(B) Ferromagnetic

(C) Superconducting

(D) Permanent magnetic

40) Dimensional formula of mutual inductance is _____

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

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

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

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

41) The magnitude of the induced emf is equal to the time rate of change of _____

(A) Electric flux

(B) Magnetic force

(C) Magnetic flux

(D) Electric force

42) Which one of the following is an equation of magnetic energy density?

(A) $\frac{B^2}{2\mu_0}$

(B) $\frac{1}{2}\mu_0 B^2$

(C) $\frac{2B^2}{\mu_0}$

(D) $\frac{B^2}{\mu_0}$

43) A $15 \mu F$ capacitor is connected to a $220 V$, 50 Hz a.c. source.

Value of capacitive reactance is _____ Ω .

(A) 424

(B) 106

(C) 212

(D) 21.2

44) Electric quantity, _____ is equivalent to mechanical quantity, force constant (k).

(A) Inductance (L)

(B) Charge (Q)

(C) Reciprocal of inductance $\left(\frac{1}{L}\right)$

(D) Reciprocal of capacitance $\left(\frac{1}{C}\right)$

45) In L-C oscillator, at _____ time, energy in capacitor and energy in inductor are equal.

(A) $\frac{T}{4}$

(B) $\frac{T}{8}$

(C) $\frac{T}{2}$

(D) T

46) A power transmission line feeds input power at 3300 V to a step down transformer with its primary windings having 2000 turns. What should be the number of turns in the secondary in order to get output power at 330 V?

(A) 200

(B) 400

(C) 33

(D) 40

47) Dimension of $\frac{1}{\mu \epsilon}$ is same as dimension of _____

(where μ = Magnetic constant, ϵ = Dielectric)

(A) Velocity

(B) Square of velocity

(C) Acceleration

(D) Momentum

48) Frequency of FM radio band is from _____

(A) 88 kHz to 108 kHz

(B) 88 MHz to 108 MHz

(C) 54 MHz to 890 MHz

(D) 54 kHz to 890 kHz

- 49) To destroy cancer cells ____ are used.
- (A) Gamma rays
 - (B) X-rays
 - (C) Ultraviolet rays
 - (D) Infrared rays

- 50) In optical fiber, the refractive index of the material of the core is ____ that of the cladding.
- (A) less than
 - (B) higher than
 - (C) equal to
 - (D) half

054 (E)

(MARCH, 2020)
SCIENCE STREAM
(CLASS - XII)
(New Course)

(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 18 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 Calculator and log-table, if necessary.

SECTION-A

- Question No. 1 to 8 do as directed. (Each question carries 2 marks) [16]

- 1) Derive expression for the capacitance of the parallel plate capacitor.
- 2) Write a note on Mobility.

OR

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 it is inserted in a hot bath, the resistance of the wire is 5.795Ω . Calculate the temperature of the bath.

- 3) Derive an expression for magnetic potential energy $U_n = -\vec{m} \cdot \vec{B}$, for a magnetic dipole kept in a uniform magnetic field.
- 4) What is called self-inductance? Derive an expression for self - induced emf.
- 5) A plane electromagnetic wave of frequency 25 MHz travels in free space along x -direction. At a particular point in space and time, $\vec{E} = 6.3 \hat{j} \text{ Vm}^{-1}$.

What is \vec{B} at this point?

- 6) Derive; $i + e = A + \delta$ for a triangular glass prism.
- 7) Summarise the photon picture of electromagnetic radiation. (any four)
OR
What is the de Broglie wavelength associated with an electron, accelerated through a potential difference of 100 Volts?
- 8) Explain Alpha Decay.

SECTION - B

■ Question No. 9 to 14 do as directed. Each question carries 3 marks. [18]

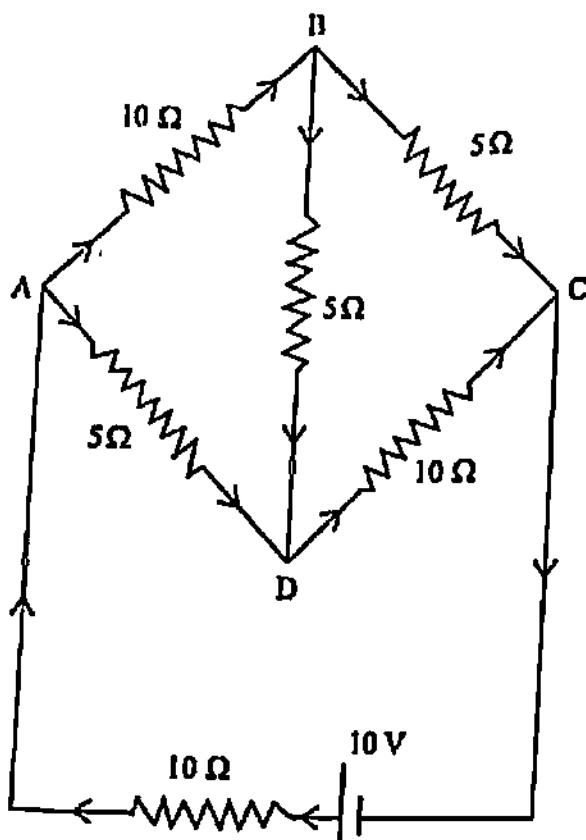
- 9) An electron falls through a distance of 1.5 cm in a uniform electric field of magnitude $2 \times 10^4 \text{ NC}^{-1}$. The direction of the field is reversed keeping its magnitude unchanged and a proton falls through the same distance. Compute the time of fall in each case.
- 10) A 600 pF capacitor is charged by a 200 V supply. It is then disconnected from the supply and is connected to another uncharged 600 pF capacitor. How much electrostatic energy is lost in the process?
- 11) Derive an expression for the magnetic field at any point on the axis of a circular current loop.
OR
A horizontal power line carries a current of 90 A in east to west direction. What is the magnitude and direction of the magnetic field due to the current 1.5 m below the line?
- 12) Draw schematic diagram of Young's experiment and derive $\beta = \frac{\lambda D}{d}$ for the distance between two consecutive bright interference fringes.
- 13) In accordance with the Bohr's model, find the quantum number that characterises the earth's revolution around the Sun in an orbit of radius $1.5 \times 10^{11} \text{ m}$ with orbital speed $3 \times 10^4 \text{ ms}^{-1}$. (Mass of the earth = $6 \times 10^{24} \text{ kg}$)
- 14) Explain the use of Zener diode as a voltage regulator.
OR

Draw the logic symbol and give the truth table of NAND gate. Why this gate is called universal gate?

SECTION - C

■ Question No. 15 to 18 do as directed. Each question carries 4 marks. [16]

- 15) Determine the current in each branch of the given network.



- 16) Derive an expression for current i passing through an AC circuit containing only inductor L. Draw a phasor diagram and graph of v and i versus ωt . Explain instantaneous power and the average power.
- 17) Derive lens maker's formula for thin lens.
- 18) The distance between the two slits in Young's experiment is 0.1 mm. The perpendicular distance between the slits and the screen is 1.5 m. The wavelength of the incident light is 6000 Å. Calculate the distance between third bright and fifth dark fringes, obtained on the screen.

OR

Explain polarisation by scattering.



This Question Paper contains 20 printed pages.

(Part - A & Part - B)

Sl.No.

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

ગુજરાતી સેટ નંબર કેન્દ્ર
સામનું વર્તુળ OMR શીટમાં
એક ક્રવાળું 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.
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- 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.

-
- 1) Electric force between electron and proton separated by a

distance of 1 mm is, $F_e = \text{_____} \text{ N. } \left[K = \frac{1}{4\pi\epsilon_0} \right]$

Rough Work

- (A) -10^6 Ke^2
(B) -10^{-6} Ke^2
(C) $-10^{-3} \text{ K}^2\text{e}$
(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

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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°

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

Rough Work

- (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 $A = 1\text{m}^2$ and the distance between two plates $d = 1\text{mm}$, then capacitance of a capacitor $C = \text{_____ F}$.

- (A) 8.85×10^{-6}
- (B) 8.85×10^{-9}
- (C) 8.85×10^{-12}
- (D) 8.85×10^{-15}

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- 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

- 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 $P_c = \text{_____}$.

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

(B) $\frac{PR_c^2}{V}$

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

(D) $\frac{VR_c}{P^2}$

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- 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 _____.

Rough Work

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

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

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

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

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22) AC Generator converts _____ energy into _____ energy.

- (A) Electrical, Mechanical
- (B) Light, Mechanical
- (C) Mechanical, Electrical
- (D) Electrical, Light

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 $Q = \dots$.

- (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 $I_s > I_p$

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

- 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

- 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

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 1 gram (g) substance is _____ J.

- (A) 9×10^{13}
- (B) 9×10^{10}
- (C) 9×10^7
- (D) 9×10^8

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

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

- (A) Isobars
- (B) Isomers
- (C) Isotopes
- (D) Isotones

46) $1 \text{ mCi} = \underline{\hspace{2cm}} \text{Bq}$

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

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

(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 1 ppm 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 $3 \times 10^{-8} C$ and $-2 \times 10^{-8} C$ 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,

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

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

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

$$R_1 = 10\Omega, N_1 = 30$$

$$A_1 = 3.6 \times 10^{-3} m^2, B_1 = 0.25 T$$

$$R_2 = 14\Omega, N_2 = 42$$

$$A_2 = 1.8 \times 10^{-3} m^2, B_2 = 0.50 T$$

(The spring constants are identical for the two meters)

Determine the ratio of

- Current sensitivity and
- 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

- a convex lens of focal length 20cm and
- 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

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



This Question Paper contains 20 printed pages.

(Part - A & Part - B)

Sl.No. 0701365

054 (E)
(MARCH/APRIL 2022)
(SCIENCE STREAM)
(CLASS - XII)

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

07

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 O 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.

- 1) Charge particles with the speed _____ can pass undeflected through the region of crossed electric field (E) and magnetic field (B) that serve as a velocity selector.

Rough Work

- (A) $\frac{E}{B}$
(B) $\frac{1}{2} \frac{E}{B}$
(C) $\frac{1}{2} \frac{B}{E}$
(D) $\frac{B}{E}$

Rough Work

- 2) A solenoid of length 0.5 m has a radius of 1 cm and is made up of 1000 turns. It carries a current of 5 A. The magnitude of the magnetic field inside the solenoid is _____ T.
- (A) $3\pi \times 10^{-3}$
 (B) $2\pi \times 10^{-3}$
 (C) $\pi \times 10^{-3}$
 (D) $4\pi \times 10^{-3}$
- 3) Experimentally, one finds that the magnetisation of a paramagnetic material is _____ proportional to applied magnetic field and _____ proportional to the absolute temperature.
- (A) directly, inversely
 (B) inversely, inversely
 (C) directly, directly
 (D) inversely, directly
- 4) A short bar magnet placed with its axis at 30° with a uniform external magnetic field of 0.25 T experiences a torque of magnitude equal to 4.5×10^{-2} J. The magnitude of magnetic moment of the magnet is _____ JT^{-1} .
- (A) 0.72
 (B) 0.18
 (C) 0.36
 (D) 0.54
- 5) A bar magnet is of length (size) l . The ratio of its equatorial field and axial field for the same distance r (where $r > > l$) is _____.
- (A) 0.5
 (B) 2
 (C) 1
 (D) 0

6) A conducting coil having number of turns N and cross section area A is kept in such a way that its plane remains perpendicular to the uniform magnetic field B . Now, if the number of turns of the coil is made double then the magnetic flux linked with coil = _____.

(A) N^2BA

(B) $\frac{NBA}{2}$

(C) NBA

(D) $2NBA$

7) Current in a circuit falls from 5 A to 0 A in 0.1 s. If an average emf of 200 V induced, the self-inductance of the circuit would be _____ H.

(A) 3

(B) 2

(C) 1

(D) 4

8) Faraday's law gives _____ of induced emf.

(A) only magnitude

(B) only direction

(C) both magnitude and direction

(D) none of the above

9) An impedance of LC circuit is _____.

(where $X_C > X_L$)

(A) $Z = \sqrt{\left(\frac{1}{\omega C}\right) - \omega L}$

(B) $Z = \frac{1}{\omega C} - \omega L$

(C) $Z = \omega C + \frac{1}{\omega L}$

(D) $Z = \left(\frac{1}{\omega C}\right)^2 - (\omega L)^2$

10) If P_o is an output power and P_i is an input power of a real step-up transformer then,

- (A) $P_o < P_i$
- (B) $P_o > P_i$
- (C) $P_o = P_i$
- (D) $P_o = \sqrt{2} P_i$

Rough Work

11) The power factor at the time of resonance is _____.

- (A) ∞
- (B) 1
- (C) 0
- (D) 0.5

12) An inductive reactance of an inductor is _____.

- (A) $\frac{1}{\omega C}$
- (B) ωC
- (C) $\frac{1}{\omega L}$
- (D) ωL

13) _____ current is obtained due to change in the electric field.

- (A) Eddy
- (B) Displacement
- (C) Conduction
- (D) Unidirectional

- 14) A light of an energy 6.48×10^5 J is incident normally on nonreflecting surface. The momentum imparted on the surface is _____ N-s.

(A) 21.6×10^{-3}
 (B) 6.21×10^{-3}
 (C) 1.26×10^{-3}
 (D) 2.16×10^{-3}

- 15) Which one of the following electromagnetic wave is of minimum wavelength?

(A) Ultraviolet rays
 (B) X - rays
 (C) Gamma rays
 (D) Infrared

- 16) The refractive index of medium-3 with respect to medium-2

$$n_{32} = \text{_____}.$$

(A) $\frac{n_{12}}{n_{31}}$

(B) $\frac{n_{31}}{n_{12}}$

(C) $n_{31} \times n_{12}$

(D) $n_{13} \times n_{21}$

- 17) A magician during a show makes a glass lens with refractive index $n = 1.5$ disappear in a trough of liquid. The refractive index of liquid = _____.

(A) 0.75
 (B) 3.0
 (C) 1.5
 (D) 0.15

- 18) The focal length of objective lens and eyepiece is f_o and f_e respectively. Magnifying power of the telescope = _____.

(A) $\frac{f_o}{f_e}$

(B) $f_o - f_e$

(C) $f_o + f_e$

(D) $\frac{f_e}{f_o}$

- 19) When light rays undergoes _____ internal reflections inside a raindrop a secondary rainbow is formed.

(A) 3

(B) 2

(C) 1

(D) 4

- 20) An object is placed at 15cm in front of a concave mirror of radius of curvature 20cm. The image distance would be _____ cm.

(A) -30

(B) -28

(C) -22

(D) -32

- 21) When the width of an aperture is a and the wavelength is λ , for a distance equal to _____ ray optics is a good approximation.

(A) $\frac{\lambda^2}{a}$

(B) $\frac{\lambda}{a}$

(C) $\frac{a}{\lambda}$

(D) $\frac{a^2}{\lambda}$

- 22) The number of interference fringes occurring in the broad diffraction peak depends on the ratio _____.

(A) $\frac{d^2}{a}$

(B) $\frac{a}{d}$

(C) $\frac{d}{a}$

(D) $\frac{a^2}{d}$

Where d = distance between two slits

a = width of slit

- 23) Unpolarised light is incident on a plane glass surface. For an angle of incidence _____ the reflected and refracted rays are perpendicular to each other? Refractive index of glass = 1.5.

(A) 57°

(B) 47°

(C) 37°

(D) 67°

- 24) Which one of the following sentence is false?

- (A) The central diffraction fringe is of maximum intensity
 (B) All bright interference fringes are of equal intensities
 (C) Interference fringes are of equal thickness
 (D) Diffraction fringes are of equal thickness

Rough Work

- 25) Width of a slit is a . The focal length of the lens kept just along with the slit is f . The light of wavelength λ is made normally incident on the slit. The size of the central maximum on the screen is ____.

(A) $\frac{fa}{\lambda}$

(B) $\frac{\lambda a}{f}$

(C) $\frac{a}{f\lambda}$

(D) $\frac{f\lambda}{a}$

- 26) The slope of the graph of the stopping potential (V_0) \rightarrow frequency (v) for the photoelectric effect is equal to ____.

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

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

(C) h

(D) $\frac{h}{2\pi}$

- 27) If Δx and Δp are the uncertainties in the specification of the position and the momentum of an electron respectively, then according to Heisenberg's uncertainty principle $\Delta x \cdot \Delta p =$ ____.

(A) $\frac{2\pi}{h}$

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

(C) h

(D) $\frac{h}{2\pi}$

- 28) Photons are _____ electrically.
- neutral
 - negatively charged
 - positively charged
 - some time positively charged and some time negatively charged
- 29) The dimensions of $\frac{me^4}{8\varepsilon_0^2 h^3 c}$ is _____.
- $M^0 L^{-1} T^0$
 - $M^0 L^1 T^0$
 - $M^0 L^0 T^0$
 - $M^{-1} L^0 T^0$
- 30) The energy required to excite an electron of the hydrogen atom from its ground state to second excited state is _____ eV.
- 13.6
 - 12.09
 - 10.2
 - 3.40
- 31) Which one of the following spectral line lies in Ultraviolet region?
- Paschen series
 - Balmer series
 - Lyman series
 - Pfund series

Rough Work

32) The radius of the nucleus of $^{27}_{13}\text{Al}$ is _____.

(A) $3R_0$

(B) $R_0^{\frac{1}{3}}$

(C) R_0

(D) R_0^3

33) Nuclear force is acting between

(A) only proton - proton

(B) only neutron - proton

(C) only neutron - neutron

(D) all the nucleons

34) Tritium has a half-life of 12.5 y undergoing beta decay. The fraction of a sample remain undecayed after 25 y is _____.

(A) $\frac{1}{8}$

(B) $\frac{1}{4}$

(C) $\frac{1}{2}$

(D) $\frac{1}{16}$

35) If n_e = number of free electrons, n_h = number of holes then for pure semi conductors;

- (A) $n_e = n_h$
- (B) $n_h > n_e$
- (C) $n_e > n_h$
- (D) $n_e = n_h^2$

36) When p-n junction is kept in forward bias, _____.

- (A) barrier potential increases
- (B) current due to majority charge carrier decreases
- (C) barrier potential decreases
- (D) none of the given choices

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

- (A) $(n_2 + n_1)e$
- (B) $(n_1^2 + n_2^2)e$
- (C) $(n_1^2 - n_2^2)e$
- (D) $(n_2 - n_1)e$

- 38) A uniformly charged conducting sphere of 2.4 m diameter has a surface charge density of $80 \mu\text{C m}^{-2}$. The charge on the sphere is _____ mC.
- (A) 1.45
 (B) 5.41
 (C) 4.51
 (D) 45.1
- 39) An electric field line is a curve drawn in such a way that the tangent drawn at any point on the curve gives _____ at that point.
- (A) magnitude of the electric field
 (B) direction of the electric field
 (C) both magnitude and direction of electric field
 (D) none of the given choices
- 40) The dimensions of $\frac{Ke^2}{Gm_e m_p}$ is _____.
- (A) $M^0 L^{-1} T^{-1} A^{-2}$
 (B) $M^0 L^1 T^0 A^1$
 (C) $M^0 L^0 T^0 A^0$
 (D) $M^1 L^{-1} T^0 A^{-2}$
- 41) The number of electric field lines coming out of charge _____, kept in a vacuum is 1.13×10^{11} .
 $(\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 \text{N}^{-1} \text{m}^{-2})$
- (A) 2 C
 (B) 1 mC
 (C) 2 mC
 (D) 1 C

42) The electric potential at a distance _____ due to the charge 4×10^{-7} C is 4×10^4 V.

- (A) 9 cm
- (B) 9 mm
- (C) 9 μ m
- (D) 9 m

43) The electric potentials at two points (0, 3) mm and (0, 4) mm in the region in which electric field $\vec{E} = 20\hat{i}$ NC⁻¹ are V_A and V_B respectively then,

- (A) $V_A > V_B$
- (B) $V_A < V_B$
- (C) $V_A = V_B$
- (D) None of the given choices

44) An electron is accelerated by a potential difference of $\Delta V = 2$ volts. The energy gained by it would be _____ eV.

- (A) 1.5 eV
- (B) 1 eV
- (C) 2 eV
- (D) 0.5 eV

- 45) Two capacitors when connected in series, their equivalent capacitance is $3\mu F$ and when they are connected in parallel their equivalent capacitance is $16\mu F$. Their values are respectively _____ μF and _____ μF .
- (A) 8, 8
(B) 8, 16
(C) 16, 1
(D) 4, 12
- 46) Which of the following physical quantity has unit $m^2V^{-1}s^{-1}$?
- (A) mobility
(B) electric field
(C) drift velocity
(D) resistivity
- 47) The value of the temperature co-efficient of resistivity (α) is _____ for metals.
- (A) zero
(B) positive
(C) negative
(D) infinite
- 48) A steady current flows in a metallic conductor of non-uniform cross-section. Which of the following quantities is constant along the conductor?
- (A) electric field
(B) current density
(C) current
(D) drift speed

49) n resistors each of equal value R combine to get maximum and minimum effective resistance. The ratio of maximum effective resistance to the minimum effective resistance is _____.

(A) $\frac{1}{n}$

(B) n^2

(C) n

(D) $\frac{1}{n^2}$

50) For a cyclotron, if v_a is the frequency of the applied voltage and v_c is the cyclotron frequency then the resonance condition is _____.

(A) $v_a < v_c$

(B) $v_a > v_c$

(C) $v_a = v_c$

(D) $v_a = \sqrt{2} v_c$

054 (E)

(MARCH/APRIL 2022)
(SCIENCE STREAM)
(CLASS - XII)

Time : 2 Hours

(Part - B)

/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 as directed.
(Each of 2 marks) [16]
- 1) Write any four properties of electric field lines. [2]
 - 2) Derive an expression for capacitance of the parallel plate capacitor. [2]
 - 3) Write only two statements for Kirchhoff's Rules. [2]
 - 4) Explain Biot-Savart law in brief. [2]
 - 5) Derive an expression for the periodic time of simple harmonic motion of an electric dipole kept in a uniform magnetic field. [2]
 - 6) Explain in brief the phenomenon of self-induction. Derive the formula for self-induced emf. [2]
 - 7) A 44 mH inductor is connected to 220 V, 50 Hz ac supply. Determine the rms value of the current in the circuit. [2]
 - 8) Write any four characteristics of electromagnetic wave. [2]
 - 9) Derive Brewster's law in the case of polarisation by reflection. [2]
 - 10) Write any four points for photon picture of electromagnetic radiation. [2]

- 11) Explain atomic number and atomic mass number of the daughter element in the case of Alpha decay. Also write one example. [2]
- 12) Draw the logic symbol and write Truth table of NOR gate. [2]

SECTION - B

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

- 13) Derive an expression for the electric field due to an infinitely long straight uniformly charged wire. [3]
- 14) A heating element using nichrome connected to a 230 V supply draws an initial current of 4.6 A which settles after a few seconds to a steady value of 2.3 A. What is the steady temperature of the heating element if the room temperature is 27 °C. $[\alpha = 1.7 \times 10^{-4} \text{ } ^\circ\text{C}^{-1}]$ [3]
- 15) Two long and parallel straight wires A and B carrying currents of 8 A and 5 A in the same direction are separated by a distance of 4 cm. Estimate the force on a 10 cm section of wire A. [3]
- 16) A circular coil of radius 8 cm and 20 turns is rotated about its vertical diameter with an angular speed of 50 rad s⁻¹ in a uniform horizontal magnetic field of magnitude 3×10^{-2} T. Obtain the maximum and average emf induced in the coil. If the coil forms a closed loop of resistance 10 Ω, calculate the maximum value of current in the coil. [3]
- 17) a) The radii of curvature of the faces of a double convex lens are 10 cm and 15 cm. Its focal length is 12 cm. What is the refractive index of glass?
 b) A convex lens has 15 cm focal length in air. What is focal length in water?
 (Refractive index of air-water = 1.33 and Refractive index of air-glass = 1.5) [3]
- 18) A beam of light consisting of two wavelengths 6000 Å and 4000 Å, is used to obtain interference fringes in a Young's double-slit experiment.
 a) Find the distance of the third dark fringe on the screen from the central maximum for wavelength 6000 Å.
 b) What is the least distance from the central maximum where bright fringes due to both the wavelengths coincide?
 (Distance between two slits = 0.1 mm. Take D = 100 cm) [3]

- 19) a) For what Kinetic energy of a neutron, will the associated de - Broglie wavelength be $1.40 \times 10^{-10} \text{ m}$?
 b) Find the de-Broglie wavelength of a neutron, in thermal equilibrium with matter, having an average Kinetic energy of $\frac{3}{2} K_B T$ at 300K.
 $[K_B = 1.38 \times 10^{-23} \text{ SI unit}]$ [3]
- 20) What is nuclear chain reaction? State any two difficulties arising against sustaining a chain reaction. Also write the necessary precautions. [3]
- 21) Draw the circuit diagram of a full-wave rectifier. Explain full-wave rectification in brief. Also draw input-output waveforms. [3]

SECTION - C

- Answer any four questions from the following question No. 22 to 27. (Each of 4 marks) [16]
- 22) Derive an electric potential at a distance r ($r \gg a$) due to an electric dipole. Also write potential on the axis and in the equatorial plane. [4]
- 23) For potentiometer derive
 a)
$$\frac{\varepsilon_1}{\varepsilon_2} = \frac{l_1}{l_2}$$

 b) Formula for internal resistance of the cell.
 (Draw necessary circuit diagrams) [4]
- 24) In the case of an AC voltage applied to an inductor, derive formula for an electric current i at time t . Also, derive an expression for an average power over a complete cycle. [4]
- 25) Derive $i + e = A + \delta$ for a triangular glass prism. Also write the condition for the angle of minimum deviation. Derive the formula for the refractive index of the material of the prism. [4]
- 26) Derive the exponential law for radioactive disintegration. Also draw the decay curve. [4]
- 27) Which characteristics of photoelectric effect are not explained by the wave nature of light. Explain Einstein's explanation. [4]



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

Sl.No.

054 (E)
(MARCH, 2023)
(SCIENCE STREAM)
(CLASS - XII)

પ્રશ્ન પેપરનો સેટ નંબર જેની
સામેનું વર્તુળ OMR શીટમાં
ઘણું 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

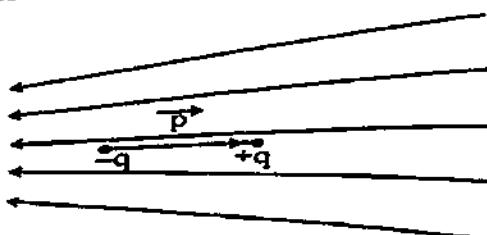
[Maximum Marks : 50]

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 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 O 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.

- 1) Figure shows electric field in which electric dipole \vec{P} is placed.
Which of the following statement is correct?

Rough Work



- (A) The dipole will not experience any force
(B) The dipole will experience a net force towards right
(C) The dipole will experience a net force towards left
(D) The dipole will experience a net force upward

2) The dimensional formula of electric flux is _____

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

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

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

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

3) A plastic rod rubbed with wool is found to have a negative charge of 8×10^{-7} C. The no. of electrons transferred (from which to which?) is _____.

(A) 5×10^{12} , from plastic rod to wool

(B) 5×10^{11} , from plastic rod to wool

(C) 5×10^{10} , from wool to plastic rod

(D) 5×10^{12} , from wool to plastic rod

4) How much charge should be placed on a spherical shell of radius 25 cm to have a surface charge density of $\frac{3}{\pi}$ C/m²?

(A) 0.25 C

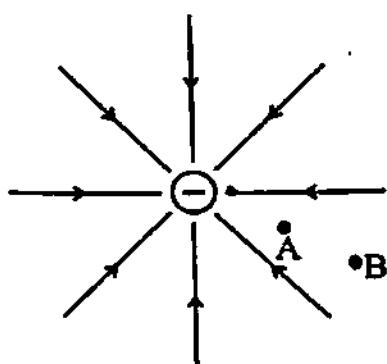
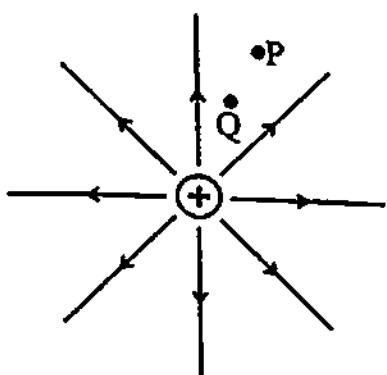
(B) 0.75 C

(C) 0.57 C

(D) 0.5 C

- 5) The Coulombian repulsive force between two alpha particles kept at a distance of 3 cm in air is _____ N.
 (A) 1.024×10^{-24}
 (B) 1.024×10^{-25}
 (C) 1.024×10^{-27}
 (D) 1.024×10^{-23}

- 6) Figure shows the field lines of a positive and negative charge respectively. Give the sign of potential difference $V_Q - V_P$, $V_B - V_A$.



- (A) +ve, +ve
 (B) +ve, -ve
 (C) -ve, +ve
 (D) -ve, -ve

- 7) Energy of a charged capacitor is U. Now it is removed from a battery and then connected to two other identical uncharged capacitors in parallel. What will be the energy of each capacitor?
 (A) U
 (B) $\frac{3U}{2}$
 (C) $\frac{U}{4}$
 (D) $\frac{U}{9}$

- 8) The electric potential energy of $2\mu\text{C}$ charge is $3 \times 10^{-5} \text{ J}$ at a point in a uniform electric field. The electric potential at that point is _____ V.

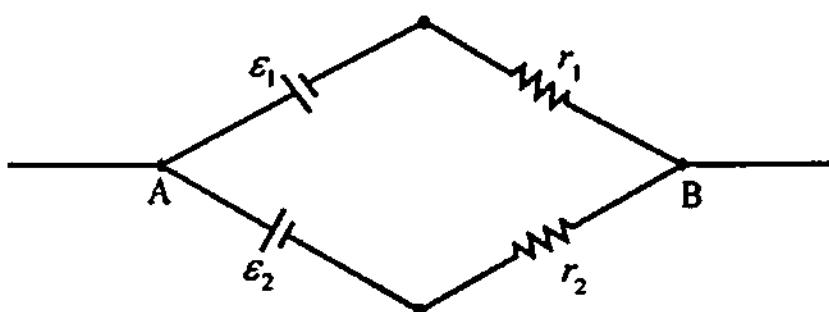
Rough Work

- (A) 6
- (B) 15
- (C) 5
- (D) Zero

- 9) Equipotential surfaces at a very large distance from the collection of charges whose total sum is not zero are approximately _____.

- (A) spheres
- (B) planes
- (C) paraboloids
- (D) ellipsoid

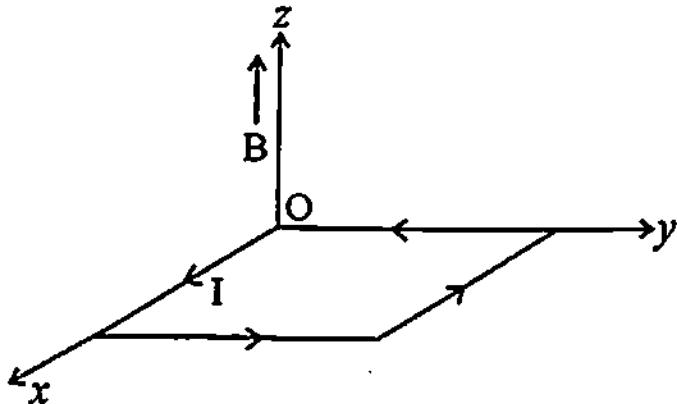
- 10) Two batteries of emf ε_1 & ε_2 ($\varepsilon_2 > \varepsilon_1$) and internal resistance r_1 & r_2 respectively are connected in parallel as shown



- (A) The equivalent emf $\varepsilon_{eq.}$ of the two cells is between ε_1 & ε_2 i.e. $\varepsilon_1 < \varepsilon_{eq.} < \varepsilon_2$
- (B) The equivalent emf $\varepsilon_{eq.}$ is smaller than ε_1
- (C) The equivalent emf is given by $\varepsilon_{eq.} = \varepsilon_1 + \varepsilon_2$
- (D) $\varepsilon_{eq.}$ is independent of internal resistance r_1 & r_2

- 11) Loop rule of Kirchhoff's is a reflection of _____.
 (A) Law of conservation of charge
 (B) Ohm's law
 (C) Law of conservation of momentum
 (D) Law of conservation of energy
- 12) The colour bands of a carbon resistor with three bands having minimum value are _____ in order.
 (A) black, brown, red
 (B) black, black, silver
 (C) black, brown, silver
 (D) black, brown, gold
- 13) A steady current flows in a metallic conductor of non uniform cross-section, which of following quantities is constant along the conductor?
 (A) current
 (B) current density
 (C) electric field
 (D) drift speed
- 14) In a Cyclotron, a charged particle
 (A) undergoes acceleration all the time
 (B) speeds up between the dees because of magnetic field
 (C) speeds up in a dee
 (D) slows down within a dee and speeds up between dees

- 15) A uniform magnetic field of 0.3 T is established along the +ve Z direction. A rectangular loop of sides 10 cm and 5 cm carries a current of 12 A is placed as shown in figure. The torque acting on the loop is _____ Nm.



- (A) $1.8 \times 10^{-2} \hat{i}$
- (B) $-1.8 \times 10^{-2} \hat{j}$
- (C) $-1.8 \times 10^{-2} \hat{i}$
- (D) Zero

- 16) A galvanometer coil has a resistance of 10Ω and the meter shows full scale deflection for 3 mA. The value of shunt to convert this meter into ammeter of range 0 to 10 A is _____ Ω .

- (A) 1
- (B) 2
- (C) 3
- (D) 4

- 17) Which of the following is not a unit of magnetic induction?
- (A) Tesla
 - (B) Newton/meter-Ampere
 - (C) Weber/meter²
 - (D) Newton-meter/Ampere

18) Ferromagnetic materials have _____ retentivity. _____ permeability and

- (A) low, high
- (B) high, low
- (C) high, high
- (D) low, low

19) In the magnetic meridian of a certain place, the horizontal component of earth's magnetic field is 0.20 G and dip angle is 30° . What is the magnetic field at this location?

- (A) 0.23 G
- (B) 0.32 G
- (C) 0.42 G
- (D) 0.82 G

20) A square of side L meter lies in the $x - y$ plane in a region where the magnetic field is given by $\vec{B} = B_0(2\hat{i} + 4\hat{j} + 3\hat{k})$ T, where B_0 is constant. The magnitude of flux passing through the square is

- (A) $2B_0L^2$ Wb
- (B) $3B_0L^2$ Wb
- (C) $4B_0L^2$ Wb
- (D) $\sqrt{29} B_0L^2$ Wb

21) When current I passes through an inductor having self inductance of 4 H. If the current is made double what will be the new self inductance of the inductor.

- (A) Zero
- (B) 2 H
- (C) 4 H
- (D) 8 H

22) Inductive reactance _____.

- (A) limits D.C. current
- (B) limits D.C. voltage
- (C) limits A.C. current
- (D) stores the A.C. current

23) Magnetic flux linked with the coil is given by

$\phi(t) = (2t^2 + 2t + 1)$ Wb and its resistance is 10Ω . The current passing through the coil at $t = 2$ s is _____ A.

- (A) 0.5
- (B) 1
- (C) 1.5
- (D) 2

24) A power transmission line feeds input power at 2300 V to a stepdown transformer with its primary winding having 4000 turns. What should be the number of turns in the secondary in order to get output power at 230 V.

- (A) 400
- (B) 40
- (C) 4000
- (D) 2300

25) For circuits used for transporting electric power, a low power factor implies _____.

- (A) power increases in transmission
- (B) remains constant in transmission
- (C) small power loss in transmission
- (D) large power loss in transmission

- 26) Which of the following combination should be selected for better tuning of an LCR a.c. circuit used for communication?
- (A) $R = 20 \Omega$, $L = 1.5 \text{ H}$, $C = 35 \mu\text{F}$
 (B) $R = 25 \Omega$, $L = 2.5 \text{ H}$, $C = 45 \mu\text{F}$
 (C) $R = 15 \Omega$, $L = 3.5 \text{ H}$, $C = 30 \mu\text{F}$
 (D) $R = 25 \Omega$, $L = 1.5 \text{ H}$, $C = 45 \mu\text{F}$
- 27) If the rms current in a 50 Hz a.c. circuit is 5A, at time $t = 0$ current I is 0. The value of current I at $t = \frac{1}{300}$ seconds is _____ A.
- (A) $5\sqrt{2}$
 (B) $5\sqrt{\frac{3}{2}}$
 (C) $\frac{5}{6}$
 (D) $\frac{5}{\sqrt{2}}$
- 28) T.V. waves range from _____.
- (A) 54 MHz - 890 MHz
 (B) 88 MHz - 108 MHz
 (C) 24.5 GHz - 229.5 GHz
 (D) 400 GHz - 600 GHz
- 29) For a given electromagnetic waves the magnitude of electric field is 6.6 V/m at a point in space. The magnitude of magnetic field at this point is _____ T.
- (A) 19.8×10^{-3}
 (B) 6.6×10^{-3}
 (C) 2.1×10^{-3}
 (D) 2.2×10^{-3}

- 30) A small pin fixed on a table top is viewed from above from a distance of 100 cm. By what distance would the pin appear to be raised if it is viewed from the same point through a 9 cm thick glass slab held parallel to the table. Refractive index of glass = 1.5.
- (A) 3 cm
(B) 6 cm
(C) 9 cm
(D) 5 cm
- 31) The amount of Rayleigh scattering is _____.
(A) directly proportional to wavelength
(B) inversely proportional to wavelength
(C) inversely proportional to fourth power of wavelength
(D) directly proportional to fourth power of wavelength
- 32) Power of plane mirror is _____.
(A) 0
(B) ∞
(C) +1
(D) -1
- 33) The earth takes 24 h to rotate once about the axis. How much time does the Sun takes to shift by 2° , when view from the earth?
(A) 240 s
(B) 480 s
(C) 720 s
(D) 960 s

34) Optical phenomenon taking place for mirror and lens respectively are _____ & _____.

- (A) reflection, refraction
- (B) interference, diffraction
- (C) reflection, diffraction
- (D) refraction, interference

35) A slit of size ' a ' is illuminated by a parallel beam of light of wavelength λ . The angle at which this light is diffracted is approximately _____.

- (A) λ/a
- (B) λ/a^2
- (C) a^2/λ
- (D) a/λ

36) The refractive index of a medium is $\frac{3}{2}$. The speed of light in this medium is _____ m/s [Speed of light in vacuum is $c = 3 \times 10^8$ m/s]

- (A) 3×10^8
- (B) 2.5×10^8
- (C) 2×10^8
- (D) 3.5×10^8

- 37) In Young's double experiment the distance between two slits is 0.2 mm and the distance between slit and screen is 1.5 m. The wavelength of light used is 600 nm. The distance between any two consecutive bright fringes is _____ mm.
- (A) 0.5
 (B) 4.5
 (C) 0.8
 (D) 2.0
- 38) The intensity of incident unpolarized light on a polaroid is I_1 , and the intensity of emergent polarized light from this polaroid is I_2 . The relation between I_1 & I_2 is _____.
- (A) $I_1 = I_2$
 (B) $I_1 > I_2$
 (C) $I_1 < I_2$
 (D) $I_1 = 2I_2$
- 39) Unpolarized light is incident on a plane transparent surface. The reflected and refracted rays are found perpendicular to each other, then the angle of incidence is _____. [Refractive index of the medium is 1.73]
- (A) 90°
 (B) 45°
 (C) 30°
 (D) 60°

- 40) Variation of stopping potential V_0 with frequency (ν) of incident radiation for a given photosensitive material is straight line. [frequency (ν) of incident radiation is greater than threshold frequency (ν_0)].

The slope of this line is _____.

(A) $\frac{\phi_0}{h}$

(B) $\frac{h}{\nu}$

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

(D) $\frac{e}{V_0}$

- 41) The de Broglie wavelength (λ) associated with an electron accelerated through a potential difference of 121 V is _____. [$m_e = 9.1 \times 10^{-31}$ kg, $h = 6.63 \times 10^{-34}$ Js]

(A) 1.12 Å

(B) 2.1 Å

(C) 12.0 Å

(D) 0.12 Å

- 42) Monochromatic light of frequency 6×10^{14} Hz is produced by laser. The power emitted is 2×10^{-3} W. The energy of the photon in this light beam is _____ eV. [$h = 6.63 \times 10^{-34}$ Js, $1\text{eV} = 1.6 \times 10^{-19}$ J]

(A) 4.0

(B) 3.5

(C) 3.0

(D) 2.5

- 43) What is the shortest wavelength present in the Balmer series of spectral lines? [Rydberg's constant $R = 1.097 \times 10^7 \text{ m}^{-1}$]

(A) 26 nm

(B) 91 nm

(C) 365 nm

(D) 820 nm

- 44) What is the angular momentum of electron of Be^{+3} ion in $n = 5$ orbit?

Rough Work

- (A) 5.3×10^{-34} Js
- (B) 6.6×10^{-34} Js
- (C) 3.3×10^{-34} Js
- (D) 1.3×10^{-34} Js

- 45) What is the ratio of total energy of an electron in hydrogen atom in first excited state and third excited state?

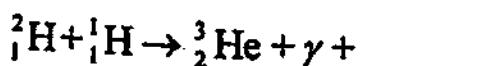
- (A) 1 : 1
- (B) 3 : 1
- (C) 4 : 1
- (D) 1 : 4

- 46) According to mass energy equivalence relation, 9×10^{13} J of energy can be converted into _____ maximum mass.

[Speed of light $c = 3 \times 10^8$ m/s]

- (A) 3 g
- (B) 9 g
- (C) 81 g
- (D) 1 g

- 47) One of the fusion reaction in Sun is given by



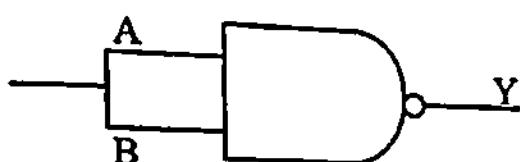
Fill in the blank with correct option.

- (A) 12.86 MeV
- (B) 5.49 MeV
- (C) 1.02 MeV
- (D) 0.42 MeV

48) For a radioactive element half life is 1.5 days. How many minutes will it take to disintegrate this element by 75%?

- (A) 1260
- (B) 4320
- (C) 3240
- (D) 2430

49) Given figure is the equivalent of which logic gate?



- (A) OR
- (B) AND
- (C) NOT
- (D) NOR

50) 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) lowers the potential barrier
- (D) none of the above

054 (E)

(MARCH, 2023)
 (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 of the question paper and total 1 to 18 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.

SECTION-A

- Questions 1 to 8 do as directed. Each question carries 2 marks. [16]
 - 1) Derive an equation for an electric field due to infinitely long straight uniformly charged wire. [2]
 - 2) At room temperature (27°C) the resistance of heating element is 100Ω . What is the temperature of the element if the resistance is found to be 134Ω , given that the temperature coefficient of material of the resistor is $1.7 \times 10^{-4} \text{ }^{\circ}\text{C}^{-1}$? [2]
 - 3) State and explain Gauss's Law for magnetism. [2]

OR

 - 3) Derive the equation $B = \frac{\mu_0}{4\pi} \frac{2m}{r^3}$ for the axial magnetic field for finite Solenoid. m is the magnetic moment of Solenoid & r is the distance of the point from the centre of Solenoid. [2]
 - 4) Define mutual inductance and mention the factors on which mutual inductance depends. [2]
 - 5) Write the four Maxwell's equations in reference to electromagnetic waves. [2]
 - 6) If the magnetic field is parallel to the +ve x - axis and the charged particle is moving along +ve y - axis. Which direction would the Lorentz force act

a) for an electron	b) for a proton?
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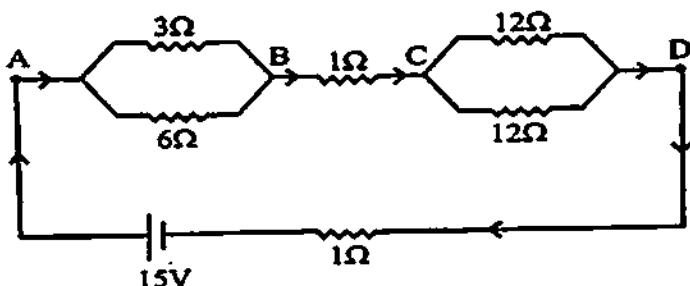
[2]
 - 7) The half life of $^{238}_{92}\text{U}$ undergoing α -decay is 4.5×10^9 years. What is the activity of 1g of sample of $^{238}_{92}\text{U}$? [2]

- 8) Explain β -decay with appropriate example. [2]
 OR
 8) Differentiate between P-type and N-type Semiconductor (any four). [2]

SECTION - B

□ Question No. 9 - 14 do as directed. Each question carries 3 marks. [18]

- 9) What is Potentiometer? Explain how can it be used to determine internal resistance of cell. Draw the circuit diagram and derive the equation. [3]
 OR
 9) A network of resistors is connected to a 15 V battery with internal resistance 1Ω as shown in figure. <https://www.gujaratboardonline.com> [3]
- Compute the equivalent resistance of the network.
 - Obtain current in 12Ω & 6Ω resistance.



- 10) A long straight wire of circular cross-section (radius a) carrying steady current I . The current I is uniformly distributed across the cross-section. Calculate the magnetic field in the region $r < a$ and $r > a$. [3]
- 11) A beam of light consisting of two wavelengths 650 nm and 520 nm is used to obtain interference fringes in Young's double slit experiment. Distance between two slits is 0.25 mm and slit & screen is 1 m. [3]
 - Find the distance of the third bright fringe on the screen from the central maximum for wavelength 650 nm.
 - What is the least distance from the central maximum where the bright fringes due to both the wavelength coincide?
- 12) State and explain Huygen's Principle. [3]
 OR
 12) Explain Davisson Germer experiment with proper diagram. Prove that this experiment confirms the wave nature of electrons and de Broglie relation. [3]
- 13) The work function of cesium is 2.14 eV. Find [3]
 - the threshold frequency of cesium, and
 - the wavelength of the incident light if the photo current is brought to zero by a stopping potential of 0.86V.
- 14) What is rectification? Explain half wave rectifier with proper circuit and draw the wave forms of input and output voltage. [3]

SECTION - C

- Questions 15 to 18 do as directed. Each question carries 4 marks.**

[16]

- 15) The plates of a parallel plate capacitor have an area of 90 cm^2 each and are separated by 2.5 mm. The capacitor is charged by connecting it to a 400 V supply.

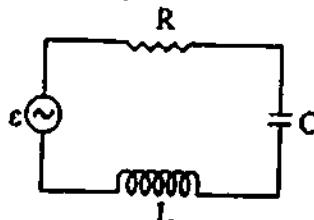
[4]

- a) How much electrostatic energy is stored by the capacitor?

- b) View this energy as stored in the electrostatic field between the plates and obtain the energy per unit volume u . Hence arrive at a relation between u and the magnitude of the electric field E between the plates.

- 16) Figure shows a series LCR circuit connected to a variable frequency 230 V a.c. source. $L = 5 \text{ H}$, $C = 80 \mu\text{F}$, $R = 40 \Omega$.

[4]



- a) Determine the source frequency which derives the circuit in resonance.
 b) Obtain the impedance of the circuit and amplitude of current at the resonating frequency.
 c) Determine the rms potential drops across the three elements of the circuit.
 d) Show that the potential drop across the LC combination is zero at the resonating frequency.

OR

- 16) A series LCR circuit with $L = 0.12 \text{ H}$, $C = 480 \text{ nF}$, $R = 23 \Omega$ is connected to 230 V variable frequency supply.

[4]

- a) What is the source frequency for which current amplitude is maximum? Obtain the maximum value.
 b) What is source frequency for which average power absorbed by the circuit is maximum? Obtain the value of maximum power.
 c) For which frequencies of the source is the power transferred to the circuit half the power at resonant frequency? What is the current amplitude at these frequencies?
 d) What is the Q factor of the given circuit?

- 17) A compound microscope consists of an objective lens of focal length 2.0 cm and an eye piece of focal length 6.25 cm separated by a distance 15 cm. How far from the objective should an object be placed in order to obtain the final image at

[4]

- a) the least distance of distinct vision (25 cm) and
 b) at infinity?

What is the magnifying power of microscope in each case?

- 18) State Bohr's postulates for atomic model. Derive the equations for orbital radius, orbital speed and total energy for an electron in n^{th} orbit in hydrogen atom.

[4]

OR

- 18) Explain atomic spectra. Write the equation for Lyman series, Paschen series, Brackett series & Pfund series for hydrogen atom.

[4]



This Question Paper contains 20 printed pages.

(Part - A & Part - B)

Sl.No.

054 (E)
(MARCH, 2024)
(SCIENCE STREAM)
(CLASS - XII)

ગુજરાતી પેપરનો સેટ નંબર જેણી
સામેનું વર્તુળ OMR શીટમાં
ઘણું કરવાનું રહે છે.
Set No. of Question Paper,
circle against which is to be
darker in OMR sheet.

06

Part - A : Time : 1 Hour / Marks : 50

Part - B : Time : 2 Hours / Marks : 50

(Part - A)

Time : 1 Hour

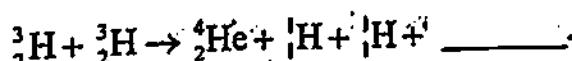
[Maximum Marks : 50]

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 O 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.

-
- 1) Choosing the correct option, complete the given nuclear fusion reaction that occurs in the sun.

Rough Work



- (A) 0.42 MeV
(B) 1.02 MeV
(C) 12.86 MeV
(D) 5.49 MeV

- 2) The radius of nuclei of $^{27}_{13}\text{Al}$ is _____. ($R_0 = 1.2 \text{ fm}$)
(A) $3.0 \times 10^{-15} \text{ m}$ (B) $3.6 \times 10^{-15} \text{ m}$
(C) $3.2 \times 10^{-14} \text{ m}$ (D) $3.6 \times 10^{-12} \text{ m}$

3) Which of the following element has maximum binding energy per nucleon?
(A) Uranium (B) Lithium
(C) Tungsten (D) Iron

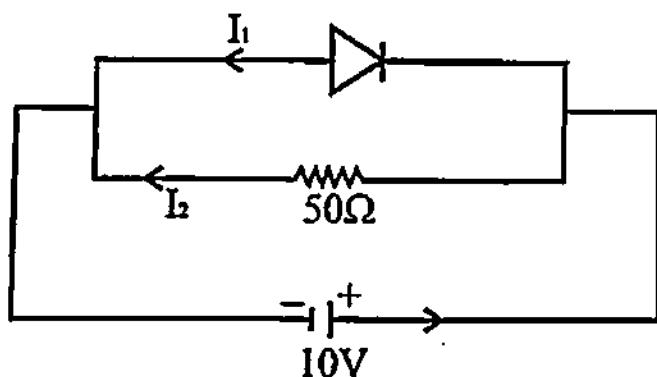
4) According to Einsteins mass-energy equivalent relation, the energy equivalent of 1mg of substance is _____.
(Speed of light in vacuum $C = 3 \times 10^8 \text{ m/s}$)
(A) $9 \times 10^{13} \text{ J}$ (B) $9 \times 10^{10} \text{ J}$
(C) $9 \times 10^{-13} \text{ J}$ (D) $9 \times 10^{-10} \text{ J}$

5) The atomic masses of two isotopes of an element are 34.98u and 36.98u and their relative abundance are 75.4% and 24.6% respectively, then the average atomic mass of the element is _____.
(A) 34.51 u (B) 36.46 u
(C) 35.47 u (D) 35.99 u

6) In a p-type semiconductor, which of the following statements is true?
(A) Electrons are majority charge carriers and trivalent atoms are the dopants
(B) Electrons are minority charge carriers and pentavalent atoms are the dopants
(C) Holes are minority carriers and pentavalent atoms are the dopants
(D) Holes are majority carriers and trivalent atoms are the dopants

- 7) When a forward bias is applied to a p-n junction it _____.
 (A) raises the potential barrier
 (B) reduces the majority carrier to zero
 (C) lowers the potential barrier
 (D) potential barrier remain same
- 8) What type of semiconductor is CdS?
 (A) Elemental
 (B) Organic
 (C) Inorganic
 (D) Organic polymer
- 9) Which of the following substance have energy gap (E_g) more than 3eV?
 (A) Metals
 (B) Alloys
 (C) Semiconductor
 (D) Non-metals

10)



If a diode having infinite reverse-bias resistance is connected in a circuit as shown in figure, then I_1 and I_2 are respectively _____.

- (A) 0.0A; 0.2A
- (B) 10.0A; 0.0A
- (C) 0.2A; 0.0A
- (D) 0.0A; 0.0A

- 11) If an electric charge 'q' is placed at the centre of a cube, then the flux associated with each surface of the cube is _____.

(A) $\frac{q}{\epsilon_0}$

(B) $\frac{q}{6\epsilon_0}$

(C) $\frac{q}{4\epsilon_0}$

(D) $\frac{q}{2\epsilon_0}$

- 12) The dimensional formula of electric field is _____.

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

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

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

(D) $[M^0 L^1 T^{-3} A^{-1}]$

- 13) Two identical conducting spheres A and B having charges $+q$ and $-q$ are kept at 'd' distance apart experience coulombian force F between them. If 50% of charge is transferred from sphere B to A then the new coulombian force between them is _____.

(A) F

(B) $\frac{F}{2}$

(C) $\frac{F}{4}$

(D) $\frac{2F}{3}$

- 14) Three equal charges $+q$ each are placed at the three vertices of an equilateral triangle. The electric field at the centroid of the triangle is _____.

(r is the length of the side of triangle)

(A) $\frac{3kq}{r^2}$

(B) $\frac{kq}{r^2}$

(C) zero

(D) $\frac{\sqrt{3}kq}{2r^2}$

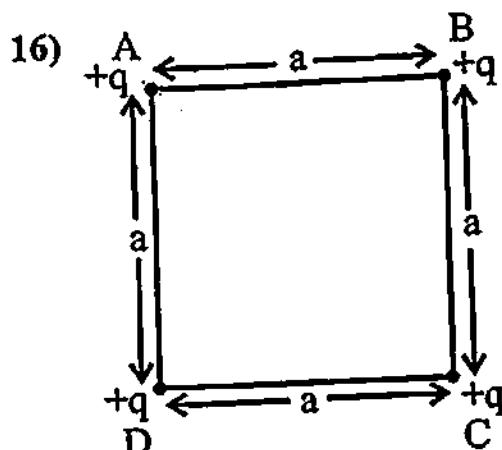
15) If two infinite plane sheets having same surface charge density σ are placed parallel to each other, then the electric field between the two sheet is _____.

(A) zero

(B) $\frac{\sigma}{\epsilon_0}$

(C) $\frac{\sigma}{2\epsilon_0}$

(D) $\frac{2\sigma}{\epsilon_0}$



As shown in figure charges $+q$ each are placed at the four vertices of a square. Then the coulombian force acting on charge placed at vertex D is _____.

(A) $\left(\sqrt{2} + \frac{1}{2}\right) \frac{kq^2}{a^2}$

(B) $\left(\sqrt{2} - \frac{1}{2}\right) \frac{kq^2}{a^2}$

(C) $\frac{\sqrt{2} kq^2}{a^2}$

(D) $\frac{kq^2}{2a^2}$

- 17) Charge $+Q$ is placed at the centre of a circular path of radius r . The work done to bring charge $+q$ from one end of the diameter to other end of the circular path in the electric field produced by charge $+Q$ is _____.

(A) $\frac{kQq}{r}$

(B) $\frac{kQq}{2r}$

(C) zero

(D) $\frac{2kQq}{r}$

- 18) By keeping a conductor in an external electric field and from the result obtained by electrostatics, which of the following options is wrong?

(A) Inside a conductor electrostatic field is zero

(B) At the surface of a charged conductor electric field must be perpendicular to the surface

(C) The interior of the conductor have excess charge in static situation

(D) Electrostatic potential is constant through out the volume of the conductor

- 19) A charged capacitor is disconnected from the battery and if the distance between the two plates of the capacitor is increased then _____.

(A) Charge on plate will decrease

(B) Charge on plate will remain same

(C) The potential difference between the two plates will decrease

(D) Capacitance of the capacitor will increase

- 20) Which of the following molecule is not polar?
 (A) HCl
 (B) H₂O
 (C) NH₃
 (D) H₂
- 21) If a 12pF capacitor is connected to a 50V battery then the electrostatic energy stored in the capacitor is _____.
 (A) 1.5×10^{-12} J
 (B) 1.5×10^{-6} J
 (C) 1.5×10^{-8} J
 (D) 3×10^{-8} J
- 22) If a conducting wire of length L is uniformly stretched to double its length, then its conductivity becomes _____.
 (A) double
 (B) 4 times
 (C) halved
 (D) remain same
- 23) Resistivity of which of the following substance decrease on increasing the temperature?
 (A) Copper
 (B) Silicon
 (C) Aluminium
 (D) Nichrome
- 24) The storage battery of a car has an emf of 12V. If the internal resistance of the battery is 0.6Ω then the maximum current that can be drawn from the battery is _____.
 (A) 20 A
 (B) 25 A
 (C) 30 A
 (D) 72 A

- 25) If a battery of 12 V is connected across the diametrically end points A & B of a conducting ring of radius R and the current drawn from the battery is I, then the magnetic field produced at the centre of the ring due to the ring is _____.

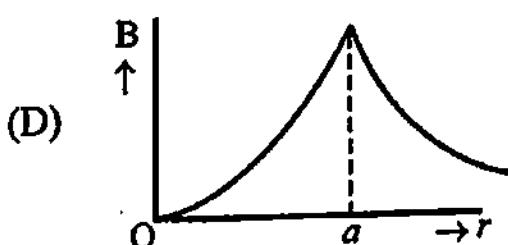
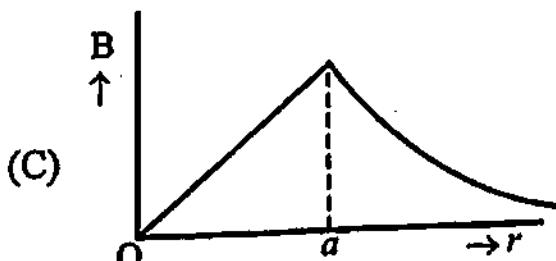
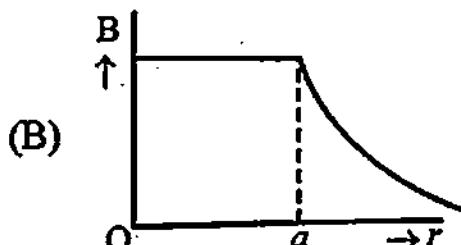
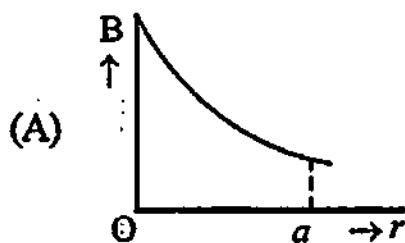
(A) Zero

(B) $\frac{\mu_0 I}{2R}$

(C) $\frac{\mu_0 I}{4\pi R}$

(D) $\frac{\mu_0 I}{R}$

- 26) Which of the following graph represents magnetic field (B) versus distance r from the centre of a long straight conducting wire of uniform cross sectional area carrying steady current I and radius a ?



- 27) A closely wound solenoid 120 cm long has 4 layers of windings of 400 turns each. The diameter of the solenoid is 1.8 cm. If the current carried is 8.0 A. Estimate the magnitude of B inside the solenoid near its centre.

(A) $5.12 \pi \times 10^{-7}$ T
 (B) $5.12 \pi \times 10^{-3}$ T
 (C) $4.27 \pi \times 10^{-3}$ T
 (D) $8 \pi \times 10^{-3}$ T

- 28) A conducting ring of radius R and one turn is formed from a conducting wire of length L and on passing current I the obtained magnetic dipole moment is m . If this wire is then converted to a ring of two turns and on passing electric current I , the new magnetic dipole moment obtained is _____.

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

- 29) A short bar magnet placed with its axis at 30° with a uniform external magnetic field of 0.25T experiences a torque of magnitude $4.5 \times 10^{-2}\text{ J}$. The magnitude of the magnetic moment of the magnet will be _____ JT^{-1} .

(A) 0.18
 (B) 0.36
 (C) 0.54
 (D) 0.72

- 30) The flux associated with a closed loop is $\phi_{(t)} = 3t^2 + 2t + 5$ weber. If the resistance of the loop is 14Ω , then the current induced in this coil in $t = 2\text{ sec}$ is _____.

(A) 1 A
 (B) 2 A
 (C) 1.5 A
 (D) 2.5 A

- 31) Current in a circuit falls from 5.0 A to 0.0 A in 0.1 s . If an average emf of 100 V induced then the value of self inductance of the circuit is _____.
 (A) 0.5 H
 (B) 1 H
 (C) 2 H
 (D) 4 H
- 32) Mutual inductance of a system of two coil does not depend on _____.
 (A) No. of turns of the coil
 (B) Distance between two coil
 (C) The relative permeability of the medium within the coil
 (D) Current passing through the coils
- 33) A 1.0 m long metallic rod is rotated with an angular frequency 200 rad/s about an axis normal to the rod passing through its one end. The other end of the rod is in contact with a circular metallic ring. A constant and uniform magnetic field of 0.5 T parallel to the axis exist everywhere. The emf developed between the centre and the ring is _____.
 (A) 100 V
 (B) 200 V
 (C) 50 V
 (D) 400 V
- 34) From which of the following options the power factor of an A.C. circuit can be zero.
 (A) R and L in series
 (B) R and C in series
 (C) L, C and R in series
 (D) L and C in series

- 35) An L-C-R series circuit is connected to an AC source of peak voltage 240V. The phase difference between voltage and current of this circuit is 45° and resistance is 100Ω , then the rms value of current through the circuit is _____.

- (A) 5.25 A
- (B) 1.7 A
- (C) 3.5 A
- (D) 1.2 A

- 36) Which of the following option represents Ampere - Maxwell Law? <https://www.gujaratboardonline.com>

- (A) $\oint \vec{B} \cdot d\vec{l} = \mu_0 i_c + \mu_0 \frac{d\phi_E}{dt}$
- (B) $\oint \vec{B} \cdot d\vec{l} = \mu_0 i_c + \epsilon_0 \frac{d\phi_E}{dt}$
- (C) $\oint \vec{B} \cdot d\vec{l} = \mu_0 i_c + \frac{d\phi_E}{dt}$
- (D) $\oint \vec{B} \cdot d\vec{l} = \mu_0 i_c + \mu_0 \epsilon_0 \frac{d\phi_E}{dt}$

- 37) Which of the following waves is used in speed gun to measure the speed of ball in cricket match?

- (A) Radio wave
- (B) Microwave
- (C) Infrared waves
- (D) Ultraviolet wave

- 38) The speed of light in a medium of refractive index 1.25 is _____.

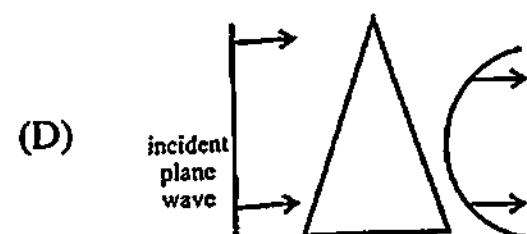
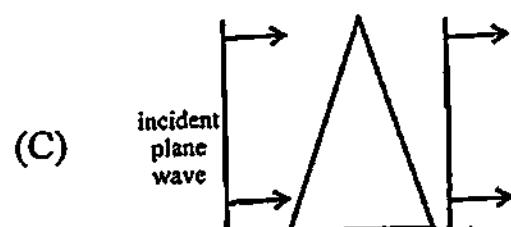
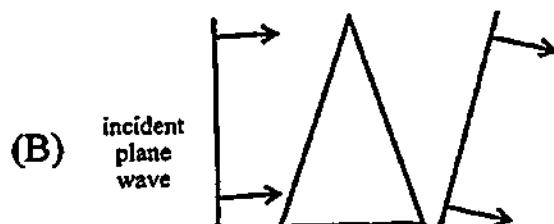
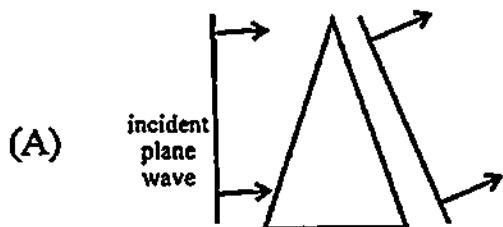
(Speed of light in vacuum is $3 \times 10^8 \text{ ms}^{-1}$)

- (A) $2.4 \times 10^8 \text{ ms}^{-1}$
- (B) $2.0 \times 10^8 \text{ ms}^{-1}$
- (C) $1.5 \times 10^8 \text{ ms}^{-1}$
- (D) $1.25 \times 10^8 \text{ ms}^{-1}$

- 39) A small telescope has an objective lens of focal length 140 cm and an eye piece of focal length 5 cm. The magnifying power of telescope for viewing distant object when the telescope is in normal adjustment is _____.

- (A) 145
- (B) 70
- (C) 28
- (D) 35

- 40) Which of the following figure is correct on the basis of Huygens principle for refraction of a plane wave by a thin prism.



- 41) Two waves having same intensity I_0 and originated from two non-coherent sources superpose at a point. The average intensity at that point is _____.

(A) I_0

(B) $2I_0$

(C) $3I_0$

(D) $4I_0$

- 42) In the case of Photoelectric effect, on increasing the frequency of incident light, _____.

(A) Photoelectric current increases

(B) Photoelectric current decreases

(C) Stopping potential increases

(D) Stopping potential decreases

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

(A) 1.5 eV

(B) 3.0 eV

(C) 1.5 J

(D) 1.6×10^{-19} J

- 44) If de-Broglie wavelength of a dust particle of mass 1.0×10^{-9} kg is 3×10^{-25} m then the speed of the particle is _____.

($h = 6.625 \times 10^{-34}$ Js)

(A) 1.1 ms^{-1}

(B) 1.0 kms^{-1}

(C) 1.2 kms^{-1}

(D) 2.2 ms^{-1}

45) Threshold frequency of which of the following metal does not lie in the ultraviolet region. (In case of photoelectric effect)

- (A) Zinc
- (B) Cadmium
- (C) Magnesium
- (D) Sodium

46) The momentum of a photon of light of frequency f is _____.

(A) $\frac{hc}{f}$

(B) $\frac{h}{cf}$

(C) $\frac{hf}{c}$

(D) hcf

47) If the radius of hydrogen atom in its first orbit is a_0 , then its radius in third excited state is _____.

- (A) $3a_0$
- (B) $4a_0$
- (C) $9a_0$
- (D) $16a_0$

48) The size of atom in Thomson's model is _____ the size in Rutherford's model.

- (A) much greater than
- (B) not different from
- (C) much less than
- (D) double

- 49) In accordance with the Bohr's model, the quantum number that characterises the earth's revolution around the sun in an orbit of radius 1.5×10^{11} m with orbit speed 3×10^4 m/s is _____.
 (Mass of earth is 6.0×10^{24} kg, $h = 6.625 \times 10^{-34}$ Js)

(A) 2.6×10^{72}
 (B) 2.6×10^{74}
 (C) 2.6×10^{39}
 (D) 2.6×10^{73}

- 50) Kinetic energy of electron in one of the orbit of hydrogen atom is x then its total energy is _____.

(A) $-x$
 (B) $-\frac{x}{2}$
 (C) $-2x$
 (D) $-\frac{x}{8}$

054 (E)

(MARCH, 2024)
 (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 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.

SECTION-A

- From the question nos. 1 to 12 given below. Answer any 8 questions (Each question carries 2 marks) [16]
- 1) Derive the formula for the torque acting on a dipole placed in a uniform external electric field. [2]
 - 2) An infinite line charge produces a field of 9×10^4 N/C at a distance of 2 cm. Calculate the linear charge density. [2]
 - 3) Define mobility and write its formula, unit and dimensional formula. [2]
 - 4) Write the characteristics of magnetic field lines. [2]
 - 5) Obtain the expression for the magnetic energy stored in a solenoid in terms of magnetic field B, area A and length l of the solenoid and hence obtain formula for magnetic energy per unit volume. [2]
 - 6) A 100Ω resistor is connected to a 220V, 50 Hz AC supply. [2]
 - a) What is the rms value of current in the circuit?
 - b) What is the net power consumed over a full cycle?

- 7) Derive the relation between focal length (f) and radius of curvature (R) for a spherical convex mirror with the help of a geometrical diagram of reflection of incident ray on a convex spherical mirror. [2]
- 8) Using Huygens principle, explain reflection of a plane wave by a plane reflecting surface. [2]
- 9) Light of frequency 7.21×10^{14} Hz is incident on a metal surface. Electrons with a maximum speed of 6.0×10^5 m/s are ejected from the surface. What is the threshold frequency for photoemission of electrons? [2]
($h = 6.625 \times 10^{-34}$ Js, $e = 1.6 \times 10^{-19}$ C, $m = 9.1 \times 10^{-31}$ kg)
- 10) A hydrogen atom initially in the ground level absorbs a photon which excites it to the $n = 4$ level. Determine the wavelength and frequency of photon. [2]
($h = 6.625 \times 10^{-34}$ Js, $C = 3 \times 10^8$ m/s)
- 11) Write any two features of nuclear binding force. [2]
- 12) Suppose a pure Si crystal has 5×10^{28} atom m^{-3} . It is doped by 1 ppm concentration of pentavalent As. Calculate the number of electrons and holes. [2]
Given that ($n_i = 1.5 \times 10^{16} \text{ m}^{-3}$).

SECTION - B

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

- 13) A spherical conductor of radius 12 cm has a charge of 1.6×10^{-7} C distributed uniformly on its surface. What is the electric field
 a) inside the sphere?
 b) just outside the sphere?
 c) at a point 18 cm from the centre of the sphere?
- 14) Obtain the formula for equivalent emf and equivalent internal resistance of a series combination of two cells of emf ϵ_1 and ϵ_2 and internal resistance r_1 and r_2 respectively. [3]
- 15) Obtain the formula for force acting between two parallel straight current carrying conductors and hence define one ampere. [3]

(P.T.O.)

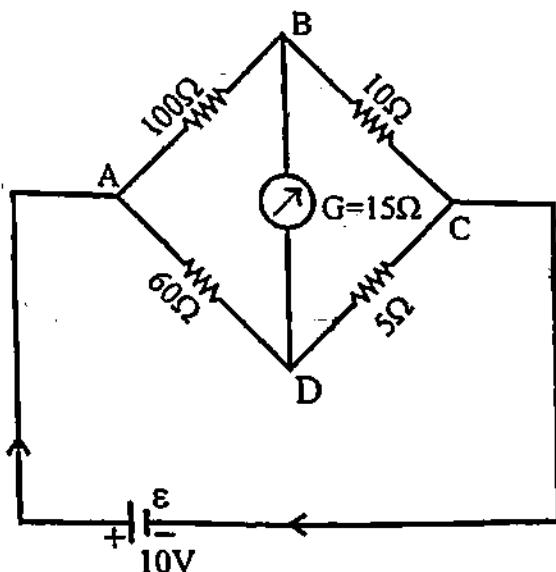
- 16) A horizontal straight wire 10m long extending from east to west is falling with a speed of 5.0 ms^{-1} at right angle to the horizontal component of the earth's magnetic field $3 \times 10^{-5} \text{ Wb m}^{-2}$. [3]
- What is the instantaneous value of the emf induced in the wire?
 - What is the direction of the emf?
 - Which end of the wire is at the higher electrical potential?
- 17) In actual transformers, small energy losses do occur. Give reason for it and how it can be reduced. (Any three) [3]
- 18) a) The radii of curvatures of the faces of a double convex lens are 10 cm and 15 cm. Its focal length is 12 cm. What is the refractive index of the material of lens?
 b) A convex lens of glass has 20 cm focal length in air. What is focal length in water? (Refractive index of air-water is 1.33. Refractive index of air-glass = 1.5) [3]
- 19) Discuss the intensity of transmitted light when a polaroid sheet is rotated between two crossed polaroids. [3]
- 20) Summarise any three experimental features and observation described in the experimental study of photoelectric effect. [3]
- 21) On the basis of Bohr's postulate obtain the formula for radius and total energy of electron in the n^{th} stable orbit for hydrogen atom. [3]

SECTION - C

- Answer any four questions from the following question nos. 22 to 27 as directed. (Each question carries 4 marks) [16]
- 22) Derive the formula for electric potential due to an electric dipole at a point having position vector \vec{r} with respect to the mid-point of the dipole and discuss the electric potential on [4]
- equator
 - axis

- 23) As shown in figure, resistances are connected in the four arms of a Wheatstone bridge.

[4]



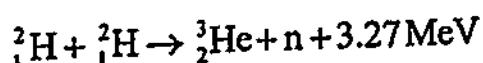
A galvanometer of 15Ω resistance is connected across BD. Calculate the current through galvanometer when a potential difference of 10V is maintained across AC.

- 24) A sinusoidal voltage of peak value 283 V and frequency 50Hz is applied to a series LCR circuit in which $R = 3\Omega$, $L = 25.48\text{mH}$ and $C = 796 \mu\text{F}$. Find [4]

- the impedance of the circuit
- the phase difference between the voltage across the source and the current,
- the power dissipated in the circuit and
- the power factor.

- 25) Draw the ray diagram for the formation of image by a compound microscope and obtained the formula for magnification. [4]

- 26) How long can an electric lamp of 100W be kept glowing by fusion of 2.0 kg of deuterium? Take the fusion reaction as [4]



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



This Question Paper contains 20 printed pages.

(Part - A & Part - B)

Sl.No. 1200967

054 (G)

(JUNE, 2024)
(SCIENCE STREAM)
(CLASS - XII)

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

12

Part - A : Time : 1 Hour / Marks : 50

Part - B : Time : 2 Hours / Marks : 50

(Part - A)

Time : 1 Hour]

[Maximum Marks : 50

સૂચનાઓ :

- 1) આ પ્રશ્નપત્રના ભાગ -A માં હેતુલક્ષી પ્રકારના કુલ 50 પ્રશ્નો છે. બધા જ પ્રશ્નો ફરજિયાત છે.
- 2) પ્રશ્નોની કમ સંખ્યા 1 થી 50 છે અને દરેક પ્રશ્નનો ગુણ 1 છે.
- 3) કાળજીપૂર્વક દરેક પ્રશ્નનો અભ્યાસ કરી સાચો વિકલ્પ પસંદ કરીને OMR શીટમાં જવાબ લખવો.
- 4) આપને અલગથી આપેલ OMR પત્રકમાં જે તે પ્રશ્ન નંબર સામે (A) O, (B) O, (C) O, (D) O આપેલા છે. તે પ્રશ્નનો જે જવાબ સાચો હોય તેના વિકલ્પ પરના વર્તુળને બોલપેનથી પૂર્ણ ● ધૂં કરવાનું રહેશે.
- 5) રૂફ કાર્ય હેતુ આ ટેસ્ટ બુકલેટમાં આપેલી જાયા પર કરવાનું રહેશે.
- 6) પ્રશ્નપત્રકમાં ઉપરની જમણી બાજુમાં આપેલા પ્રશ્નપત્રક સેટ નં. ને OMR પત્રકમાં આપેલી જાયામાં લખવાનું રહેશે.
- 7) વિદ્યાર્થીઓ જડી જણાય ત્યાં સાદા કેલ્ક્યુલેટર અને લોગ ટેબલનો ઉપયોગ કરી શકશે.
- 8) આ પ્રશ્નપત્રમાં વપરાયેલ સંજાઓને તેના ઘોષ્ય પ્રચલિત અર્થ છે.

- 1) કાર્બન, સિલિકોન અને જર્મનિયમ દરેકને ચાર વેલેન્સ ઈલેક્ટ્રોન હોય છે. તેમને અનુક્રમે $(E_g)_C > (E_g)_{Si} > (E_g)_{Ge}$ અને $(E_g)_{Ge} < (E_g)_{Si} < (E_g)_C$ જેટલા ઊર્જા બેન્ડ ગેપ વડે છુટા પાડતા વેલેન્સ અને કન્ડક્શન બેન્ડ વડે દર્શાવવામાં આવે છે. નીચેનામાંથી કયું વિદ્યાન સત્ય છે?

રૂફ કાર્ય

- (A) $(E_g)_C > (E_g)_{Si} > (E_g)_{Ge}$ ✓
- (B) $(E_g)_C < (E_g)_{Ge} > (E_g)_{Si}$ ✗
- (C) $(E_g)_{Si} < (E_g)_{Ge} < (E_g)_C$
- (D) $(E_g)_C = (E_g)_{Si} = (E_g)_{Ge}$

૨૬ કાર્ય

2) n - પ્રકારના સિલિકોન માટે નીચેના વિધાનોમાંથી ક્યું સાચું છે?

- (A) હોલ્સ મેજેરિટી વાહકો છે અને ટ્રાઇવેલન્ટ પરમાણુઓ ડોપન્ટ છે.
- (B) ઈલેક્ટ્રોન માઈનોરિટી વાહકો છે અને પેન્ટાવેલન્ટ પરમાણુઓ ડોપન્ટ છે.
- (C) ઈલેક્ટ્રોન મેજેરિટી વાહકો છે અને ટ્રાઇવેલન્ટ પરમાણુ ડોપન્ટ છે.
- (D) હોલ્સ માઈનોરિટી વાહકો છે અને પેન્ટાવેલન્ટ પરમાણુઓ ડોપન્ટ છે.

3) નીચેના પૈકી ક્યું અકાર્બનિક મિશ્ર અર્ધવાહક છે?

- (A) Ge
- (B) Si
- (C) GaAs ✓
- (D) C

4) એક ઘનાકાર ગાર્સિયન સપાટી સાથે સંકળાયેલું કુલ વિદ્યુત ફલક્સ $1.9 \times 10^5 \text{ Nm}^2 \text{ C}^{-1}$ છે. સપાટીના કેન્દ્ર પરનો વિદ્યુતભાર _____ જેટલો હશે. (ઘનની ધારની લંબાઈ = 9.0 cm)

- (A) $4 \mu\text{C}$
- (B) 2 mC
- (C) $2 \mu\text{C}$ ✓
- (D) 4 mC

$$\phi = \frac{q}{6}$$

$$\begin{aligned} q &= \phi \cdot 6 \\ &= 1.9 \times 10^5 \times 8.85 \times 10^{-12} \\ &= 1.68 \times 10^{-7} \\ &= 0.17 \times 10^{-6} \text{ C} \\ &= 0.17 \mu\text{C} \end{aligned}$$

5) એક અનંત લંબાઈનો રેખીય વિદ્યુતભાર 2 cm અંતરે $9 \times 10^4 \text{ NC}^{-1}$ વિદ્યુતક્ષેત્ર ઉત્પન્ન કરે છે, તો રેખીય વિદ્યુતભાર ધનતા _____.

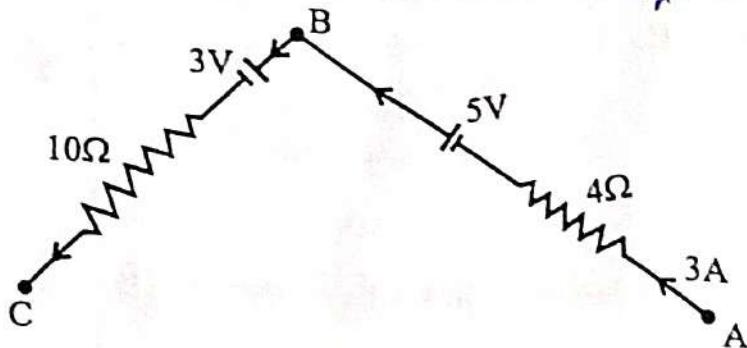
- | | |
|-----------------------------|-----------------------------|
| (A) $0.1 \mu\text{Cm}^{-1}$ | (B) 0.2 mCm^{-1} |
| (C) 0.1 mCm^{-1} | (D) $0.2 \mu\text{Cm}^{-1}$ |

૨૬ કાર્ય

- 6) જો કોઈ પદાર્થ 10^{24} ઇલેક્ટ્રોન અને 10^{26} પ્રોટોન ધરાવતો હોય તો, પદાર્થ પર
વિદ્યુતભારનો જથ્થો n_1 n_2 C. $\frac{Q = n_2 e - n_1 e}{(n_2 - n_1)e} = \frac{(10^{26} - 10^{24})e}{(100 \times 10^{24} - 10^{24})e} = \frac{99 \times 10^{24}}{99 \times 10^{24}} e = 158.4 \times 10^{-7}$
- (A) 1.6×10^{17} (B) 1.58×10^7
(C) 1.6×10^{-17} (D) 1.58×10^{-7}
- 7) જ્યારે વિદ્યુત ડાયપોલ ચાકમાત્રા હોય અસમાન વિદ્યુતક્ષેત્ર E, ને સમાંતર હોય છે
ત્યારે ડાયપોલ પર લાગતું બુન્દ $-1 \frac{1}{2}$. એટાની પણ લાગે છે.
- (A) ઘટતા ક્ષેત્રની દિશામાં લાગે છે.
(B) E ક્ષેત્રને લંબ દિશામાં લાગે છે.
(C) શૂન્ય હોય છે. ✓
(D) વધતા ક્ષેત્રની દિશામાં લાગે છે.
- 8) 9cm ની બાજુવાળા નિયમિત ષટ્કોણના દરેક શિરોબિંદુએ $5\mu C$ વિદ્યુતભાર
હો. ષટ્કોણના કેન્દ્ર પર વિદ્યુત સ્થિતિમાં 3×10^5 V. $V = C \frac{Q}{R}$
 $K = 9 \times 10^9 N m^2 C^{-2}$
- (A) 3×10^6 (B) 3×10^5
(C) 3×10^7 (D) 3×10^8
- 9) 12pF નું એક કેપેસીટર 50V ની બેટરી સાથે જોડેલ હો. કેપેસીટરમાં સંગ્રહ
પામતી સ્થિત વિદ્યુત ઊર્જા $1.5 \times 10^{-10} J$. $U = \frac{1}{2} C V^2$
- (A) 2.5×10^{-8} (B) 1.5×10^{-10}
(C) 1.5×10^{-8} (D) 2.5×10^{-10}
- 10) સમાંતર પ્લેટ કેપેસીટરમાં સીમિત ક્ષેત્રફળની પ્લેટો આટે, ડિનારીઓ પાસે વિદ્યુતક્ષેત્ર
રૂખાઓ બહાર તરફ વળે છે. આ ઘટનાને $-\infty$ કહે છે.
- (A) ધૂવીભવન $-0.5 \times 12 \times 10^{-10}$
(B) ફૂન્ઝંગ ઓફ ધ ફિલ $\times C_{50}$
(C) સ્થિતવિદ્યુત રીલ્ડિંગ
(D) વિવર્તન

૨૬ કાર્ય

11)



$$V_A - 12 + 5 - 3 - 30 - V_C = 0$$

$$V_A - V_C = 12 - 5 + 3 + 30$$

આપેલ પરિપथ માટે $V_A - V_C = \underline{\hspace{2cm}}$ V.

(A) 20

✓(B) 15

© (C) 40

(D) 30

- 12 + 5 +

3 - 10

- 12) 15m લંબાઈના $6 \times 10^{-7} \text{ m}^2$ જેટલું નિયમિત ક્ષેત્રફળ ધરાવતા તારમાંથી અવગાળી શક્યતા ઓછો પ્રવાહ પસાર કરવામાં આવે છે ત્યારે તેનો અવરોધ 5Ω માપવામાં આવે છે. આ તાપમાને દ્રવ્યની અવરોધકતા $\underline{\hspace{2cm}}$ Ωm .

(A) 2×10^{-7}

$$\sigma = \frac{RA}{l}$$

✓(B) 3×10^{-7} (C) 2×10^7

$$= 2 \times 10^{-7}$$

(D) 3×10^7

$$\frac{0.006}{0.6}$$

- 13) જો $\epsilon_1 = 1.2 \text{ V}$, $\epsilon_2 = 1.4 \text{ V}$ અને $\epsilon_3 = 1.5 \text{ V}$ emf ધરાવતા અને અનુક્રમે $r_1 = 0.1 \Omega$, $r_2 = 0.2 \Omega$ અને $r_3 = 0.3 \Omega$ જેટલો આંતરિક અવરોધ ધરાવતા 3 કોષોને સમાંતર જોડવામાં આવેલા હોથ તો, $\frac{\epsilon_{eq}}{r_{eq}} = \underline{\hspace{2cm}}$ $\text{V}\Omega^{-1}$.

(A) 2.4

(B) 3.4

(C) 34

✓(D) 24

$$\frac{12.616}{0.01}$$

~~$$\frac{0.12}{0.01} = 12$$~~

$$\frac{0.12}{0.01} = 12$$

$$\frac{\epsilon_1 r_1 + \epsilon_2 r_2}{r_1 + r_2} = 0.6$$

$$\frac{r_1 r_2}{r_1 + r_2}$$

$$\frac{\epsilon_{eq}}{r_{eq}} = \frac{\epsilon_1}{r_1} + \frac{\epsilon_2}{r_2} + \frac{\epsilon_3}{r_3}$$

$$= 12 \left(\frac{4}{7} + 5 \right)$$

- 14) P જેટલો પાવર ધરાવતાં ઉપકરણને પાવર સ્ટેશનથી જોડતા તારનો વોલ્ટેજ V અને નિયત અવરોધ R_c છે. તો આ પ્રસારણમાં વ્યથ પામતી ઊર્જા _____ હશે.

(A) $\frac{PR_c^2}{V}$

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

(C) $\frac{PR_c^2}{V^2}$

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

$$\begin{aligned} P &= I^2 R \\ R &= \sqrt{Z} \\ Z &= \ell \\ P &= \frac{P^2 R_c}{V^2} \end{aligned}$$

- 15) 8.0 cm નિબયાવણા 200 આંટા ધરાવતા, તારના એક વર્તુળાકાર ગૂંચળામાંથી 0.40 A વિદ્યુત પ્રવાહ વહે છે. ગૂંચળાના કેન્દ્ર પાસે ચુંબકીયક્ષેત્ર B નું મૂલ્ય _____ T.

(A) $2\pi \times 10^{-6}$

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

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

(D) $\pi \times 10^{-6}$

$$\begin{aligned} B &= \frac{\mu_0 NI}{2R} \\ &= \frac{4\pi \times 10^{-7} \times 200 \times 10^3}{2 \times 8 \times 10^{-2}} \\ &\approx 20\pi \times 10^{-5} \\ &\approx 2 \times 10^{-4} \end{aligned}$$

- 16) બે ખૂબ લાંબા, સીધા અને અવગાઇય આડહેદ ધરાવતા તથા શૂન્યાવકાશમાં એકબીજાથી એક મીટર અંતરે સમાંતર મુક્કેલા વાહકોમાંથી પસાર થતો સમાન વિદ્યુત પ્રવાહ 1mA જેટલો હોય, ત્યારે બંને વાહકો પર એક મીટર લંબાઈ દીઠ લાગતું બળ _____ N જેટલું હોય છે. ($\mu_0 = 4\pi \times 10^{-7} \text{ TmA}^{-1}$)

(A) 2×10^{-13}

(B) 2×10^{-10}

(C) 2×10^{-7}

(D) 2×10^{-4}

$$\begin{aligned} F &= \frac{\mu_0 I_a I_b}{2\pi d} \\ &= \frac{4\pi \times 10^{-7} \times 10^{-3} \times 10^{-3}}{2\pi \times 1} \\ &= 2 \times 10^{-10} \end{aligned}$$

- 17) 1000 આંટા અને $2 \times 10^{-4} \text{ m}^2$ જેટલું આડહેદનું ક્ષેત્રફળ ધરાવતા એક સોલેનોઇડમાંથી 5.0 A વિદ્યુત પ્રવાહ પસાર થાય છે. સોલેનોઇડ સાથે સંકળાયેલી મેન્ટેન્ટ મોમેન્ટ Am² હશે.

(A) 2

(B) 3

(C) 4

(D) 1

$$\begin{aligned} M &= NIA \\ &= 10^3 \times 5 \times 2 \times 10^{-4} \\ &= 10 \times 10^{-1} \\ &\approx 1. \end{aligned}$$

૨૬ કાર્ય

18) ચુંબકીય કંપાસની સોથ બનાવવામાં _____ નામનો પદાર્થ વપરાય છે.

(A) કોપર

(B) લોડસ્ટોન

(C) બિસ્મથ

(D) એલ્યુમિનિયમ

19) સુપર કંડક્ટરસમાં જેવા મળતી સંપૂર્ણ ડાયામેન્ડિઝમની અસરને _____ કહે છે.

(A) મિઝનર અસર

(B) લોરેન્ટજ અસર

(C) ક્યુરી અસર

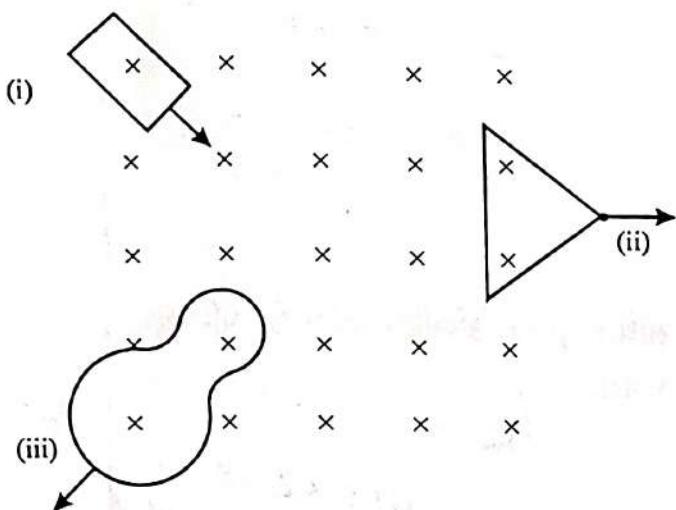
(D) કોમ્પન અસર

20) આત્મ-પ્રેરકત્વનું પરિમાણ _____ છે.

(A) $M^{-1}L^{-2}T^{-2}A^{-2}$ (B) $M^1L^{-2}T^{-2}A^2$ (C) $M^1L^2T^{-2}A^{-2}$ (D) $M^1L^2T^{-2}A^2$ 21) 0.5m ના લંબાઈના ધાતુના 10 આરા ધરાવતું એક વીલ એક સ્થળ પર પૃથ્વીના ચુંબકીયક્ષેત્રના સમક્ષિતિજ ઘટક H_E ને લંબ એવા એક સમતલમાં 120 rev/min ની ઝડપે ફરે છે. જો આ સ્થાન પર $H_E = 0.4G$ હોય તો, ધરી અને વીલના રિમ વચ્ચે પ્રેરિત emf _____ . ($1G = 10^{-4}\text{T}$)(A) $6.28 \times 10^{-2}\text{mV}$ (B) $6.28 \times 10^{-2}\mu\text{V}$ (C) $6.28 \times 10^{-5}\text{mV}$ (D) $6.28 \times 10^{-5}\mu\text{V}$

$$\begin{aligned}
 \Sigma &= \frac{\beta \omega R^2}{2} \\
 &= \frac{0.4 \times 10^{-4} \times 4\pi \times (0.5)}{2} \\
 &= 0.628 \times 10^{-4} \\
 &= 6.28 \times 10^{-5}
 \end{aligned}$$

- 22) નીચેની આકૃતિમાં જુદા જુદા આકારના સમતલ ગાળાઓ દર્શાવેલ છે, જે લૂપના સમતલને લંબ અને વાંચકથી દૂર તરફની દિશામાંના ચુંબકીય ક્ષેત્રમાંથી બહારની તરફ કે અંદરની તરફ ગતિ કરે છે _____ માંથી પ્રેરિત વિદ્યુતપ્રવાહની દિશા વિષમઘડી દિશામાં હશે.



(A) ફક્ત લૂપ (iii)

(B) ફક્ત લૂપ (ii)

(C) ફક્ત લૂપ (i) ✓

(D) લૂપ (ii) અને લૂપ (iii)

- 23) ચુંબકીયક્ષેત્ર B ના પદમાં, સોલેનોઇડમાં સંગ્રહિત એકમ કદ દીઠ ચુંબકીય ઊર્જા u_B _____.

(A) $\sqrt{\frac{1}{2} \frac{B}{\mu_0}}$

(B) $\frac{1}{2} B \mu_0^2$

(C) $\frac{1}{2} B^2 \mu_0$

(D) $\frac{1}{2} \frac{B^2}{\mu_0}$

- 24) એક પરિપथમાં 0.1s માં વિદ્યુતપ્રવાહમાં 5.0A થી 0.0A ઘટાડો થાય છે. જો 200V સરેરાશ �emf પ્રેરિત થાય, તો આ પરિપથનો આત્મ-પ્રેરકત્વ $\Delta I = -5A$ H હશે.

25 કાર્ય

- (A) 40 ✓
 (B) 4.0
 (C) 0.4
 (D) 0.004

$$\begin{aligned} \epsilon &= -L \frac{\Delta I}{\Delta t} \\ L &= -\epsilon \frac{\Delta t}{\Delta I} \\ &= -\frac{200 \times 0.1}{-5} \end{aligned}$$

- 25) 110V, 60Hz ના ac સ્ત્રોત સાથે 60μF નું કેપેસીટર જોડેલ છે. પરિપથમાં પ્રવાહનું rms મૂલ્ય _____ A થશે.

- (A) 2.49
 (B) 4.29
 (C) 1.94
 (D) 9.24

$$\begin{aligned} i_{rms} &= V_{rms} \omega C \\ &= 110 \times 2\pi \times 60 \times \frac{1}{60 \times 10^{-6}} \\ &= 226.08 \end{aligned}$$

492.3

- 26) LCR પરિપથમાં પાવર વ્યથ _____ થાય છે.

- (A) માત્ર ઈન્ડક્ટરમાં
 (B) માત્ર કેપેસીટરમાં
 (C) માત્ર અવરોધકમાં
 (D) અવરોધક, કેપેસીટર અને ઈન્ડક્ટર ત્રણેમાં

- 27) 220V, 50Hz ના સ્ત્રોત સાથે 15.0μF ના કેપેસીટરને જોડવામાં આવે છે. પરિપથમાં કેપેસીટીવ રીએક્ટન્સનું મૂલ્ય _____ Ω.

- (A) 202
 (B) 152
 (C) 122
 (D) 212

$$\begin{aligned} X_C &= \frac{1}{\omega C} \\ &= \frac{1}{2\pi \times 50 \times 15 \times 10^{-6}} \\ &= \frac{1}{4710} \end{aligned}$$

- 28) 27mH ઇન્કુર સાથે $30\mu F$ નું સંપૂર્ણ વિદ્યુતભારિત કેપેસીટર જોડેલ છે તો પરિપથમાં થતાં દોલનોની આવૃત્તિ _____ Hz હશે.

(A) 267.4 ✓

(B) 176.9

(C) $\frac{111.1}{2}$

(D) 613.8

$$\omega_c = \frac{1}{\sqrt{27 \times 10^{-3} \times 30 \times 10^{-6}}}$$

$$= \frac{1}{\sqrt{9 \times 10^{-4}}} \\ \therefore f_o = \frac{111.1}{2} \text{ Hz}$$

- 29) આંખના વાઢકાપ LASIK માં _____ વિકિરણોનો ઉપયોગ થાય છે.

(A) રેડિયો

(B) પારબંબતી

(C) પારરક્ત

(D) ગામા ✓

૨૬ કાર્ય

$$f_o = \frac{1}{\sqrt{LC}} \\ = \frac{1}{\sqrt{27 \times 30}}$$

૧૨૦

૨૮.૫૬૦

- 30) એક વિદ્યુતભાર તેના સરેરાશ સમતોલન સ્થાનની આસપાસ 10^9 Hz ની આવૃત્તિ થી દોલન કરે છે. આ દોલક દ્વારા ઉત્પન્ન વિદ્યુત ચુંબકીય તરંગોની આવૃત્તિ _____ Hz જેટલી હશે.

(A) $\frac{1}{\sqrt{2}} \times 10^9$ (B) $\frac{1}{2} \times 10^9$ (C) 2×10^9 (D) 10^9 ✓

- 31) સંયુક્ત માઈક્રોસ્કોપ માટે વસ્તુકાચ (objective) માટે પ્રતિબિંબ અંતર v_o અને નેત્રકાચ (eye piece) માટે વસ્તુઅંતર u_e હોય તો આ માઈક્રોસ્કોપના બંને લેન્સો વચ્ચેનું અંતર _____ હશે.

(A) $|v_o| - |u_e|$ (B) $\frac{|v_o|}{|u_e|}$ (C) $|v_o| + |u_e|$ ✓(D) $\frac{|u_e|}{|v_o|}$

૨૫ કાય્ય

- 32) 1mm^2 ના ચોરસને અભિસારી લેન્સ વડે જોવામાં આવે છે ત્યારે પ્રતિબિંબનું ક્ષેત્રફળ 6.25mm^2 મળે છે. તો લેન્સની મોટવણી _____.

- (A) 2.5
- (B) 5.25
- (C) 6.25 ✓
- (D) 0

- 33) 1.5 વકીલબનાંક ધરાવતાં કાચમાંથી બંને સપાટીઓની સમાન વક્તા ત્રિજ્યા R હોય તેવા દ્વિ- બહિગોળ લેન્સની કેન્દ્ર લંબાઈ f હોય તો _____.

- (A) $R = \frac{f}{2}$
- (B) $R = f$
- (C) $R = 2f$ ✓
- (D) $R = \frac{f}{4}$

$$\begin{aligned}\frac{1}{f} &= (n-1) \left(\frac{1}{R} + \frac{1}{R} \right) \\ \frac{1}{f} &= 0.5 \left(\frac{2}{R} \right) \\ R &= 2 \times 0.5 f \\ &= f\end{aligned}$$

- 34) જે પ્રિઝમનો ઉપયોગ પ્રતિબિંબનાં પરિમાળામાં ફેરફાર કર્યા વિના પ્રતિબિંબને ઉલટાવવા માટે કરવો હોય તો પ્રિઝમના દ્રવ્યનો કાંતિકોણ _____ હશે.

- (A) $i_c = \frac{\pi}{2} \text{ rad}$
- (B) $i_c > \frac{\pi}{4} \text{ rad}$
- (C) $i_c = \frac{\pi}{3} \text{ rad}$ ✓
- (D) $i_c < \frac{\pi}{4} \text{ rad}$

35) જ્યારે સમતલ તરંગ અગ્ર પાતળા બહિગોળ લેન્સ ઉપર આપાત થાય છે. ત્યારે, નિર્ગમન પામતું તરંગ અગ્ર _____ હશે.

- (A) ગોળકાર
- (B) નળકાર
- (C) સમતલ
- (D) ધોખ્ય વિકલ્પ આવ્યો નથી. ✓

36) એક સ્લિટથી થતાં વિવર્તન માટે જ્યારે સ્લિટની પોહળાઈ આપાત પ્રકારની તરંગલંબાઈ કરતાં અડધી હોય ત્યારે, પડદા પર રચાતી વિવર્તન ભાતમાં બીજા કુમના ન્યૂનતમ માટે વિવર્તન કોણ ઠ આશરે _____ જેટલો હોય છે.

- (A) 6°
- (B) 5°
- (C) 4° ✓
- (D) 8°

$$u = \frac{\lambda}{2}$$

$$n = 1$$

$$\theta = \frac{n\lambda}{\lambda} \quad n=2$$

$$= \frac{2\lambda}{\lambda/2}$$

$$= 4$$

37) હાઇગેન્ઝના તર્ક મૂજબ ગૌણ લઘુ તરંગોનો આગળની દિશાનો કંપવિસ્તાર _____ જ્યારે પાછળની દિશામાં કંપવિસ્તાર _____ હોય છે.

- (A) શૂન્ય, શૂન્ય
- (B) મહત્તમ, શૂન્ય ✓
- (C) શૂન્ય, મહત્તમ
- (D) મહત્તમ, મહત્તમ

- 38) એક પ્રયોગમાં ફેટો ઈલેક્ટ્રીક કટ ઓફ વોલ્ટેજ 4V છે. ઉત્સર્જયેતા ફેટો ઈલેક્ટ્રોનની મહુતમ ગતિ ઊર્જા _____ eV.

(A) 8.0

(B) 3.2

(C) 6.4

(D) 4.0

$$V_o = 4V$$

$$K_{max} = eV_o$$

$$= 1.6 \times 10^{-19} \times 4$$

$$= 6.4 \times 10^{-19}$$

$$= \frac{6.4 \times 10^{-19}}{1.6 \times 10^{-19}}$$

eV

- 39) ફેટો ઈલેક્ટ્રીક અસરના એક પ્રયોગમાં કટ ઓફ વોલ્ટેજ વિદ્ધુલિયાની આપાત પ્રકાશની આવૃત્તિના આદેખનો ફળ _____ Vs જેટલો મળે છે.

$$(h = 6.625 \times 10^{-34} \text{ Js})$$

$$m = \frac{h}{c}$$

$$(A) 4.14 \times 10^{-15}$$

$$= \frac{6.625 \times 10^{-34}}{1.6 \times 10^{-19}}$$

$$(B) 6.14 \times 10^{-15}$$

$$= 4.14 \times 10^{-15}$$

$$(C) 1.41 \times 10^{-15} \checkmark$$

$$(D) 2.14 \times 10^{-15}$$

- 40) એક વિદ્યુત ચુંબકીય વિકિરણની તરંગલંબાઈ λ_1 અને તેના ક્વોન્ટમની ડિ-ભ્રોઝી તરંગલંબાઈ λ_2 છે. તો _____.

$$(A) \lambda_1 = \frac{\lambda_2}{2}$$

$$(B) \lambda_1 = 2\lambda_2$$

$$(C) \lambda_1 = \lambda_2 \checkmark$$

$$(D) \lambda_1 = \frac{\lambda_2}{\sqrt{2}}$$

41) આવृત्ति વાળા ફોટોનનું વેગમાન _____ હશે.

(A) $\frac{c}{hv}$

$$\rho = \frac{E}{hv} = \frac{h\nu}{E}$$

(B) $\frac{hc}{v}$ ✓

(C) hcv

(D) $\frac{hv}{c}$

42) કઈ બે ભૌતિક રાશિઓના એકમો સમાન છે?

(A) વર્કફર્શન અને સ્ટોપીંગ પોટેન્શીયલ

(B) પ્લાન્કનો અચળાંક અને કોણિય વેગમાન

(C) પ્લાન્કનો અચળાંક અને કોણિય વેગ ✓

(D) વર્કફર્શન અને થ્રેશોલ્ડ આવृત્તિ

43) દાઈટ્રોઝન પરમાગુની સૌથી અંદરની ઇલેક્ટ્રોન કક્ષાની વિજ્યા $5.3 \times 10^{-11} \text{ m}$
ઠ. તો $n = 2$ કક્ષાની વિજ્યા _____ m હશે.

(A) 2.12×10^{-10} ✓

(B) 3.12×10^{-10}

(C) 1.22×10^{-10}

(D) 4.12×10^{-10}

૨૬ કાર્ય

- 44) હાઈડ્રોજન પરમાણુની ધરા અવસ્થાની ઊર્જા -13.6 eV છે. આ અવસ્થામાં ઈલેક્ટ્રોનની સ્થિતિઊર્જા _____ eV.

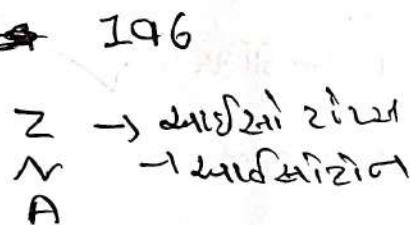
- (A) -13.6
- (B) -23.6
- (C) -27.2 ✓
- (D) -31.6

- 45) α - કળાના પ્રક્રીએનના પ્રયોગમાં સન્મુખ સંઘાત માટે પ્રક્રીએન કોણ $\theta =$ _____ હશે.

- (A) 90°
- (B) 60°
- (C) 0° ✓
- (D) 180°

- 46) $^{238}_{92}\text{U}$ અને $^{236}_{90}\text{Th}$ એકબીજના _____ છે.

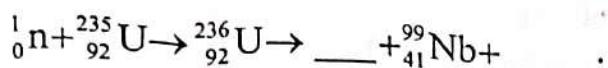
- (A) આઇસોભાર
- (B) આઇસોટોન ✓
- (C) આઇસોટોપ
- (D) આઇસોમર



- 47) ગોલ્ડના સમસ્થાનિક $^{197}_{79}\text{Au}$ અને સિલ્વરના સમસ્થાનિક $^{107}_{47}\text{Ag}$ ના ન્યુક્લિયસની ત્રિજ્યાનો આશારે ગુણોત્તર _____ હશે.

- (A) 1.23 ✓
- (B) 3.12
- (C) 2.13
- (D) 2.31

48) નીચેની ન્યુક્લિયર પ્રક્રિયા પૂર્ણ કરો :



(A) ${}_{54}^{140} Xe ; 2 {}_0^1 n$

(B) ${}_{51}^{133} Sb ; 4 {}_0^1 n$

(C) ${}_{56}^{144} Ba ; 3 {}_0^1 n$

(D) ${}_{54}^{130} Sb ; 2 {}_0^1 n$

49) ન્યુક્લિયસની ઘનતા તેના પરમાણુના પરમાણુ દળંક _____.

(A) ના વ્યસ્ત પ્રમાણમાં હોય છે.

(B) ના વર્ગના સમપ્રમાણમાં હોય છે.

(C) ના સમપ્રમાણમાં હોય છે. ✓

(D) પર આધારિત નથી.

50) બાયસિંગ કર્યા વગરના p - n જંક્શનમાં હોલ p - વિસ્તારમાંથી n - વિસ્તારમાં વિસરણ પામે છે કારણ કે

(A) p - વિસ્તારમાં હોલની સંખ્યા ઘનતા n - વિસ્તાર કરતાં વધુ હોય છે.

(B) તેઓ સ્થિતિમાન તફાવતના કારણે જંક્શનમાં થઈને ગતિ કરે છે.

(C) n - વિસ્તારના મુક્ત ઈલેક્ટ્રોન તેમને આકર્ષે છે.

(D) p - વિસ્તારના હોલ તેમને અપાકર્ષે છે.

15) ઇલેક્ટ્રોન માટે ડિઝિટલ વેગાનું સૂત્ર સ્વીકારી $\sigma = \frac{ne^2}{m} \tau$ સૂત્ર તારવો. [3]

16) વિદ્યુતપ્રવાહ ધારિત વર્તુળકાર પ્રવાહગાળાની અક્ષ પર ચુંબકીયક્ષેત્રનું સૂત્ર ગેળવો. [3]

17) $283V$ મહત્તમ ભૂત્ય અને $50Hz$ આવૃત્તિવાળો Sine પ્રકારનો વોલ્ટેજ LCR શ્રેણી પરિપથને લાગુ પડેલ છે. જેમાં $R = 3\Omega$, $L = 25.48mH$ અને $C = 796\mu F$ છે. તો, [3]

a) પરિપથનો ઈમ્પિન્સ

$$V_m = \frac{\sqrt{Z_{ms}}}{\sqrt{2}}$$

b) સ્ત્રોત વોલ્ટેજ અને પ્રવાહ વચ્ચેનો કળા તફાવત

$$\sqrt{Z_{ms}} = V_m \sqrt{2}$$

c) પરિપથમાં વ્યંય થતો પાવર શોધો.

18) ગોળીય સ્પેચ્ટી પોસે થતાં વકીભવન માટે $\frac{n_1}{-u} + \frac{n_2}{v} = \frac{n_2 - n_1}{R}$ સૂત્ર તારવો. [3]

19) સિલિયમનું કાર્યવિધેય $2.14eV$ છે. [3]

a) સિલિયમની થ્રેશોલ્ડ આવૃત્તિ શોધો.

b) જે $0.60V$ ના સ્ટોપિંગ પોટેન્શિયલ દ્વારા ફેટો પ્રવાહ શૂન્ય થતો હોય તો આપાત પ્રકાશની તરંગલંબાઈ શોધો.

$$(h = 6.625 \times 10^{-34} Js)$$

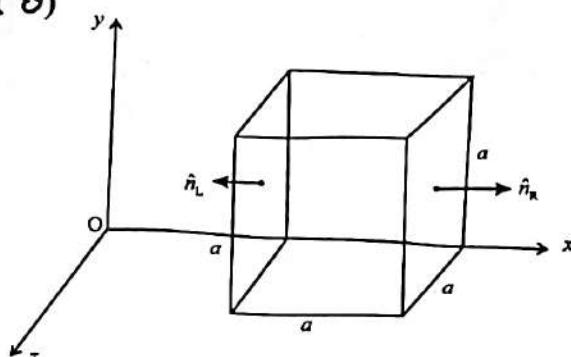
20) એક આપેલ સિક્કાનું દળ $3.0g$ છે. બધા ન્યુક્લોન અને ગ્રોટોનને એકબીજાથી અલગ કરવા માટે જરૂરી ન્યુક્લિયર ઉત્તેની ગાળતરી કરો. સરળતા ખાતર સિક્કો સંપૂર્ણપણે ^{63}Cu પરમાળુઓ ($62.92960 u$) નો બનેલો ગાળો. [3]

21) નંકરાન ડાયોડનો પૂર્ણ તરંગ રેફ્લક્શન તરફનો ઉપયોગ સમજાવો. [3]

વિભાગ - C

- નીચે આપેલા પ્રશ્ન નં. 22 થી 27 માંથી માઝા મુજબ ગમે તે 4 પ્રશ્નોના યોઝ્ય ઉત્તર લખો
(દરેક પ્રશ્નના 4 ગુણ છે) [16]

22)



[4]

આકૃતિમાં વિદ્યુતક્ષેત્રના ઘટકો $E_x = \alpha x^{\frac{1}{2}}$, $E_y = 0$, $E_z = 0$ છે. જ્યાં $\alpha = 800 \text{ NC}^{-1} m^{-\frac{1}{2}}$.

- a) ધનમાંથી ફલક્સ અને
b) ધનની અંદરના વિદ્યુતભારની ગણતરી કરો.
[$a = 0.1 \text{ m}$ છે]

- 23) સમાન ચુંબકીયક્ષેત્રમાં એક વિદ્યુતપ્રવાહ ધારીત લંબચોરસ ગૂંચળાને એવી રીતે રાખ્યું છે કે તેની ચુંબકીય ચાકમાત્રા ચુંબકીયક્ષેત્ર સાથે 0 ખૂણો બનાવે છે. આ ગૂંચળા પર લાગતા ટોકનું સૂત્ર તારવો. [4]

- 24) માત્ર ઈન્ડક્ટર ધરાવતો AC પરિપથ સમજાવો.



[4]

- ✓ 25) પ્રિઝમ માટે $\delta = i + e - A$ તારવો. પ્રિઝમના દ્રવ્યનો વકીભવનાંક શોધવાનું સૂત્ર પણ તારવો. [4]

- ✓ 26) ધેંગના બે-સ્લિટ પ્રયોગમાં વ્યતિકરણ શલાકાઓ મેળવવા માટે 4500\AA અને 6000\AA બે તરંગલંબાઈઓ ધરાવતા પ્રકાશ કિરણપૂંજનો ઉપયોગ કરવામાં આવે છે.

[$D = 90\text{cm}$ અને $d = 0.15 \text{ cm}$]

[4]

- a) 4500\AA તરંગલંબાઈ માટે પડા પરની ત્રીજી અપ્રકાશીત શલાકાનું મધ્યસ્થ અધિકતમથી અંતર શોધો.

- b) જો 4500\AA તરંગલંબાઈના કારણે મળતી પ્રકાશીત શલાકા, 6000\AA તરંગલંબાઈના કારણે મળતી અપ્રકાશીત શલાકા પર સંપાત થાય તે માટેનું મધ્યસ્થ અધિકતમથી ઓછામાં ઓછું અંતર શોધો.

[4]

- ✓ 27) ન્યુક્લિયર સંલયન દ્વારા તારાઓમાં થતી ઊર્જાની ઉત્પત્તિ સમજાવો. સૂર્યમાં થતી પ્રોટોન-પ્રોટોન ચંકિય પ્રક્રિયા પણ સમજાવો.



0.42

1.02

5.49

12.86

MeV

[4]

This Question Paper contains 20 printed pages.

(Part - A & Part - B)

Sl.No. 0100002

054 (G)

SPECIAL SUPPLEMENTARY
EXAM, JULY - 2025
(SCIENCE STREAM)
(CLASS - XII)

પ્રશ્ન પેપરનો સેટ નંબર જેની
સામેનું વર્તુળ OMR શીટમાં
ઘડું 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

સૂચનાઓ :

- 1) આ પ્રશ્નપત્રના લાગ - A માં બહુવિકલ્પ પ્રકારના કુલ 50 પ્રશ્નો છે. બધા જ પ્રશ્નો ફરજિયાત છે.
- 2) પ્રશ્નોની ફરજ સંખ્યા 1 થી 50 છે અને દરેક પ્રશ્નનો ગુણ 1 છે.
- 3) કાળજીપૂર્વક દરેક પ્રશ્નનો અભ્યાસ કરી સાચો વિકલ્પ પસંદ કરીને OMR શીટમાં જવાબ લખવો.
- 4) આપને અલગથી આપેલ OMR પત્રકમાં જે તે પ્રશ્ન નંબર સામે (A) O, (B) O, (C) O, (D) O આપેલા છે. તે પ્રશ્નનો જે જવાબ સાચો હોય તેના વિકલ્પ પરના વર્તુળને બોલપેનથી પૂર્ણ ● ઘડું કરવાનું રહેશે.
- 5) રૂફ કાર્ય હેતુ આ ટેસ્ટ બુકલેટમાં આપેલી જગ્યા પર કરવાનું રહેશે.
- 6) પ્રશ્નપત્રકમાં ઉપરની જગ્યાની બાજુમાં આપેલા પ્રશ્નપત્ર સેટ નં. ને OMR પત્રકમાં આપેલી જગ્યામાં લખવાનું રહેશે.
- 7) વિદ્યાર્થીઓ જરૂર જાણાય ત્યાં સાધા કેલ્ક્યુલેટર અને લોગ ટેબલનો ઉપયોગ કરી શકશે.
- 8) આ પ્રશ્નપત્રમાં વપરાયેલ સંજ્ઞાઓને તેના ઘોઝ્ય પ્રચલિત અર્થ છે.
- 9) આકૃતિવાળા/આતેખ પ્રશ્નોમાં દિઝીન વિદ્યાર્થીઓ માટે અલગ પ્રક્રિયા આપેલા છે. જેનું ખાસ ધ્યાન રાખવું. આ પ્રશ્નો માત્ર દિઝીન વિદ્યાર્થીઓ માટે જ છે.

- 1) બે સમાન મૂલ્યના વિજ્ઞતીય વિદ્યુતભારોને એકબીજાથી અમુક અંતરે મૂક્તાં લાગતું બળ F છે. જો 25% વિદ્યુતભાર એક પરથી બીજા વિદ્યુતભાર લઈ જવામાં આવે તો તેમની વચ્ચે લાગતું બળ કેટલું હશે?

રૂફ કાર્ય

- (A) F
(B) $\frac{15}{16}F$
(C) $\frac{9}{16}F$
(D) $\frac{4}{5}F$

2) સમાન વિદ્યુતભાર ગ ધરાવતાં 16 વિદ્યુતભારિત કણોને બે કંપિક કણો વચ્ચેનું

અંતર $\frac{R}{3}$ હોય તે રીતે y - અક્ષ પર ગોઠવેલ છે. એક વિદ્યુતભારિત કણ ઉગમબિંદુ પર રહેલો છે. જેનું કેન્દ્ર ઉગમબિંદુ પર અને નિજ્યા $\frac{3}{2} R$ હોય તેવા ગોળા સાથે સંકળાયેલ વિદ્યુત ફલક્સ કેટલું હશે?

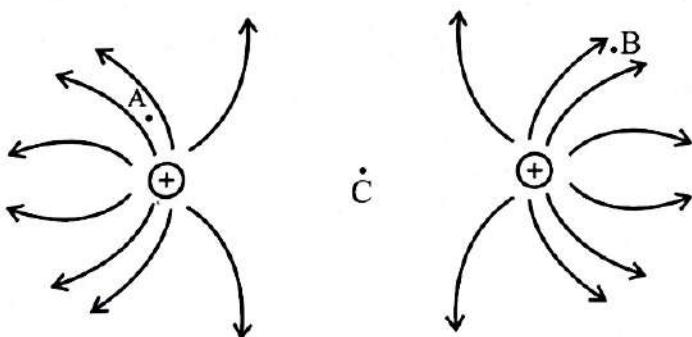
(A) $16 \frac{q}{\epsilon_0}$

(B) $8 \frac{q}{\epsilon_0}$

(C) $4 \frac{q}{\epsilon_0}$

(D) $9 \frac{q}{\epsilon_0}$

3) આકૃતિમાં કાગળના સમતલ પર રહેલા સ્થિત વિદ્યુતભારો વડે ઉદ્ભવતી વિદ્યુતક્ષેત્ર રેખાઓ દર્શાવેલ છે.



વિદ્યુત ક્ષેત્રના નિક્ષેપણનો અભ્યાસ કરો અને એક ખોટું વિધાન શોધો.

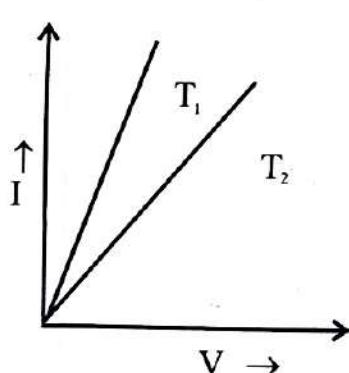
- (A) બિંદુ B પાસેનું વિદ્યુતક્ષેત્ર બિંદુ A પાસેના ક્ષેત્ર કરતાં નભણું છે.
- (B) વિદ્યુતક્ષેત્રનું વિતરણ દ્વિ પારિમાણીક છે.
- (C) ઘન વિદ્યુતભારનું વિદ્યુતક્ષેત્ર હંમેશા બહારની તરફ હોય છે.
- (D) બિંદુ C પાસેનું વિદ્યુતક્ષેત્ર શૂન્ય છે.

(આપેલ પ્રક્રિયા ફક્ત દર્શિતીન વિધાથીઓ માટે છે.)

- 3) વિદ્યુતક્ષેત્ર રેખાએ એવો વક્ત છે કે જેના દરેક બિંદુએ દોરેલો સ્પર્શક આ બિંદુ પાસે, _____ દર્શાવે છે.
- (A) વિદ્યુતક્ષેત્રનું માત્ર મૂલ્ય આપે છે.
 - (B) વિદ્યુતક્ષેત્રની માત્ર હિસા આપે છે.
 - (C) વિદ્યુતક્ષેત્રનું મૂલ્ય અને હિસા બંને આપે છે.
 - (D) માત્ર બળનું મૂલ્ય આપે છે.
- 4) બિંદુ ડાયાલ માટે નીચેના પૈકી કયું સાચું છે?
- (A) $2a \rightarrow 0, q \rightarrow \infty$
 - (B) $2a \rightarrow \infty, q \rightarrow \infty$
 - (C) $2a \rightarrow \infty, q \rightarrow 0$
 - (D) $2a \rightarrow 0, q \rightarrow 0$
- 5) 2.4m નો વ્યાસ ધરાવતા એક સમાન વિદ્યુતભારિત ગોળા પર વિદ્યુતભારની પૃષ્ઠ ઘનતા $\frac{1}{4\pi} \mu C / m^2$ હોય તો ગોળા પરનો વિદ્યુતભાર, _____.
- (A) $0.2 \mu C$
 - (B) $1.44 \mu C$
 - (C) $14.4 mC$
 - (D) $6.28 \mu C$
- 6) શૂન્યાવકાશની પરમિટિવિટી (પરાવૈદ્યુતાંક) નો S.I. એકમ _____ છે.
- (A) Fm^{-1}
 - (B) Fm^{-2}
 - (C) Fm^{-3}
 - (D) Fm

૨૬ કાર્ય

- 7) $4\mu F$ ના ત્રણ કેપેસીટરોને એવી રીતે જોડવામાં આવેલા છે કે જેથી તેનું પરિણામી કેપેસીટન્સ $6\mu F$ મળે છે તો તેમનું જોડાણ અને તેની સાથે એક શ્રેણીમાં _____.
- (A) બે સમાંતર અને તેની સાથે એક સમાંતરમાં
(B) બધા શ્રેણીમાં
(C) બધા સમાંતરમાં
(D) બે શ્રેણીમાં અને તેની સાથે એક સમાંતરમાં
- 8) A અને B વિદ્યાર્થીઓ એક પરિપથમાંથી વહેતા વિદ્યુતભારની ગણતરી કરે છે. A એવું તારણ કઢે છે કે 1 મિનિટમાં $300 C$ ઈલેક્ટ્રોન વહે છે અને B એવું તારણ કઢે છે કે 1 સેકન્ડમાં 3.125×10^{19} જેટલા ઈલેક્ટ્રોન વહે છે. જો પરિપથમાંથી વહેતો પ્રવાહ $5A$ હોય તો ક્યા વિદ્યાર્થીની ગણતરી સાચી છે?
- (A) માત્ર વિદ્યાર્થી A ની
(B) માત્ર વિદ્યાર્થી B ની
(C) વિદ્યાર્થી A અને B બંનેની
(D) A અને B બંને વિદ્યાર્થીઓ માંથી એક પણની નહિ.
- 9) કોઈ એક વાહક માટે બે જુદાં જુદાં તાપમાને $I \rightarrow V$ ના આલેખો દર્શાવ્યા છે. તેના પરથી કહી શકાય કે,



- (A) $T_1 > T_2$
(B) $T_1 < T_2$
(C) $T_1 = T_2$
(D) $T_1 = 2T_2$

(નીચેનો પ્રશ્ન ફક્ત દિલ્હીન વિદ્યાર્થીઓ માટે છે.)

- 9) વર્તુળકાર ભાર્ગ પરિભ્રમણ કરતાં ઈલેક્ટ્રોનની આવૃત્તિ v હોય તો તેનાથી મળતો
પ્રવાહ,

(A) $v et$

(B) $v e$

(C) $\frac{v}{et}$

(D) $\frac{1}{vet}$

- 10) વિદ્યુત વાહકતાનું પારિમાણીક સૂત્ર _____ છે.

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

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

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

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

- 11) વિધાન-કારણ પ્રકારનો પ્રશ્ન

a) વિધાન અને કારણ બંને સાચા છે અને કારણ વિધાનની સાચી સમજ આપે છે.

b) વિધાન અને કારણ બંને સાચા છે પરંતુ કારણ વિધાનની સાચી સમજ આપતું નથી.

c) વિધાન સાચું છે પરંતુ કારણ ખોટું છે.

d) વિધાન ખોટું છે પરંતુ કારણ સાચું છે.

વિધાન : 100W ના બલ્બને 110 V ના સપ્લાય સાથે જોડતાં મળતો બલ્બનો
અવસ્રોધ 121Ω છે.

કારણ : પાવર $P = VI = I^2R = \frac{V^2}{R}$

(A) a

(B) b

(C) c

(D) d

12) એક પ્રોટોન $\vec{V} = (2\hat{i} + 3\hat{j}) \text{ m/s}$ ના વેગથી $\vec{B} = (2\hat{i} + 3\hat{j}) \text{ T}$

ના ચુંબકીયક્ષેત્રમાંથી પસાર થાય છે, તો તેના પર લાગતું ચુંબકીય બળ _____
N.

- (A) $13 \times 1.6 \times 10^{-19}$
- (B) $1.69 \times 1.6 \times 10^{-19}$
- (C) $14.4 \times 10^{-19} \hat{j}$
- (D) શૂન્ય

13) નીચેનામાંથી કયું વિધાન ખોટું છે?

- (A) વોલ્ટમીટરનો અવરોધ ખૂલ્ય જ મોટો હોય છે.
- (B) એમીટરનો અવરોધ ઘણો જ નાનો હોય છે.
- (C) પરિપથમાં ઘટકને સમાંતર એમીટર જોડવામાં આવે છે.
- (D) પરિપથમાં ઘટકને સમાંતર વોલ્ટમીટર જોડવામાં આવે છે.

14) 0.1 kg/m રેખીય દળ ઘનતા ઘરાવતાં એક સીધા તારમાંથી $2A$ પ્રવાહ પસાર થાય છે. તેને સમક્ષિતિજ અને સમાન ચુંબકીય ક્ષેત્ર (B) માં હવામાં લટકતો રાખેલ હોય તો ચુંબકીય ક્ષેત્રનું મૂલ્ય _____.

- (A) 0.65 T
- (B) 0.32 T
- (C) 0.49 T
- (D) 0.98 T

15) વિદ્યુતભારિત કણાની કોણીય ઝડપ _____ થી સ્વતંત્ર છે.

- (A) તેના દળ
- (B) તેના રેખીય વેગ
- (C) તેના વીજભાર
- (D) ચુંબકીય ક્ષેત્ર

16) 2 m લંબાઈના સોલેનોઇડમાં અંટાની સંખ્યા 2000 છે. જો તેમાંથી 2A પ્રવાહ વહેતો હોય તો તેની ચુંબકીય તીવ્રતા _____ A/m.

- (A) 2×10^3
- (B) 0.5×10^3
- (C) 4×10^3
- (D) 0.25×10^3

17) એક નાના ગાજિયા ચુંબકને તેની અક્ષ, 0.25T ના નિયમિત બાહ્ય ચુંબકીય ક્ષેત્ર સાથે 60° કોણ બનાવે તે રીતે મુકતાં તે $1.73 \times 10^{-2} J$ જેટલું ટોક અનુભવે તો ચુંબકની મેઝેટીક મોમેન્ટનું મૂલ્ય _____ Am² થશે.

- (A) 13.8×10^{-2}
- (B) 4×10^{-2}
- (C) 0.43×10^{-2}
- (D) શૂન્ય

18) નીચેનામાંથી કયો ફેરોમેઝેટીક પદાર્થ નથી?

- (A) એલિન્કો
- (B) ગોડોલિનિયમ
- (C) લોડસ્ટોન
- (D) કોપર ક્લોરાઇડ

19) એક પરિપथમાં 1s માં વિધુત પ્રવાહમાં 5.0A થી 0.0A ઘટાડો થાય છે. જો 200V સરેરશ emf પ્રેરિત થાય તો આ પરિપથનું આત્મ-પ્રેરકત્વ _____.

- (A) 4 H
- (B) 2 H
- (C) 40 H
- (D) 5 H

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- 20) ૧ લંબાઈ અને ρ અવસ્થાદાન ઘરાવતો એક વાહક સળિયો ચુંબકીય ક્ષેત્ર B માં લંબડ્ઝે V વેગથી ગતિ કરતો હોય તો તેમાં પ્રેરીત થતો પ્રવાહ,

(A) $\frac{BVA}{\rho}$

(B) $BVA\rho$

(C) $\frac{BVA}{R}$

(D) BVI

- 21) નીચેનામાંથી કોણું પરિમાણ વિદ્યુત પ્રવાહના પરિમાણ જેવું છે?

(A) $\frac{\text{પ્રેરકત્વ}}{\text{ચુંબકીય ફલક્સ}}$

(B) $\frac{\text{ચુંબકીય ફલક્સ}}{\text{પ્રેરકત્વ}}$

(C) $\frac{\text{પ્રેરકત્વ}}{\text{ચુંબકીય ક્ષેત્ર}}$

(D) $\frac{\text{ચુંબકીય ક્ષેત્ર}}{\text{પ્રેરકત્વ}}$

- 22) એક AC જનરેટરમાં $t = 0$ સમયે વોલ્ટેજ મહત્તમ છે. કેટલા લઘૃતમ સમયમાં તેનું ભૂત્ય ઘટીને શૂન્ય થશે?

(A) $\frac{\pi}{2\omega}$

(B) $\frac{\pi}{\omega}$

(C) $\frac{\pi}{3\omega}$

(D) $\frac{2\pi}{\omega}$

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23) સોલેનોઇડનું આત્મપ્રેરકત્વ _____ ના સમપ્રમાણમાં હોય છે.

- (A) સોલેનોઇડમાંથી વહેતા વિદ્યુત પ્રવાહ
- (B) તેની લંબાઈ
- (C) તેના આડછેદના ક્ષેત્રફળ
- (D) તેના આડછેદના ક્ષેત્રફળના વ્યસ્ત

24) AC પરિપथમાં એક બલ્બને કેપેસીટર સાથે શ્રેણીમાં ભેડેલ છે. જો કેપેસીટરનું કેપેસીટન્સ ઘટાડવામાં આવે તો,

- (A) બલ્બ પહેલા કરતાં ઓછા તેજથી પ્રકાશિત થશે.
- (B) બલ્બ પહેલા કરતાં વધારે તેજથી પ્રકાશિત થશે.
- (C) બલ્બના તેજમાં કોઈ ફેરફાર થશે નહીં.
- (D) બલ્બ પ્રકાશિત થશે નહીં.

25) એક ટ્રાન્સફોર્મરના પ્રાથમિક ગૂંચળામાં 100 આંટા અને ગૌણ ગૂંચળામાં 200 આંટા છે. જો પ્રાથમિક ગૂંચળામાંથી વહેતો પ્રવાહ 10 A હોય તો ગૌણ ગૂંચળામાંથી વહેતો પ્રવાહ _____ A.

- (A) 20
- (B) 0.5
- (C) 10
- (D) 5

26) એક સમતલ વિદ્યુત ચુંબકીય તરંગમાં ચુંબકીય ક્ષેત્ર

$$By = (2 \times 10^{-7})T \sin(0.5 \times 10^3 x + 1.5 \times 10^{11}t)T$$

સૂત્ર વડે આપવામાં આવે છે. આ તરંગની તરંગલંબાઈ,

- (A) 1.26 m
- (B) 1.26 cm
- (C) 0.126 mm
- (D) 12.6 cm

- 27) ટ્રાફિક પોલીસ દ્વારા વપરાતી સ્પીડ ગનમાં _____ વપરાય છે.
 (A) રેડિયો તરંગો
 (B) માઈક્રોવેવ
 (C) પારરક્ત તરંગો
 (D) પારભાંબલી કિરણો
- 28) પ્રકાશનું કિરણ જ્યારે એક માધ્યમમાંથી બીજા માધ્યમમાં ગતિ કરે ત્યારે નીચેના પૈકી કઈ ભૌતિક રાશિ બદલાતી નથી?
 (A) વેગ
 (B) તરંગલંબાઈ
 (C) તીવ્રતા
 (D) આવૃત્તિ
- 29) હવામાં રાખેલા એક પાતળા કાચના સમતલ બહિગોળ લેન્સ માટે વક્તાત્રિજ્યા 20 cm હોય તો તેની કેન્દ્રલંબાઈ _____ cm.
 લેન્સના દ્રવ્યનો વકીભવનનંક = 1.5 છે.
 (A) 20
 (B) 40
 (C) 60
 (D) 30
- 30) સમબાજુ પ્રિઝમમાંથી પ્રકાશનું કિરણ એ રીતે પસાર થાય છે કે આપાતકોણ અને નિર્ભનકોણ સમાન બને. જો આપાતકોણ પ્રિઝમકોણ કરતાં $\frac{3}{4}$ ગણો હોય તો લઘુતમ વિચલન કોણ _____.
 (A) 30°
 (B) 40°
 (C) 45°
 (D) 50°
- 31) વ્યતિકરણ અને વિવર્તનની ઘટનાઓ _____ ના નિયમ સાથે સુસંગત છે.
 (A) વેગમાન સંરક્ષણ
 (B) વિદ્યુતભાર સંરક્ષણ
 (C) જડત્વ
 (D) ઉર્જા સંરક્ષણ

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- 32) નીચેનામાંથી કઈ ઘટના પ્રકાશ અને ધ્વનિના તરંગો માટે સામાન્ય નથી?
- વિવર્તન
 - વ્યતિકરણ
 - ધ્રુવિભવન
 - પ્રકિર્ણન
- 33) ધાતુની સપાટી પર ફોટોન આપાત કર્યા બાદ કેટલા સમય પછી ફોટો ઇલેક્ટ્રોન ઉત્સર્જિત થશે?
- 10^{-9} s
 - 10^{-4} s
 - 10^{-1} s
 - 10^{-6} s
- 34) કોઈ કણાની ડિ-બ્રોઝી તરંગલંબાઈ 1 m થવા માટે તેનું વેગમાન ક્યા કમનું હોવું જોઈએ?
- 10^{-10}
 - 10^{-34}
 - 10^{-27}
 - 10^{-19}
- 35) ધાતુની સપાટીમાંથી ઉત્સર્જિત ફોટો ઇલેક્ટ્રોનની મહત્તમ ગતિઉઝ _____ થી સ્વતંત્ર છે.
- આપાત વિકિરણની આવૃત્તિ
 - આપાત વિકિરણની તીવ્રતા
 - કેથોડના પ્રકાર
 - આપાત વિકિરણની તરંગલંબાઈ
- 36) 2 eV કાર્ય વિધેય ધરાવતી ધાતુ પર 6200\AA તરંગલંબાઈનો પ્રકાશ આપાત કરતાં ઉત્સર્જિત ઇલેક્ટ્રોનની મહત્તમ ઝડપ લગભગ _____.
- ($hc = 12,400\text{\AA}$)
- $2 \times 10^6 \text{ m/s}$
 - $1.6 \times 10^7 \text{ m/s}$
 - $1.6 \times 10^5 \text{ m/s}$
 - શૂન્ય

37) 30.0 m/s ની ઝડપથી ગતિ કરતાં 150 g ના બોલ સાથે સંકળાયેલ ડિ-ભ્રોઝી તરંગાલંબાઈ _____.

- (A) $1.47 \times 10^{-34} \text{ m}$
- (B) $0.135 \times 10^{-9} \text{ m}$
- (C) $2.76 \times 10^{-34} \text{ m}$
- (D) $4.54 \times 10^{-9} \text{ m}$

38) પ્રથમ ત્રણ બહેર વિજ્યાઓનો ગુણોત્તર _____.

- (A) $1 : \frac{1}{2} : \frac{1}{3}$
- (B) $1 : 2 : 3$
- (C) $1 : 4 : 9$
- (D) $1 : 8 : 27$

39) હાઈડ્રોજન પરમાણુની કોઈ પણ બહેર કક્ષામાં ઇલેક્ટ્રોનની ગતિઓળ્ઝ અને સ્થિતિઓળ્ઝનો ગુણોત્તર _____.

- (A) $\frac{1}{2}$
- (B) 2
- (C) $-\frac{1}{2}$
- (D) -2

40) થોમસનના મોડેલમાં પરમાણુનું પરિમાણ, રઘર્ફર્ડના મોડેલમાં પરમાણુના પરિમાણ

-
- (A) કરતાં ધણું મોદું છે.
 - (B) થી જુદું નથી.
 - (C) કરતાં ધણું નાનું છે.
 - (D) બંને મોડેલમાં પરમાણુના પરિમાણ વિશે કોઈ માહિતી આપેલ નથી.

41) ઈમ્પેક્ટ પેરામીટરનું મૂલ્ય વધારતાં પ્રકિર્ણન કોણ _____ છે.

- (A) અચળ રહે
- (B) ધટે
- (C) વધે
- (D) ગ્રારંભમાં વધે ત્યાર બાદ ધટે

૨૬ કાર્ય

42) 1mg દ્વયને સમતુલ્ય ઊર્જા, _____.

- (A) $9 \times 10^{13}\text{J}$
 (B) $9 \times 10^{16}\text{J}$
 (C) $9 \times 10^{19}\text{J}$
 (D) $9 \times 10^{10}\text{J}$

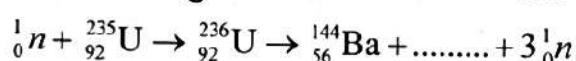
43) ${}_{80}^{198}\text{Hg}$ અને ${}_{79}^{197}\text{Au}$ એકભીજના _____ છે.

- (A) સમસ્થાનિકો
 (B) સમદળીય
 (C) આઈસોટોન
 (D) સમઘટકો

44) ${}_{3}^7\text{Li}$ ની દળ ક્ષતિ $0.042\mu\text{J}$ હોય તો તેની બંધન ઊર્જા પ્રતિ ન્યુક્લિયોન લગભગ _____ MeV.

- (A) 46
 (B) 5.6
 (C) 38.1
 (D) 23

45) નીચેની ન્યુક્લિયર વિખંડન પ્રક્રિયા પૂર્ણ કરો:



- (A) ${}_{38}^{94}\text{Sr}$
 (B) ${}_{41}^{99}\text{Nb}$
 (C) ${}_{51}^{133}\text{Sb}$
 (D) ${}_{36}^{89}\text{Kr}$

46) જો પરમાણુ દળાંક A વધારવામાં આવે તો ન્યુક્લિયસ સાથે સંકળાયેલ નીચેના પૈકી કઈ ભૌતિક રાશિ અચળ રહેશે?

- (A) બંધન ઊર્જા
 (B) ઘનતા
 (C) કદ
 (D) દળ

૨૫ કાર્ય

47) અર્ધવાહકોની અવરોધકતા લગભગ _____ Ω m.

- (A) 10^{-2} થી 10^{-8}
- (B) 10^5 થી 10^{-6}
- (C) 10^{11} થી 10^{19}
- (D) 10^{-5} થી 10^6

48) શુદ્ધ અર્ધવાહકમાં તાપમાન વધારતાં ઊર્જા ગોપ _____.

- (A) પ્રારંભમાં વધે છે ત્યાર બાદ ઘટે છે.
- (B) ઘટે છે.
- (C) વધે છે.
- (D) અચળ રહે છે.

49) સિલિકોન સ્ફિટિકમાં અલ્યુ માત્રામાં એન્ટિમનીનું ડોપીંગ કરવામાં આવે તો સિલિકોન સ્ફિટિક, _____.

- (A) સારો અવાહક છે.
- (B) P-પ્રકારનો અર્ધવાહક બને છે.
- (C) N-પ્રકારનો અર્ધવાહક બને છે.
- (D) સારો સુવાહક બને છે.

50) પૂર્ણ તરંગ રેફ્લેક્શનમાં ઈનપુટ આવૃત્તિ 60 Hz હોય તો આઉટપુટ આવૃત્તિ _____.

- (A) 30 Hz
- (B) 60 Hz
- (C) 120 Hz
- (D) 90 Hz

054 (G)

**SPECIAL SUPPLEMENTARY EXAM, JULY - 2025
(SCIENCE STREAM)
(CLASS - XII)**

(Part - B)

Time : 2 Hours]

[Maximum Marks : 50]

સૂચનાઓ :

- 1) સ્પષ્ટ વંચાય તેવું હસ્તલેખન જાળવવું.
- 2) આ પ્રશ્નપત્રના ભાગ - B માં ત્રણ વિભાગો A, B અને C છે. અને કુલ 1 થી 27 પ્રશ્નો આપેલા છે.
- 3) બધા ૭ પ્રશ્નો ફરજિયાત છે. જનરલ વિકલ્પો આપેલા છે.
- 4) પ્રશ્નની જમણી બાજુના અંક તેના ગુણ દર્શાવે છે.
- 5) નથો વિભાગ નવા પાના પર લખવો.
- 6) પ્રશ્નોના જવાબ ફરજમાં લખવો.
- 7) વિદ્યાર્થીઓ જરૂર જણાય ત્યાં સાદા કેલ્ક્યુલેટર અને લોગ ટેબલનો ઉપયોગ કરી શકશો.
- 8) આકૃતિવાળા/આદેખ પ્રશ્નોમાં દાખિલીન વિદ્યાર્થીઓ માટે અલગ પ્રશ્નો આપેલા છે. જેનું ખાસ ધ્યાન રાખવું. આ પ્રશ્નો માત્ર દાખિલીન વિદ્યાર્થીઓ માટે ૭ છે.

વિભાગ - A

- નીચે આપેલા પ્રશ્ન નં. 1 થી 12 માંથી માત્રા મુજબ ગમે તે 8 પ્રશ્નોના ઉત્તર લખો. (દરેક પ્રશ્નના 2 ગુણ છે.) [16]

- 1) ગોસના નિયમનો ઉપયોગ કરીને સમાન રીતે વિદ્યુતભારિત અનંત સમતલ વહે મળતાં વિદ્યુતક્ષેત્રનું સૂત્ર મેળવો. [2]
- 2) a) કોઈ માણસના સૂક્ષ્મ વાળમાંથી પસાર કરેલો કાંસકો કાગળના નાના ટુકડાઓને આકર્ષે છે.- શા માટે? (યાદ રાખો કે કાગળ વિદ્યુતનું વહન કરતો નથી).
b) સામાન્ય રખર અવાહક છે. પરંતુ વિમાનના વિશીષ રખરના ટાયરો સહેજ સુવાહક બનાવવામાં આવે છે.-આવું શા માટે જરૂરી છે? [2]
- 3) પ્લેટીનમ અવરોધ ધરાવતાં થર્મોભીટરમાં રહેલા પ્લેટીનમ તારનો અવરોધ બરફના તાપમાને 6 Ω અને વરણના તાપમાને 6.23 Ω છે. જ્યારે થર્મોભીટરને Hot Bath માં ડૂબાડવામાં આવે છે ત્યારે પ્લેટીનમ તારનો અવરોધ 6.795 Ω મળે છે તો Hot Bath નું તાપમાન ગણો. [2]
- 4) પેરામેટ્રેટિક અને ડાયામેટ્રેટિક પદ્ધાર્થો વચ્ચે તફાવતના કોઈપણ ચાર મુદ્દાઓ લખો. [2]
- 5) દર્શાવો કે કોઈપણ પરિપથમાં વિદ્યુતપ્રવાહ (I) પ્રસ્થાપિત કરવા માટે બેક emf(ε) ની વિઝદ્વમાં કરવું પડતું કાર્ય $W = \frac{1}{2} LI^2$ જેટલું હોય છે. [2]

- 6) 220 V, 50 Hz ના AC સ્ત્રોત સાથે 44 mH નું ઈન્ડક્ટર જોડેલ છે. પરિપथમાં પ્રવાહનું rms મૂલ્ય શોધો. [2]
- 7) વિદ્યુત ચુંબકીય તરંગોની કોઈ પણ ચાર લાક્ષાંિકતાઓ લખો. [2]
- 8) a) કાચના લેન્સ માટે $f = 0.5 \text{ m}$ હોય તો લેન્સનો પાવર કેટલો હશે?
- b) દ્વિ-બહિર્ગ૊ળ લેન્સની બંને બાજુઓની વક્તાત્રિજ્યા અનુકૂમે 10 cm અને 15 cm છે. તેની તેન્દ્રલંબાઈ 12 cm હોય તો લેન્સના દ્વિવ્યનો વકીલબનાંક કેટલો હશે? [2]
- 9) ધેરણા બે સ્લિટના પ્રયોગમાં, બે સ્લિટો વચ્ચેનું અંતર 0.28 mm અને પડદો 1.4 m દૂર મૂકેલો છે. મધ્યસ્થ પ્રકાશિત શલાકા અને ચોથી પ્રકાશિત શલાકા વચ્ચેનું અંતર 1.2 cm જેટલું માપવામાં આવે છે. પ્રયોગમાં વપરાયેલ પ્રકાશની તરંગ લંબાઈ શોધો. [2]
- 10) ફોટો ઇલેક્ટ્રોક અસર માટે આઈ-સ્ટાઇનની સમજૂતી આપી તેનું સમીકરણ મેળવો. [2]
- 11) બોહરની કર્વાન્ટમીકરણની બીજી સ્વીકૃતિની ડિ બ્રોઝીની સમજૂતી ટૂંકમાં સમજાવો. [2]
- 12) P-પ્રકારના અર્ધવાહક અને N-પ્રકારના અર્ધવાહક વચ્ચે તફાવતના કોઈ પણ ચાર મુદ્દાઓ લખો. [2]

વિભાગ - B

- નીચે આપેલા પ્રશ્ન નં. 13 થી 21 માંથી માઝ્યા પ્રમાણે ગમે તે 6 પ્રશ્નોના ઉત્તર લખો. (દરેક પ્રશ્નના 3 ગુણ છે.) [18]

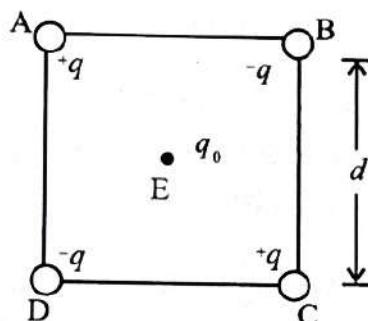
- 13) બે બિંદુવિદ્યુતભારો $q_A = 5 \mu\text{C}$ અને $q_B = -5 \mu\text{C}$ એકબીજાથી શૂન્યાવકાશમાં 20 cm દૂર રહેલા છે.
- a) બે વિદ્યુતભારોને જોડતી રેખા AB ના મધ્યબિંદુ O આગળ વિદ્યુતક્ષેત્ર કેટલું હશે?
- b) જો $2.0 \times 10^{-9}\text{C}$ માન ધરાવતો એક ઝાણ પરિક્ષાળ વિદ્યુતભાર આ બિંદુએ મૂકવામાં આવે તો તેના પર લાગતું બળ કેટલું હશે? આ બળ કઈ દિશામાં લાગશે? [3]
- 14) બે પ્લેટો વચ્ચે હવા હોય તેવા સમાંતર પ્લેટ કેપેસીટરમાં દરેક પ્લેટનું ક્ષેત્રફળ $6 \times 10^{-3} \text{ m}^2$ અને બે પ્લેટો વચ્ચેનું અંતર 3 mm છે.
- a) કેપેસીટરનું કેપેસીટન્સ ગણો.
- b) જો આ કેપેસીટરને 100 V સપ્લાય સાથે જોડવામાં આવે તો તેની દરેક પ્લેટ પરનો વિદ્યુતભાર કેટલો હશે?
- c) આપેલ કેપેસીટરની બે પ્લેટ વચ્ચે 3 mm જાઈકા (અભરખ) ની પ્લેટ (ડાયરીલેક્ટ્રીક અચળાંક = 6) જ્યારે વોલ્ટેજ સપ્લાય જોડેલો હોય ત્યારે દાખલ કરવામાં આવે તો શું થાય તે સમજાવો. [3]

- 15) ઇલેક્ટ્રોન માટે ડિફેન્સ વેગનું સૂત્ર સ્વીકારી $\rho = \frac{m}{ne^2\tau}$ સૂત્ર તરફે ઘાતુઓનું તાપમાન વધારતાં અવરોધકતા (ρ) વધશે કે ઘટશે? [3]
- 16) નિયમિત ચુંબકીય ક્ષેત્રમાં ઠ કોણે રાખેલ વિદ્યુત પ્રવાહ ઘારિત લંબચોરસ લૂપ પર લાગતાં ટેક્ઝનું સૂત્ર $\vec{\tau} = \vec{m} \times \vec{B}$ મેળવો. (નીચેનો પ્રશ્ન ફક્ત દાખિલ વિદ્યાર્થીઓ માટે છે.) [3]
- 16) પાસપાસે વિટાળેલા 100 આંટાવાળું, 10 cm ત્રિજ્યાનું એક વર્તુળકાર ગૂંઘળું 3.2A વિદ્યુત પ્રવાહ ધરાવે છે.
- આ ગૂંઘળાના કેન્દ્રમાં કેટલું ચુંબકીય ક્ષેત્ર હશે?
 - ગૂંઘળાની ચુંબકીય મોમેન્ટ કેટલી હશે?
- [3]
- 17) 8 cm અને 2 cm બાજુઓ વાળા અને એક નાનો કાપો (cut) ધરાવતાં એક લંબચોરસ તારનો ગાળો 0.3T ની તીપ્રતાના અને ગાળાને લંબ દિશાના એક સમાન ચુંબકીય ક્ષેત્રના વિસ્તારમાંથી બહારની તરફ ગતિ કરી રહ્યો છે. જો ગાળાનો વેગ 1 cm S⁻¹
- લાંબી બાજુને,
 - ગાળાની ટૂંકી બાજુને
- લંબ દિશા તરફનો હોય, તો આ કાપાના છેડા વચ્ચે ઉત્પન્ન થતું emf કેટલું હશે? પ્રત્યેક કિરસામાં પ્રેરિત વોલ્ટેજ કેટલા સમય માટે રહેશે? [3]
- 18) હાઈગેન્સના સિદ્ધાંતની ભદ્રથી સમતલ તરંગોનું વકીલબન સમજવો. (નીચેનો પ્રશ્ન ફક્ત દાખિલ વિદ્યાર્થીઓ માટે છે.) [3]
- 18) 589 nm તરંગલંબાઈ ધરાવતો એકરંગી પ્રકાશ હવામાંથી પાણીની સપાટી ઊપર આપાત થાય છે.
- પરાવર્તિત પ્રકાશની
 - વકીલૂત પ્રકાશની
- તરંગ લંબાઈ, આવૃત્તિ અને ઝડપ કેટલી હશે? પાણીનો વકીલબનાંક 1.33 છે. [3]
- 19) પ્રાયોગિક રીતે એમ જણાયું છે કે હાઈડ્રોજન પરમાણુને પ્રોટોન અને ઇલેક્ટ્રોનમાં છૂટા પાડવા માટે 13.6 eV ઊર્જાની જરૂર પડે છે. હાઈડ્રોજન પરમાણુમાં ઇલેક્ટ્રોનની કક્ષીય ત્રિજ્યા અને વેગની ગણતરી કરો. [3]
- 20) ગોલ્ડના સમસ્થાનિક $^{197}_{79}\text{Au}$ અને સિલ્વરના સમસ્થાનિક $^{107}_{47}\text{Ag}$ નાં ન્યુક્લિયસની ત્રિજ્યાઓનો આશરે ગુણોત્તર મેળવો. [3]

- 21) P-N જંક્શન ડાયોડની રીવર્સ બાયસ V-I લાક્ષણિકતાના અભ્યાસ માટે પરિપથની પ્રાયોગિક ગોઠવણી દોરો અને રીવર્સ બાયસ લાક્ષણિકતા સમજાવો.
(નીચેનો પ્રશ્ન ફક્ત દસ્તિહીન વિદ્યાર્થીઓ માટે છે.) [3]
- 21) ધારોકે શુદ્ધ Si સ્ફિટિકમાં 5×10^{28} પરમાણુ/m⁻³ છે. તેને 1 ppm ઘનતા સાથે પેન્ટાવેલેન્ટ As વડે ડોપ કરવામાં આવે છે. ઈલેક્ટ્રોન અને હોલની સંખ્યા ગણો. $n_i = 1.5 \times 10^{16} \text{ m}^{-3}$ આપેલ છે. [3]

વિભાગ - C

- નીચે આપેલા પ્રશ્ન નં. 22 થી 27 માંથી માઝ્યા મુજબ ગમે તે 4 પ્રમોના યોગ્ય ઉત્તર લખો.
(દ્વારા પ્રક્રિયા 4 ગુણ છે.) [16]
- 22) આકૃતિમાં દર્શાવ્યા મુજબ ત બાજુવાળા ચોરસ ABCD ના શિરોબિંદુઓ પર ચાર વિદ્યુતભારો ગોઠવેલ છે.
- આ ગોઠવણી પ્રાપ્ત કરવા માટે જરૂરી કાર્ય શોધો.
 - ચાર વિદ્યુતભારોને તે શિરોબિંદુઓ પર જરૂરી રાખીને વિદ્યુતભાર q_0 ને ચોરસના કેન્દ્ર E પર લાવવામાં આવે છે. આ માટે વધારાનું કેટલું કાર્ય જરૂરી છે.
- [4]



- (નીચેનો પ્રશ્ન ફક્ત દસ્તિહીન વિદ્યાર્થીઓ માટે છે.)
- 22) સમસ્થિતિમાન પૃષ્ઠ એટલે શું? વિદ્યુત ક્ષેત્ર અને વિદ્યુત સ્થિતિમાન વચ્ચેનો સંબંધ મેળવો. આ સંબંધ અંગેના બે મહત્વના નિર્જર્ખો લખો. [4]
- 23) વિદ્યુત કોષોનું સમાંતર જોડાણ એટલે શું? બે વિદ્યુત કોષોને સમાંતરમાં જોડતાં મળતા સમતૂલ્ય emf અને સમતૂલ્ય આંતરિક અવરોધના સૂત્રો મેળવો. [4]
- 24) LCR AC શ્રેણી પરિપથ માટે સરેરાશ પાવરનું સૂત્ર લખો. પાવર ફેક્ટર કોને કહે છે? નીચેના કિસ્સાઓમાં પાવરની ચર્ચા કરો :
- અવરોધક પરિપથ
 - શુદ્ધ ઈન્ડક્ટિવ અથવા કેપેસીટીવ પરિપથ
 - LCR શ્રેણી પરિપથ
 - LCR પરિપથમાં અનુનાની સ્થિતિએ વ્યય થતો પાવર
- [4]

- 25) 1.25 cm કેન્દ્રલંબાઈના ઓપ્જેક્ટીવ અને 5 cm કેન્દ્રલંબાઈના આઈપીસ વડે 30X કોણીથી મોટવણી (મોટવ શક્તિ) મેળવવી હોય તો સંયુક્ત માઈક્રોસ્કોપની ગોઠવણી કઈ રીતે કરવી જોઈએ? [4]
- 26) હિસિયમ-નિયોન લેસર વડે 632.8 nm તરંગલંબાઈનો એકરંગી પ્રકાશ ઉત્પન્ન થાય છે. ઉત્સર્જિત પાવર 9.42 mW જેટલો છે.
- પ્રકાશપૂજ્ઞમાં રહેતા દરેક ફોટોનની ઊર્જા શોધો.
 - પ્રકાશપૂજ્ઞમાં રહેતા દરેક ફોટોનનું વેગમાન શોધો.
 - આ પૂજ્ઞ વડે પ્રકાશિત લક્ષ્ય (ટાર્ગેટ) પર સરેરાશ રીતે એક સેકન્ડ દીઠ કરેતા ફોટોન આપાત થતા હશે? (પૂજ્ઞનો આડછેદ સમાન અને લક્ષ્યના ક્ષેત્રફળ કરતાં નાનો છે તેમ ધારો)
 - ફોટોનના વેગમાન જેટલું વેગમાન ઘરાવવા માટે હાઇડ્રોજન પરમાણુએ કેટલી ઝડપથી ગતિ કરવી જોઈએ?
- 27) ન્યુક્લિયોન દીઠ બંધન ઊર્જા (E_{bn}) વિચ્છદ દળાંક (A) નો આલેખ દોરો. આ આલેખના મુખ્ય બે લક્ષણો જણાવી તેના પરથી મળતા કોઈપણ બે નિર્જર્ખ લખો. [4]

(નીચેનો પ્રશ્ન ફક્ત દણિહીન વિદ્યાર્થીઓ માટે છે.)

- 27) ડ્યુટેરિયમના 1.0 kg ના સંલયનથી 100W નો વિદ્યુતભલ્બ કેટલો સમય સુધી પ્રકાશતો રાખી શકાય? સંલયન પ્રક્રિયા નીચે મુજબ થાય છે એમ ગણો :
- $$^2_1\text{H} + ^2_1\text{H} \rightarrow ^3_2\text{He} + n + 3.27 \text{ MeV}$$



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

Sl.No.

054 (H)

SPECIAL SUPPLEMENTARY
EXAM, JULY - 2025
(SCIENCE STREAM)
(CLASS - XII)

प्रश्न पेपरनो सेट नंबर जेनी
सामेनु वर्तुण OMR शीटमा
घट करवानु रहे छे.
Set No. of Question Paper,
circle against which is to be
darker in OMR sheet.

01

Part - A : Time : 1 Hour / Marks : 50

Part - B : Time : 2 Hours / Marks : 50

(Part - A)

/Maximum Marks : 50

Time : 1 Hour]

सूचनाएँ :

- 1) इस प्रश्न पत्र में Part - A में वस्तुनिष्ठ प्रकार के कुल 50 प्रश्न हैं। सभी प्रश्न अनिवार्य हैं।
- 2) प्रश्नों की क्रम संख्या 1 से 50 हैं। हरेक प्रश्न का गुण 1 है।
- 3) प्रश्न पुस्तिका को अच्छी तरह पढ़ना और सही विकल्प को लिखना।
- 4) आपको अलग से दिए गये OMR पत्रक में प्रश्नों के सामने (A) O, (B) O, (C) O और (D) O दिए गये हैं। सही विकल्प के गोलाकार को बॉल पेन से पूर्ण गाढ़ा (●) करना होगा।
- 5) रफ़ कार्य करने हेतु प्रश्न पुस्तिका में दी गई जगह में करना होगा।
- 6) दिए गए प्रश्नपत्र में ऊपर दाहिनी ओर प्रश्नपत्र सेट नंबर को OMR शीट में उपलब्ध कॉलम में लिखिए।
- 7) यदि जरूरी हो, तो सरल केल्क्युलेटर और तालिका (log table) के उपयोग की अनुमति दी जाती है।
- 8) इस प्रश्नपत्र में उपयोग की गई संज्ञाओं का प्रचलित अर्थ है।
- 9) आकृति/आलेख वाले प्रश्नों में सिर्फ़ दृष्टिहीन विद्यार्थीयों के लिए अलग से प्रश्न दिया गया है। यह प्रश्न केवल दृष्टिहीन विद्यार्थीयों के लिए ही है।

-
- 1) एक दूसरे से कुछ दूरी पर समान मान के दो विपरीत आवेशों पर लगने वाला वैद्युत बल F है। यदि 25% आवेश एक पर से दुसरे पर स्थानान्तरित कर दिया जाये तो उनके बीच लगने वाला नया विद्युत बल क्या होगा?

रफ़ कार्य

- (A) F
(B) $\frac{15}{16}F$
(C) $\frac{9}{16}F$
(D) $\frac{4}{5}F$

रफ कार्य

- 2) q मान के एकसमान 16 आवेशित कण एक दूसरे से $\frac{R}{3}$ दूरी पर y-अक्ष पर रखे

गये हैं। मूल बिन्दु पर भी एक आवेशित कण है। मूल बिन्दु पर रखे $\frac{3}{2} R$ त्रिज्या वाले एक गोले से निकलने वाला वैद्युत फ्लक्स कितना होगा?

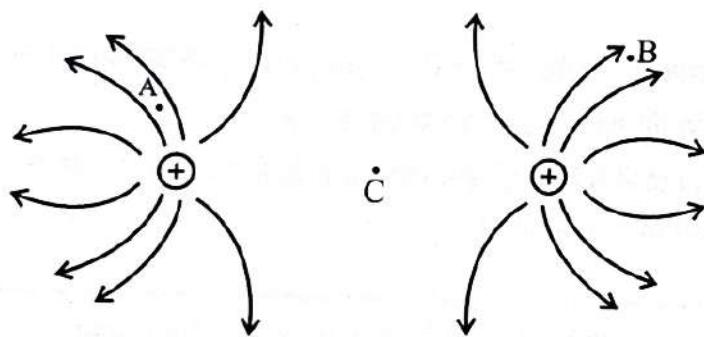
(A) $16 \frac{q}{\epsilon_0}$

(B) $8 \frac{q}{\epsilon_0}$

(C) $4 \frac{q}{\epsilon_0}$

(D) $9 \frac{q}{\epsilon_0}$

- 3) चित्र में कागज के समतल पर स्थित स्थिरवैद्युत आवेशों से निकलने वाली विद्युत क्षेत्र रेखाएं दर्शाइ गई हैं।



इस विद्युत क्षेत्र निरूपण को समझकर एक असत्य विधान (प्रकथन) पहचानिए।

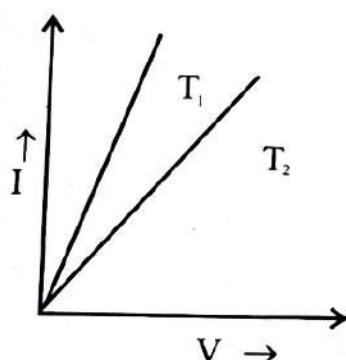
- (A) बिन्दु B पर विद्युत क्षेत्र बिन्दु A पर विद्युत क्षेत्र से निर्बल है।
- (B) विद्युत क्षेत्र का वितरण द्विविमीय है।
- (C) धन वैद्युत आवेश का वैद्युत क्षेत्र हमेशा बाहर की तरफ होता है।
- (D) बिन्दु C पर वैद्युत क्षेत्र का मान शून्य है।

(निम्नलिखित प्रश्न मात्र दृष्टिहीन विद्यार्थियों के लिए है।)

रङ् कार्य

- 3) विद्युत क्षेत्र रेखा एक ऐसा वक्र है जिसके प्रत्येक बिन्दु पर खींचा गया स्पर्श रेखा इस बिन्दु पर
- केवल विद्युत क्षेत्र का मान देता है।
 - केवल विद्युत क्षेत्र की दिशा देता है।
 - विद्युत क्षेत्र का मान और दिशा दोनों देता है।
 - केवल बल का मान देता है।
- 4) बिन्दु द्विध्रुव के लिए निम्नलिखित में कौन-सा सही है?
- $2a \rightarrow 0, q \rightarrow \infty$
 - $2a \rightarrow \infty, q \rightarrow \infty$
 - $2a \rightarrow \infty, q \rightarrow 0$
 - $2a \rightarrow 0, q \rightarrow 0$
- 5) 2.4m व्यास के किसी एकसमान आवेशित चालक गोले का पृष्ठीय आवेश घनत्व $\frac{1}{4\pi} \mu C / m^2$ हो तो गोले पर आवेश _____ होगा।
- $0.2 \mu C$
 - $1.44 \mu C$
 - $14.4 mC$
 - $6.28 \mu C$
- 6) मिर्वात की विद्युतशीलता (परमिटिविटी) का S.I. मात्रक _____ है।
- Fm^{-1}
 - Fm^{-2}
 - Fm^{-3}
 - Fm

- 7) $4\mu F$ धारिता वाले तीन संधारित्र (कैपासिटर) इस प्रकार जुड़े हुए हैं कि इनकी समतुल्य धारिता $6\mu F$ है तो उनका संयोजन _____ है।
- (A) दो समान्तर और एक इनके साथ श्रेणी क्रम में
 (B) सभी श्रेणी क्रम में
 (C) सभी समान्तर क्रम में
 (D) दो श्रेणी और इनके साथ एक समान्तर क्रम में
- 8) दो विद्यार्थी A और B एक परिपथ में बहते विद्युत आवेश की गणना करते हैं। विद्यार्थी A यह निष्कर्ष निकालता है कि 1 मिनट में $300 C$ इलेक्ट्रॉन बहता है तथा विद्यार्थी B यह निष्कर्ष निकालता है कि 1 सेकेण्ड में 3.125×10^{19} इलेक्ट्रॉन बहता है। यदि परिपथ में बहती धारा $5A$ हो तो कौन-से विद्यार्थी की गणना सही है?
- (A) केवल विद्यार्थी A की
 (B) केवल विद्यार्थी B की
 (C) विद्यार्थी A और B दोनों की
 (D) A और B दोनों विद्यार्थी में से किसी की नहीं
- 9) किसी एक चालक तार के लिए दो अलग-अलग स्थिर तापमान पर $I \rightarrow V$ ग्राफ दर्शाया गया है। इससे कहा जा सकता है कि –



- (A) $T_1 > T_2$
 (B) $T_1 < T_2$
 (C) $T_1 = T_2$
 (D) $T_1 = 2T_2$

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(निम्नलिखित प्रश्न मात्र दृष्टिहीन विद्यार्थियों के लिए है।)

9) यदि वृत्तीय पथ में परिक्रमा करने वाले इलेक्ट्रॉन की आवृत्ति v है तो प्राप्त धारा,

(A) $v et$

(B) $v e$

(C) $\frac{v}{et}$

(D) $\frac{1}{vet}$

10) वैद्युत चालकता का विमीय सूत्र _____ है।

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

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

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

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

11) विधान – कारण प्रकार के प्रश्न

a) विधान और कारण दोनों सही हैं और कारण विधान का सही स्पष्टीकरण करता है।

b) विधान और कारण दोनों सही हैं परन्तु कारण विधान का सही स्पष्टीकरण नहीं करता है।

c) विधान सही है परन्तु कारण गलत है।

d) विधान गलत है परन्तु कारण सही है।

विधान : 100 W के बल्ब को 110 V की सप्लाई से जोड़ने पर बल्ब का अवरोध 121Ω मिलता है।कारण : पावर $P = VI = I^2 R = \frac{V^2}{R}$

(A) a

(B) b

(C) c

(D) d

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- 12) जब एक प्रोटॉन $\bar{V} = (2\hat{i} + 3\hat{j}) \text{ m/s}$ वेग से $\bar{B} = (2\hat{i} + 3\hat{j}) \text{ T}$ के चुम्बकीय क्षेत्र में गति करता हो तो उस पर लगने वाला चुम्बकीय बल _____ N होगा?
- (A) $13 \times 1.6 \times 10^{-19}$
 (B) $1.69 \times 1.6 \times 10^{-19}$
 (C) $14.4 \times 10^{-19} \hat{j}$
 (D) शून्य
- 13) निम्नलिखित में से कौन-सा कथन असत्य है?
- (A) वोल्टमीटर का प्रतिरोध अधिक होता है।
 (B) एमीटर का प्रतिरोध बहुत कम होता है।
 (C) परिपथ में घटक के समान्तर एमीटर जोड़ा जाता है।
 (D) परिपथ में घटक के समान्तर वोल्टमीटर जोड़ा जाता है।
- 14) 0.1 kg/m रेखीय द्रव्यमान घनत्व वाले सीधे तार से 2A विद्युत धारा प्रवाहित हो रही है। यह किसी एकसमान क्षैतिज चुम्बकीय क्षेत्र (B) के द्वारा वायु के बीच में निलंबित (suspended) है तो चुम्बकीय क्षेत्र का मान _____
- (A) 0.65 T
 (B) 0.32 T
 (C) 0.49 T
 (D) 0.98 T
- 15) आवेशित कण की कोणीय चाल _____ से स्वतंत्र है।
- (A) इसके द्रव्यमान
 (B) इसके रेखीय वेग
 (C) इसके आवेश
 (D) चुम्बकीय क्षेत्र
- 16) 2 m लंबे सोलेनायड (परिनालिका) में फेरों की संख्या 2000 है। यदि इसमें 2A की विद्युत धारा बहती हो तो इसकी चुम्बकीय तीव्रता _____ A/m है।
- (A) 2×10^3
 (B) 0.5×10^3
 (C) 4×10^3
 (D) 0.25×10^3

- 17) एक छोटा छड़ चुंबक जो एक समान बाह्य चुम्बकीय क्षेत्र 0.25T के साथ 60° का कोण बनाता है, उस पर $1.73 \times 10^{-2}\text{J}$ का बल आधूर्ण लगता है तो चुंबक के चुम्बकीय आधूर्ण का परिमाण _____ Am^2 होगा। रफ़ कार्य
 (A) 13.8×10^{-2}
 (B) 4×10^{-2}
 (C) 0.43×10^{-2}
 (D) शून्य
- 18) निम्नलिखित में से कौन-सा पदार्थ लौह चुम्बकीय (Ferromagnetic) पदार्थ नहीं है?
 (A) एलनिको
 (B) गैडोलिनियम
 (C) लोडस्टोन
 (D) कॉपर क्लोराइड
- 19) किसी परिपथ में 1s में धारा 5.0A से 0.0A तक गिरती है। यदि औसत प्रेरित विद्युत वाहक बल 200V है तो परिपथ का स्वप्रेरकत्व _____
 (A) 4H
 (B) 2H
 (C) 40 H
 (D) 5 H
- 20) I लंबाई और ρ अवरोधकता वाला एक चालक छड़ चुम्बकीय क्षेत्र B में V वेग से लम्बवत गति करता हो तो इसमें प्रेरित विद्युत धारा _____
 (A) $\frac{BVA}{\rho}$
 (B) $BVA\rho$
 (C) $\frac{BVA}{R}$
 (D) BVI

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21) निम्नलिखित में से किसकी विमा, विद्युत धारा की विमा के बराबर है?

(A) $\frac{\text{प्रेरकत्व}}{\text{चुम्बकीय फ्लक्स}}$

(B) $\frac{\text{चुम्बकीय फ्लक्स}}{\text{प्रेरकत्व}}$

(C) $\frac{\text{प्रेरकत्व}}{\text{चुम्बकीय क्षेत्र}}$

(D) $\frac{\text{चुम्बकीय क्षेत्र}}{\text{प्रेरकत्व}}$

22) एक AC जनरेटर में $t = 0$ समय पर वोल्टेज महजम है तो कम से कम कितने समय में इसका मान घटकर शून्य हो जायेगा?

(A) $\frac{\pi}{2\omega}$

(B) $\frac{\pi}{\omega}$

(C) $\frac{\pi}{3\omega}$

(D) $\frac{2\pi}{\omega}$

23) सोलेनायड (परिनालिका) का स्वप्रेरकत्व _____ के अनुक्रमानुपाती होता है।

(A) सोलेनायड में बहती धारा

(B) इसकी लम्बाई

(C) इसके अनुप्रस्थ काट के क्षेत्रफल

(D) इसके अनुप्रस्थ काट के क्षेत्रफल के व्युत्क्रम

24) AC परिपथ में एक लैंप किसी संधारित्र के साथ श्रेणी क्रम में जुड़ा है। यदि संधारित्र की धारिता घटाई जाये तो _____

(A) लैंप पहले की तुलना में कम दीपि से प्रकाशित होगा।

(B) लैंप पहले की तुलना में अधिक दीपि से प्रकाशित होगा।

(C) लैंप की दीपि में कोई परिवर्तन नहीं होगा।

(D) लैंप प्रकाशित नहीं होगा।

- 25) एक ट्रांसफार्मर की प्राथमिक कुण्डली में 100 एवं द्वितीयक कुण्डली में 200 फेरे हैं। यदि प्राथमिक कुण्डली में विद्युत धारा 10 A हो तो द्वितीयक कुण्डली में विद्युत धारा _____ A होगी।
- (A) 20
 (B) 0.5
 (C) 10
 (D) 5
- 26) किसी समतल वैद्युत चुम्बकीय तरंग में चुम्बकीय क्षेत्र $By = (2 \times 10^{-7})T \sin(0.5 \times 10^3 x + 1.5 \times 10^{11}t)T$ है। इस तरंग की तरंगदैर्घ्य _____ है।
- (A) 1.26 m
 (B) 1.26 cm
 (C) 0.126 mm
 (D) 12.6 cm
- 27) ट्रैफिक पुलिस द्वारा प्रयुक्त स्पीड गन में _____ का प्रयोग होता है।
- (A) रेडियो तरंगो
 (B) सूक्ष्म तरंगो
 (C) अवरक्त तरंगो
 (D) परावैंगनी तरंगो
- 28) जब प्रकाश की किरण एक माध्यम में से दूसरे माध्यम में गति करती है तो निम्नलिखित में से कौन-सी भौतिक राशि नहीं बदलती है?
- (A) वेग
 (B) तरंगदैर्घ्य
 (C) तीव्रता
 (D) आवृत्ति
- 29) हवा में रखे एक पतले काँच के समतलोत्तल लेंस की वक्रता त्रिज्या 20 cm हो तो उसकी फोकस दूरी _____ cm होगी। लेंस के काँच का अपवर्तनांक 1.5 है।
- (A) 20
 (B) 40
 (C) 60
 (D) 30

रफ़ कार्य

रफ कार्य

- 30) किसी समबाहु प्रिज्म में प्रकाश की किरण इस प्रकार गुजरती है कि इसका आपतन कोण और निर्गत कोण समान है। यदि आपतन कोण, प्रिज्म कोण का $\frac{3}{4}$ गुना हो तो लघुत्तम विचलन कोण _____
- (A) 30°
 (B) 40°
 (C) 45°
 (D) 50°
- 31) व्यतिकरण और विवर्तन की घटना में _____ के सिद्धान्त के अनुकूल है।
- (A) संवेग संरक्षण
 (B) आवेश संरक्षण
 (C) जड़त्व
 (D) ऊर्जा संरक्षण
- 32) निम्नलिखित में से कौन-सी घटना प्रकाश और ध्वनि तरंगों के लिए सामान्य (Common) नहीं है।
- (A) विवर्तन
 (B) व्यतिकरण
 (C) ध्रुवण
 (D) प्रकीर्णन
- 33) धातु के पृष्ठ पर फोटान आपतित करने के कितनी देर बाद फोटो इलेक्ट्रॉन उत्सर्जित होता है?
- (A) 10^{-9} s
 (B) 10^{-4} s
 (C) 10^{-1} s
 (D) 10^{-6} s

- 34) किसी कण का दे-ब्रॉग्ली तरंगदैर्घ्य 1 m होने के लिए इसका संवेग किस कोटि
का होना चाहिए?
 (A) 10^{-10}
 (B) 10^{-34}
 (C) 10^{-27}
 (D) 10^{-19}
- 35) धातु के पृष्ठ से उत्सर्जित होने वाले फोटो इलेक्ट्रॉन की महत्तम गतिज ऊर्जा _____
से स्वतंत्र है।
 (A) आपतित विकिरण की आवृत्ति
 (B) आपतित विकिरण की तीव्रता
 (C) कैथोड के प्रकार
 (D) आपतित विकिरण की तरंगदैर्घ्य
- 36) 2 eV कार्य फलन (वर्क फंक्शन) वाले धातु पर 6200\AA तरंगदैर्घ्य का प्रकाश^(hc = 12,400\AA) आपतित करने पर उत्सर्जित फोटान का महत्तम चाल लगभग _____
 (A) $2 \times 10^6 \text{ m/s}$
 (B) $1.6 \times 10^7 \text{ m/s}$
 (C) $1.6 \times 10^5 \text{ m/s}$
 (D) शून्य
- 37) 150 g द्रव्यमान की एक गेंद जो 30.0 m/s की चाल से गति कर रही है, से
जुड़ी दे-ब्रॉग्ली तरंगदैर्घ्य _____
 (A) $1.47 \times 10^{-34} \text{ m}$
 (B) $0.135 \times 10^{-9} \text{ m}$
 (C) $2.76 \times 10^{-34} \text{ m}$
 (D) $4.54 \times 10^{-9} \text{ m}$
- 38) बोर की प्रथम तीन त्रिज्याओं का अनुपात _____
 (A) $1 : \frac{1}{2} : \frac{1}{3}$
 (B) $1 : 2 : 3$
 (C) $1 : 4 : 9$
 (D) $1 : 8 : 27$

39) हाइड्रोजन परमाणु की किसी भी कक्षा में इलेक्ट्रॉन की गतिज ऊर्जा और स्थितिज ऊर्जा का अनुपात _____

(A) $\frac{1}{2}$

(B) 2

(C) $-\frac{1}{2}$

(D) -2

40) थॉमसन मॉडल में परमाणु का साइज, रदरफोर्ड मॉडल में परमाणवीय साइज से _____ होता है।

(A) अपेक्षाकृत काफी अधिक

(B) भिन्न नहीं

(C) अपेक्षाकृत काफी कम

(D) दोनों मॉडल में परमाणवीय साइज के बारे में कोई जानकारी नहीं है।

41) संघट प्राचल (इम्पैक्ट पैरामीटर) का मान बढ़ाने पर प्रकीर्णन कोण _____ है।

(A) अचल

(B) घटता

(C) बढ़ता

(D) प्रारंभ में बढ़ता है उसके बाद घटता

42) 1mg पदार्थ के समतुल्य ऊर्जा _____

(A) $9 \times 10^{13} \text{J}$

(B) $9 \times 10^{16} \text{J}$

(C) $9 \times 10^{19} \text{J}$

(D) $9 \times 10^{10} \text{J}$

रफ कार्य

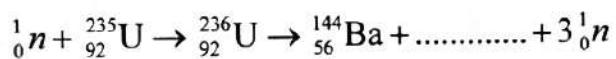
43) $^{198}_{80}\text{Hg}$ और $^{197}_{79}\text{Au}$ एक दूसरे के _____ हैं।

- (A) समस्थानिक
- (B) समभारिक
- (C) समन्यूट्रानिक
- (D) समघटकी

44) ^7_3Li की द्रव्यमान क्षति 0.042u हो तो उसकी प्रति न्यूक्लियॉन बंधन-ऊर्जा लगभग _____ MeV है।

- (A) 46
- (B) 5.6
- (C) 38.1
- (D) 23

45) निम्नलिखित नाभिकीय विखण्डन की प्रक्रिया पूर्ण करें:



- (A) $^{94}_{38}\text{Sr}$
- (B) $^{99}_{41}\text{Nb}$
- (C) $^{133}_{51}\text{Sb}$
- (D) $^{89}_{36}\text{Kr}$

46) यदि द्रव्यमान संख्या A को बढ़ाया जाए तो इनमें से नाभिक से सम्बन्धित कौन-सी भौतिक राशि अचर रहती है?

- (A) बंधन ऊर्जा
- (B) घनत्व
- (C) आयतन
- (D) द्रव्यमान

रफ कार्य

- 47) अद्वचालकों की अवरोधकता लगभग _____ Ωm होती है।
- (A) 10^{-2} से 10^{-8}
 - (B) 10^5 से 10^{-6}
 - (C) 10^{11} से 10^{19}
 - (D) 10^{-5} से 10^6
- 48) शुद्ध अद्वचालक में तापमान बढ़ाने पर ऊर्जा बैंड अंतराल _____
- (A) पहला बढ़ता है फिर घटता है।
 - (B) घटता है।
 - (C) बढ़ता है।
 - (D) अचर रहता है।
- 49) सिलिकान क्रिस्टल में अल्प मात्रा में ऐंटीमनी की डोपिंग की जाती है तो सिलिकान क्रिस्टल _____ बन जाता है।
- (A) अच्छा कुचालक
 - (B) P प्रकार का अद्वचालक
 - (C) N प्रकार का अद्वचालक
 - (D) अच्छा सुचालक
- 50) पूर्ण तरंग दिष्टकारी में निवेश आवृत्ति 60 Hz हो तो निर्गम आवृत्ति _____
- (A) 30 Hz
 - (B) 60 Hz
 - (C) 120 Hz
 - (D) 90 Hz

054 (H)

**SPECIAL SUPPLEMENTARY EXAM, JULY - 2025
(SCIENCE STREAM)
(CLASS - XII)**

(Part - B)

Time : 2 Hours]

[Maximum Marks : 50]

सूचनाएँ :

- 1) हस्तलेखन को स्पष्ट कीजिए।
- 2) प्रश्नपत्र के Part - B में तीन विभाग A, B तथा C हैं और कुल 1 से 27 प्रश्न हैं।
- 3) सभी प्रश्न अनिवार्य हैं, जनरल विकल्प दिये गये हैं।
- 4) दाहिनी ओर प्रश्न के अंक दिये गए हैं।
- 5) नया विभाग नये पन्ने पर लिखिए।
- 6) प्रश्नों का जवाब क्रमानुसार दीजिये।
- 7) विद्यार्थी आवश्यकता के अनुसार सादा केल्व्युलेटर एवं लॉग टेबल का उपयोग कर सकते हैं।
- 8) आकृति/आलेख वाले प्रश्नों में सिर्फ दृष्टिहीन विद्यार्थीयों के लिए अलग से प्रश्न दिया गया है। यह प्रश्न केवल दृष्टिहीन विद्यार्थीयों के लिए ही है।

विभाग - A

■ निम्नलिखित प्रश्न क्रमांक 1 से 12 में से किन्हीं 8 प्रश्नों के उत्तर माँगे अनुरूप लिखें।
(प्रत्येक प्रश्न के प्राप्तांक 2 हैं) [16]

- 1) गॉस के नियम का उपयोग करके एकसमान आवेशित अनंत समतल चादर के कारण विद्युत क्षेत्र का सूत्र प्राप्त करें। [2]
- 2) a) सूखे बालों में कंधा घुमाने के बाद वह कागज के टुकड़ों को आकर्षित कर लेता है, क्यों? [ध्यान रहे कि कागज विद्युत चालक नहीं है]
b) साधारण रबर विद्युतरोधी है। परंतु वायुयान के विशेष रबर के पहिए हल्के चालक बनाए जाते हैं। यह क्यों आवश्यक है? [2]
- 3) प्लैटिनम प्रतिरोध तापमापी के प्लैटिनम के तार का प्रतिरोध हिमांक पर 6 Ω तथा भाप बिन्दु पर 6.23 Ω है। जब तापमापी को किसी तम ऊष्मक में प्रविष्ट कराया जाता है तो प्लैटिनम के तार का प्रतिरोध 6.795 Ω हो जाता है। ऊष्मक का ताप परिकलित कीजिए। [2]
- 4) पैरामैग्नेटिक (अनुचुम्बकीय) और डायामैग्नेटिक (प्रतिचुम्बकीय) पदार्थों के बीच कोई चार अन्तर लिखें। [2]
- 5) दर्शाइए कि किसी परिपथ में विद्युत धारा (I) स्थापित करने के लिए विरोधी विद्युत वाहक बल (back emf) (ϵ) के विरुद्ध किया गया कार्य $W = \frac{1}{2} LI^2$ होता है। [2]

- 6) एक 44 mH का प्रेरित $220 \text{ V}, 50 \text{ Hz AC}$ आपूर्ति से जोड़ा गया है। परिपथ में धारा के rms मान को ज्ञात कीजिए। [2]
- 7) विद्युत चुम्बकीय तरंगों की कोई चार लाभणिकताएं लिखें। [2]
- 8) a) यदि $f = 0.5 \text{ m}$ है तो लेंस की क्षमता क्या है?
 b) किसी उभयोन्तल लेंस के दो फलकों की वक्रता त्रिज्याएँ 10 cm तथा 15 cm हैं। उसकी फोकस दूरी 12 cm है। लेंस के काँच का अपवर्तनांक ज्ञात कीजिए। [2]
- 9) यंग के द्वितीय प्रयोग में डिस्ट्रियों के बीच की दूरी 0.28 mm है तथा परदा 1.4 m की दूरी पर रखा गया है। केंद्रीय दीप फ्रिंज एवं चतुर्थ दीप फ्रिंज के बीच की दूरी 1.2 cm मापी गई है। प्रयोग में उपयोग किये गये प्रकाश की तरंगदैर्घ्य ज्ञात कीजिए। [2]
- 10) प्रकाश वैद्युत प्रभाव के लिए आइंस्टाइन की व्याख्या लिखें तथा इसका समीकरण प्राप्त करें। [2]
- 11) बोर के क्वांटमीकरण के द्वितीय अभिग्रहीत का दे-ब्रॉगली द्वारा स्पष्टीकरण संक्षिप्त में समझाएं। [2]
- 12) P-प्रकार के अर्धचालक तथा N-प्रकार के अर्धचालक के बीच कोई चार अन्तर लिखें। [2]

विभाग - B

- निम्नलिखित प्रश्न क्रमांक 13 से 21 में से माँगे अनुरूप किन्हीं 6 प्रश्नों के उत्तर दीजिए।
 (प्रत्येक के प्राप्तांक 3 हैं) [18]
- 13) दो बिन्दु आवेश $q_A = 5 \mu\text{C}$ तथा $q_B = -5 \mu\text{C}$ निर्वात में एक दूसरे से 20 cm दूरी पर स्थित हैं।
 a) दोनों आवेशों को मिलाने वाली रेखा AB के मध्य बिंदु O पर विद्युत क्षेत्र कितना है?
 b) यदि $2.0 \times 10^{-9}\text{C}$ परिमाण का कोई क्रणात्मक परीक्षण आवेश इस बिन्दु पर रखा जाये तो परीक्षण आवेश कितने बल का अनुभव करेगा? तथा इस बल की दिशा क्या होगी? [3]

- 14) पट्टिकाओं के बीच वायु वाले एक समान्तर पट्टिका संधारित्र की प्रत्येक पट्टिका का क्षेत्रफल $6 \times 10^{-3} \text{ m}^2$ तथा उनके बीच की दूरी 3 mm है।
- संधारित्र की धारिता को परिकलित कीजिए।
 - यदि इस संधारित्र को 100V के संभरण से जोड़ दिया जाये तो संधारित्र की प्रत्येक पट्टिका पर कितना आवेश होगा ?
 - दिये गये संधारित्र की पट्टिकाओं के बीच यदि 3mm मोटी अभ्रक की एक शीट (पत्तर) (परावैद्युतांक=6) रख दी जाती है तो स्पष्ट कीजिए कि क्या होगा जब विभव (वोल्टेज) संभरण जुड़ा ही रहेगा। [3]
- 15) इलेक्ट्रॉन के लिए अपवाह वेग (drift velocity) का सूत्र स्वीकृत कर $\rho = \frac{m}{ne^2\tau}$ सूत्र प्राप्त करो। धातुओं की तापमान बढ़ाने पर अवरोधकता (ρ) बढ़ती है या घटती है। [3]
- 16) एक समान चुम्बकीय क्षेत्र में θ कोण पर रखे आयताकार विद्युत धारा पाश पर लगता बल आधूर्ण (टार्क) का सूत्र $\vec{T} = \vec{m} \times \vec{B}$ प्राप्त करो। [3]
- (निम्नलिखित प्रश्न मात्र दृष्टिहीन विद्यार्थियों के लिए है।)
- 16) 10 cm त्रिज्या की किसी कुण्डली जिसमें पास-पास सटे 100 फेरे हैं, में 3.2A विद्युत धारा प्रवाहित हो रही है।
- कुण्डली के केन्द्र पर चुम्बकीय क्षेत्र कितना है?
 - इस कुण्डली का चुम्बकीय आधूर्ण क्या है? [3]
- 17) एक आयताकार लूप जिसकी भुजाएँ 8 cm एवं 2 cm हैं, एक स्थान पर थोड़ा कटा हुआ है। यह लूप अपने तल के अभिलम्बवत 0.3T के एक समान चुम्बकीय क्षेत्र से बाहर की ओर निकल रहा है। यदि लूप के बाहर निकलने का वेग 1 cm s^{-1} है तो कटे भाग के सिरों पर उत्पन्न विद्युत वाहक बल (emf) कितना होगा, जब लूप की गति अभिलम्बवत हो।
- लूप की लंबी भुजा के
 - लूप की छोटी भुजा के
- प्रत्येक स्थिति में उत्पन्न प्रेरित वोल्टता कितने समय तक टिकेगी? [3]

- 18) हाइंगेंस सिद्धान्त का उपयोग करते हुए समतल तरंगों का अपवर्तन समझाइए। [3]

(निम्नलिखित प्रश्न मात्र दृष्टिहीन विद्यार्थियों के लिए है।)

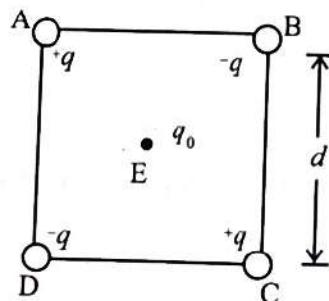
- 18) 589 nm तरंगदैर्घ्य का एकवर्णीय प्रकाश वायु से जल की सतह पर आपतित होता है।
 a) परावर्तित प्रकाश की
 b) अपवर्तित प्रकाश की
 तरंगदैर्घ्य, आवृत्ति तथा चाल क्या होगी? जल का अपवर्तनांक 1.33 है। [3]
- 19) प्रयोग द्वारा यह पाया गया कि हाइड्रोजन परमाणु को एक इलेक्ट्रॉन तथा एक इलेक्ट्रॉन में पृथक करने के लिए 13.6 eV ऊर्जा की आवश्यकता है। हाइड्रोजन परमाणु में कक्षीय-त्रिज्या तथा इलेक्ट्रॉन का वेग परिकलित कीजिए। [3]
- 20) स्वर्ण के समस्थानिक $^{197}_{79}\text{Au}$ एवं रजत के समस्थानिक $^{107}_{47}\text{Ag}$ की नाभिकीय त्रिज्या के अनुपात का सन्त्रिकट मान ज्ञात कीजिए। [3]
- 21) P-N संधि डायोड का पश्चादिशिक बायस में V-I अभिलाखणिक के अध्ययन के प्रायोगिक परिपथ बनाइए तथा पश्चादिशिक बायस (रिवर्स बायस) की अभिलाखणिकता समझाइए। [3]

(निम्नलिखित प्रश्न मात्र दृष्टिहीन विद्यार्थियों के लिए है।)

- 21) मान लीजिए किसी शुद्ध Si क्रिस्टल में 5×10^{28} परमाणु m^{-3} है। इसे पंचसंयोजी As से 1 ppm सांद्रता पर अपमिश्रित किया जाता है। इलेक्ट्रॉनों तथा होलों की संख्या परिकलित कीजिए। दिया है कि $n_i = 1.5 \times 10^{16} \text{ m}^{-3}$ [3]

विभाग - C

- निम्नलिखित प्रश्न क्रमांक 22 से 27 में से किन्हीं 4 प्रश्नों के उत्तर माँगे अनुरूप दीजिए। (प्रत्येक का प्राप्तांक 4 है) [16]
- 22) चित्र में दर्शाए अनुसार चार आवेश भुजा d वाले किसी वर्ग ABCD के शीर्षों पर व्यवस्थित किये गये हैं।
 a) इस व्यवस्था को एक साथ बनाने में किया गया कार्य ज्ञात कीजिए।
 b) कोई आवेश q_0 वर्ग के केन्द्र E पर लाया जाता है तथा चारों आवेश अपने शीर्षों पर दृढ़ रहते हैं। ऐसा करने के लिए कितना अतिरिक्त कार्य करना पड़ता है? [4]



(निम्नलिखित प्रश्न मात्र दृष्टिहीन विद्यार्थियों के लिए है।)

- 22) समविभव पृष्ठ क्या है? वैद्युत क्षेत्र और विद्युत विभव के बीच संबंध प्राप्त करो। इस संबंध पर से दो महत्वपूर्ण निष्कर्ष लिखो। [4]
- 23) सेलों का समान्तर संयोजन क्या है? दो सेलों के समान्तर संयोजन के लिए समतुल्य विद्युत बाहक बल (emf) और समतुल्य आंतरिक अवरोध के लिए व्यंजक प्राप्त करें। [4]
- 24) LCR श्रेणी AC परिपथ के लिए औसत शक्ति गुणांक (पावर फैक्टर) का सूत्र लिखें। शक्ति गुणांक किसे कहते हैं? निम्नलिखित प्रकरणों में शक्ति की चर्चा करें :
- प्रतिरोधकीय परिपथ
 - शुद्ध प्रेरकीय अथवा धारितीय परिपथ
 - श्रेणी बद्ध LCR परिपथ
 - LCR परिपथ में अनुनाद स्थिति में शक्ति क्षण
- [4]
- 25) 1.25 cm फोकस दूरी का अभिदृश्यक तथा 5 cm फोकस दूरी की नेत्रिका का उपयोग करके वांछित कोणीय आवर्धन (आवर्धन क्षमता) 30X होता है। आप संयुक्त सूक्ष्मदर्शी का समायोजन कैसे करेंगे? [4]
- 26) 632.8 nm तरंगदैर्घ्य का एकवर्णी (Monochromatic) प्रकाश एक हीलियम-नियॉन लेसर के द्वारा उत्पन्न किया जाता है। उत्सर्जित शक्ति 9.42 mW है।
- प्रकाश के किरण-पुंज में प्रत्येक फोटान की ऊर्जा प्राप्त कीजिए।
 - प्रकाश के किरण-पुंज में प्रत्येक फोटान का संवेग प्राप्त कीजिए।
 - इस किरण-पुंज के द्वारा विकिरित किसी लक्ष्य पर औसतन कितने फोटान प्रति सेकेण्ड पहुँचेंगे? (यह मान लीजिए की किरण-पुंज की अनुप्रस्थ काट एकसमान है जो लक्ष्य के क्षेत्रफल से कम है), तथा
 - एक हाइड्रोजन परमाणु को फोटान के बराबर संवेग प्राप्त करने के लिए कितनी तेज चाल से चलना होगा?
- [4]
- 27) प्रति न्युक्लियॉन बंधन ऊर्जा (E_{bn}) एवं द्रव्यमान संख्या (A) के बीच ग्राफ बनाए। इस ग्राफ के दो मुख्य लक्षण लिखें तथा इससे प्राप्त होने वाले कोई दो निष्कर्ष लिखिए। [4]

(निम्नलिखित प्रश्न मात्र दृष्टिहीन विद्यार्थियों के लिए है।)

- 27) 1.0 kg इयूट्रीरियम के संलयन से एक 100 वाट का विद्युत लैंप कितनी देर प्रकाशित रखा जा सकता है? संलयन अभिक्रिया निम्नवत ली जा सकती है। [4]
- $${}_1^2\text{H} + {}_1^2\text{H} \rightarrow {}_2^3\text{He} + n + 3.27 \text{ MeV}$$

① ① ① ①

This Question Paper contains 20 printed pages.

(Part - A & Part - B)

Sl.No.

054 (E)
SPECIAL SUPPLEMENTARY
EXAM, JULY - 2025
(SCIENCE STREAM)
(CLASS - XII)

પ્રશ્ન પેપરનો સેટ નંબર જેની
સામેનું વર્તુળ OMR શીટમાં
ધૂલ 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 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) Symbols used in this question paper have usual meaning.
- 9) For Graphical/Figure based questions, separate questions are given for visually impaired students. Only they have to attend them.

- 1) Force acting between two equal and unlike charges at a certain distance is F. What is the force acting between two charges if 25% of charge is displaced from one charge to the another?

- (A) F
(B) $\frac{15}{16}F$
(C) $\frac{9}{16}F$
(D) $\frac{4}{5}F$

Rough Work

Rough Work

- 2) 16 charged particles with the same charge q are placed on the y -axis. The distance between any two consecutive particles is $\frac{R}{3}$ and one of the charge particle is at origin. What is the electric flux through a sphere centered at the origin having a radius of $\frac{3}{2} R$.

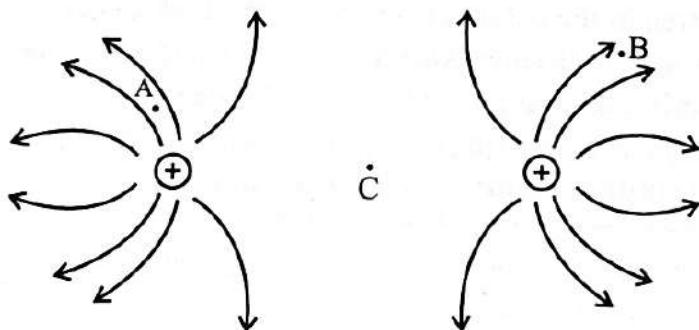
(A) $16 \frac{q}{\epsilon_0}$

(B) $8 \frac{q}{\epsilon_0}$

(C) $4 \frac{q}{\epsilon_0}$

(D) $9 \frac{q}{\epsilon_0}$

- 3) Figure shows electric field lines due to static charges on the plane of a paper.



Study the given electric field representation and identify one INCORRECT statement.

- (A) The electric field at a point B is weaker than at point A.
- (B) The electric field distribution is two dimensional.
- (C) The electric field always points away from a positive charge.
- (D) The electric field at point C is zero.

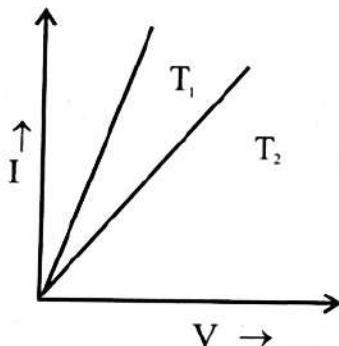
Rough Work

(The following question is only for Blind/Visually Impaired Students)

- 3)** Electric field line is a curve drawn in such a way that tangent drawn at every point gives _____.
 (A) Only magnitude of electric field
 (B) Only direction of electric field
 (C) Magnitude and direction both
 (D) Magnitude of force only
- 4)** For a point dipole, which one is correct from below.
 (A) $2a \rightarrow 0, q \rightarrow \infty$
 (B) $2a \rightarrow \infty, q \rightarrow \infty$
 (C) $2a \rightarrow \infty, q \rightarrow 0$
 (D) $2a \rightarrow 0, q \rightarrow 0$
- 5)** A uniformly charged conducting sphere of 2.4 m diameter has a surface charge density of $\frac{1}{4\pi} \mu C / m^2$. The charge on the sphere is _____.
 (A) $0.2 \mu C$
 (B) $1.44 \mu C$
 (C) $14.4 mC$
 (D) $6.28 \mu C$
- 6)** The S.I. unit of permittivity of vacuum is _____.
 (A) Fm^{-1}
 (B) Fm^{-2}
 (C) Fm^{-3}
 (D) Fm

Rough Work

- 7) Three capacitors of $4\mu F$ are connected in such a way that, its resultant capacitance is $6\mu F$, type of connection must be _____.
 (A) Two capacitors in parallel and one with series
 (B) All are connected in series
 (C) All are connected in parallel
 (D) Two capacitors in series and one with parallel
- 8) Two students A and B calculated the charge flowing through a circuit. Student A concludes that $300 C$ of electrons flows in 1 minute. Student B concludes that 3.125×10^{19} electrons flow in 1 second. If the current flowing in the circuit is $5A$ then the correct calculation is done by
 (A) Only student A
 (B) Only student B
 (C) Both the students A and B
 (D) Neither student A nor student B
- 9) Graph of $I \rightarrow V$ is given for the same conductor at two different temperature. We can say from the graph _____.
 (A) $T_1 > T_2$
 (B) $T_1 < T_2$
 (C) $T_1 = T_2$
 (D) $T_1 = 2T_2$



(The following question is only for Blind/Visually Impaired Students)

Rough Work

- 9) Frequency of an electron moving on a circular path is v , the current produced by the electron is,

(A) $v et$

(B) $v e$

(C) $\frac{v}{et}$

(D) $\frac{1}{vet}$

- 10) Dimensional formula for electrical conductivity is _____.

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

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

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

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

- 11) Assertion and Reason type M.C.Q.

- Both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
- Both Assertion and Reason are true but Reason is not correct explanation of the Assertion.
- Assertion is True but Reason is False.
- Assertion is False but the Reason is True.

Assertion : When a 100 watt Bulb is connected with 110 V supply, Resistance of the bulb is 121Ω .

Reason : $P = VI = I^2R = \frac{V^2}{R}$

- a
- b
- c
- d

Rough Work

- 12)** A proton is passing from the magnetic field $\vec{B} = 2\hat{i} + 3\hat{j}\text{T}$ with velocity $\vec{V} = 2\hat{i} + 3\hat{j}\text{ m/s}$ force acting on the proton is _____ N.
- (A) $13 \times 1.6 \times 10^{-19}$
 (B) $1.69 \times 1.6 \times 10^{-19}$
 (C) $14.4 \times 10^{-19} \hat{j}$
 (D) Zero
- 13)** Which statement given below is wrong?
- (A) Resistance of voltmeter is very high
 (B) Resistance of an Ammeter is very small
 (C) Ammeter is connected parallel with the component in the circuit
 (D) Voltmeter is connected parallel with component in the circuit
- 14)** A straight wire of linear mass density 0.1 kg/m carries a current of 2A . It is suspended in mid-air by a uniform horizontal magnetic field B . The magnitude of the magnetic field is _____.
 (A) 0.65 T
 (B) 0.32 T
 (C) 0.49 T
 (D) 0.98 T
- 15)** The angular speed of the charged particle is independent of _____.
 (A) its mass
 (B) its linear speed
 (C) charge of particle
 (D) magnetic field

Rough Work

- 16)** A solenoid of length 2 m is having number of turns 2000. If the current flowing from it is 2A, then its magnetic intensity is _____ A/m.
- (A) 2×10^3
 (B) 0.5×10^3
 (C) 4×10^3
 (D) 0.25×10^3
- 17)** A short bar magnet placed with its axis at 60° with a uniform external magnetic field of 0.25T experiences a torque of magnitude equal to 1.73×10^{-2} J. The magnitude of magnetic moment of the magnet will be _____ Am².
- (A) 13.8×10^{-2}
 (B) 4×10^{-2}
 (C) 0.43×10^{-2}
 (D) Zero
- 18)** Which of the following is not a ferromagnetic substance?
- (A) Alnico
 (B) Gadolinium
 (C) Lodestone
 (D) Copper chloride
- 19)** Current in a circuit falls from 5.0A to 0.0A in 1s. If an average emf of 200V induced then the self inductance of the circuit is _____.
- (A) 4 H
 (B) 2 H
 (C) 40 H
 (D) 5 H

Rough Work

- 20)** A conducting rod of length l with resistivity ρ moves with velocity V perpendicularly in a magnetic field B , then the induced current produced in the rod is _____.

(A) $\frac{BVA}{\rho}$

(B) $BVA\rho$

(C) $\frac{BVA}{R}$

(D) BVl

- 21)** Which of the following has the same dimensions of current

(A) $\frac{\text{inductance}}{\text{magnetic flux}}$

(B) $\frac{\text{magnetic flux}}{\text{inductance}}$

(C) $\frac{\text{inductance}}{\text{magnetic field}}$

(D) $\frac{\text{magnetic field}}{\text{inductance}}$

- 22)** In AC generator at $t = 0$, voltage is maximum. In how much minimum time its value decreases to zero?

(A) $\frac{\pi}{2\omega}$

(B) $\frac{\pi}{\omega}$

(C) $\frac{\pi}{3\omega}$

(D) $\frac{2\pi}{\omega}$

- 23) Self inductance of a solenoid is directly proportional to _____.

Rough Work

- (A) current passing through solenoid
- (B) its length
- (C) its area of cross-section
- (D) reciprocal of its area of cross-section

- 24) In AC connection, a lamp is connected in series with capacitor. If the capacitance of the capacitor is decreases then _____.

- (A) lamp will shine less brightly than before
- (B) lamp will shine more brightly than before
- (C) no change in the brightness of the bulb
- (D) bulb will not glow

- 25) If the primary coil of a transformer has 100 turns and the secondary has 200 turns. If current passing from primary coil is 10 A, then current flowing from secondary coil _____ A.

- (A) 20
- (B) 0.5
- (C) 10
- (D) 5

- 26) The magnetic field in a plane electromagnetic wave is given by, $By = (2 \times 10^{-7})T \sin (0.5 \times 10^3 x + 1.5 \times 10^{11}t)T$. Then the wavelength of this wave is _____.

- (A) 1.26 m
- (B) 1.26 cm
- (C) 0.126 mm
- (D) 12.6 cm

- 27) _____ are used in the speed gun by traffic police.

- (A) Radio waves
- (B) Microwave
- (C) Infrared waves
- (D) Ultraviolet rays

Rough Work

- 28)** When a ray of light travel from one medium to other medium then the physical quantity which does not change is _____.
 (A) velocity
 (B) wavelength
 (C) intensity
 (D) frequency
- 29)** If the radius of curvature of a plano convex lens, placed in air is 20 cm then its focal length is _____ cm.
 Refractive index of lens = 1.5
 (A) 20
 (B) 40
 (C) 60
 (D) 30
- 30)** A ray of light is passing from equilateral triangular prism such that its angle of incidence is equal to angle of emergence. If the angle of incidence is $\frac{3}{4}$ times the angle of prism, then the angle of minimum deviation is _____.
 (A) 30°
 (B) 40°
 (C) 45°
 (D) 50°
- 31)** Interference and diffraction phenomenon are consistent with the law of _____.
 (A) conservation of momentum
 (B) conservation of charge
 (C) inertia
 (D) conservation of energy

Rough Work

- 32)** Which of the following phenomenon is not common in case of light and sound waves?
- Diffraction
 - Interference
 - Polarization
 - Scattering
- 33)** When photon is incident on metal surface after how much time photo-electron are emitted?
- 10^{-9} s
 - 10^{-4} s
 - 10^{-1} s
 - 10^{-6} s
- 34)** The order of momentum of any particle, whose de Broglie wavelength is 1m should be -
- 10^{-10}
 - 10^{-34}
 - 10^{-27}
 - 10^{-19}
- 35)** Maximum kinetic energy of photo electron emitted from the metal surface is independent of _____.
- frequency of incident radiation
 - intensity of incident radiation
 - type of cathode
 - wavelength of incident radiation
- 36)** When the light of wavelength 6200\AA is incident on a metal. Whose work function is 2 eV. The maximum speed of emitted electron is approximately _____.
- ($hc = 12,400\text{\AA}$)
- 2×10^6 m/s
 - 1.6×10^7 m/s
 - 1.6×10^5 m/s
 - Zero

Rough Work

37) The de Broglie wavelength associated with a ball of mass 150 g travelling at 30.0 m/s is _____.

- (A) 1.47×10^{-34} m
- (B) 0.135×10^{-9} m
- (C) 2.76×10^{-34} m
- (D) 4.54×10^{-9} m

38) The ratio of first three Bohr radii is _____.

- (A) $1 : \frac{1}{2} : \frac{1}{3}$
- (B) 1 : 2 : 3
- (C) 1 : 4 : 9
- (D) 1 : 8 : 27

39) In any Bohr orbit of the hydrogen atom, the ratio of kinetic energy to potential energy of the electron is _____.

- (A) $\frac{1}{2}$
- (B) 2
- (C) $-\frac{1}{2}$
- (D) -2

40) The size of the atom in Thomson's model is _____ the atomic size in Rutherford's model.

- (A) much greater than
- (B) no different from
- (C) much less than
- (D) in both the models there is no information regarding the dimension of atom

- 41) As the value of impact parameter is larger, the scattering angle is _____.

(A) constant
 (B) smaller
 (C) larger
 (D) initially increases then decreases

Rough Work

- 42) The energy equivalent of 1mg of substance is _____.

(A) 9×10^{13} J
 (B) 9×10^{16} J
 (C) 9×10^{19} J
 (D) 9×10^{10} J

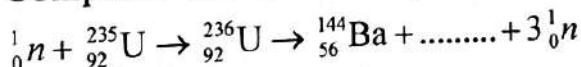
- 43) $^{198}_{80}\text{Hg}$ and $^{197}_{79}\text{Au}$ are _____ of each other

(A) isotopes
 (B) isobars
 (C) isotones
 (D) isomers

- 44) The mass defect of ^7_3Li nucleus is 0.042u then its binding energy per nucleon is nearly _____ MeV.

(A) 46
 (B) 5.6
 (C) 38.1
 (D) 23

- 45) Complete the following nuclear fission reaction



(A) $^{94}_{38}\text{Sr}$
 (B) $^{99}_{41}\text{Nb}$
 (C) $^{133}_{51}\text{Sb}$
 (D) $^{89}_{36}\text{Kr}$

Rough Work

- 46)** If the mass number A is increases, what is the physical quantity associated with nucleus remains constant?
 (A) Binding energy
 (B) Density
 (C) Volume
 (D) Mass
- 47)** Resistivity of semiconductor is approximately _____ Ωm .
 (A) 10^{-2} to 10^{-8}
 (B) 10^5 to 10^{-6}
 (C) 10^{11} to 10^{19}
 (D) 10^{-5} to 10^6
- 48)** In intrinsic semiconductor, on increasing the temperature, the energy gap _____.
 (A) initially increases then decreases
 (B) decreases
 (C) increases
 (D) remains constant
- 49)** The doping of a minute quantity of antimony to a silicon crystal makes it _____.
 (A) a good insulator
 (B) a P-type semiconductor
 (C) a N-type semiconductor
 (D) a good conductor
- 50)** In full wave rectification, if input frequency is 60 Hz then output frequency is _____.
 (A) 30 Hz
 (B) 60 Hz
 (C) 120 Hz
 (D) 90 Hz

054 (E)

SPECIAL SUPPLEMENTARY EXAM, JULY - 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 Graphical/Figure based questions, separate questions are given for visually impaired students. Only they have to attend them.

SECTION-A

■ Answer any 8 of the following given questions 1 to 12. (Each carries 2 marks.) [16]

- 1) Using Gauss's law, obtain the equation for electric field due to a uniformly charged infinite plane sheet. [2]
- 2) a) A comb run through one's dry hair attracts small bits of paper, why? (Remember, a paper does not conduct electricity).
 b) Ordinary rubber is an insulator. But special rubber tyres of aircraft are made slightly conducting. Why is this necessary? [2]
- 3) The resistance of the platinum wire of a platinum resistance thermometer at the ice point is 6Ω and at steam point is 6.23Ω . When the thermometer is inserted in a hot bath. The resistance of the platinum wire is 6.795Ω . Calculate the temperature of the hot bath. [2]
- 4) Differentiate between Paramagnetic and Diamagnetic substances (any 4 points) [2]
- 5) Show that the work needs to be done against the back emf(ϵ) in establishing the current (I) in any circuit is, $W = \frac{1}{2}LI^2$. [2]

- 6) A 44 mH inductor is connected to 220 V, 50 Hz AC supply. Determine the rms value of the current in the circuit. [2]
- 7) Write down any 4 characteristics of electromagnetic waves. [2]
- 8) a) If $f = 0.5$ m for a glass lens, what is the power of the lens?
 b) The radii of curvature of the faces of a double convex lens are 10 cm and 15 cm. Its focal length is 12 cm. What is the refractive index of glass? [2]
- 9) In a Young's double-slit experiment, the slits are separated by 0.28 mm and the screen is placed 1.4 m away. The distance between the central bright fringe and the fourth bright fringe is measured to be 1.2 cm. Determine the wavelength of light used in the experiment. [2]
- 10) Explain the Einstein's explanation regarding photo-electric effect and derive its equation. [2]
- 11) Explain in brief de Broglie's explanation of Bohr's second postulate of quantisation. [2]
- 12) Differentiate in between P-type semiconductor and N-type semiconductor (any 4 points). [2]

SECTION - B

■ Answer any 6 of the following given questions 13 to 21. (Each carries 3 marks) [18]

- 13) Two point charges $q_A = 5 \mu\text{C}$ and $q_B = -5 \mu\text{C}$ are located 20 cm apart in vacuum.
 a) What is the electric field at the midpoint O of the line AB joining the two charges?
 b) If a negative test charge of magnitude $2.0 \times 10^{-9}\text{C}$ is placed at this point, what is the force experienced by the test charge? What is the direction of this force. [3]
- 14) In a parallel plate capacitor with air between the plates, each plate has an area of $6 \times 10^{-3}\text{ m}^2$ and the distance between the plates is 3 mm.
 a) Calculate the capacitance of the capacitor.
 b) If this capacitor is connected to 100 V supply, what is the charge on each plate of the capacitor?
 c) Explain what would happen, if in the capacitor, 3 mm thick mica sheet of dielectric constant 6 were inserted between the plates while the voltage supply remained connected. [3]

- 15) Considering drift velocity of electron, prove that $\rho = \frac{m}{ne^2\tau}$. If the temperature is increased for metals, its resistivity ρ will increase or decrease? [3]

- 16) Obtain equation of the torque $\vec{\tau} = \vec{m} \times \vec{B}$ on a rectangular current loop placed at an angle θ in a uniform magnetic field. [3]

(The following question is only for Blind/Visually Impaired Students)

- 16) A 100 turn closely wound circular coil of radius 10 cm carries a current of 3.2A.
 a) What is the magnetic field at the centre of the coil?
 b) What is the magnetic moment of this coil? [3]

- 17) A rectangular wire loop of sides 8 cm and 2 cm with a small cut is moving out of a region of uniform magnetic field of magnitude 0.3T directed normal to the loop. What is the emf developed across the cut. If the velocity of the loop is 1 cm s⁻¹ in a direction normal to the

- a) longer side
 b) shorter side of the loop

For how long does the induced voltage last in each case? [3]

- 18) Explain Refraction of a plane wave by using Huygen's principle. [3]

(The following question is only for Blind/Visually Impaired Students)

- 18) Monochromatic light of wavelength 589 nm is incident from air on a water surface. What are the wavelength, frequency and speed of
 a) reflected light
 b) refracted light

Refractive index of water is 1.33.

[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) Obtain approximately the ratio of the nuclear radii of the gold isotope $^{197}_{79}\text{Au}$ and the silver isotope $^{107}_{47}\text{Ag}$. [3]

- 21) Draw the experimental circuit arrangement for studying Reverse biased V-I characteristics of a P-N junction diode and explain it. [3]

(The following question is only for Blind/Visually Impaired Students)

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

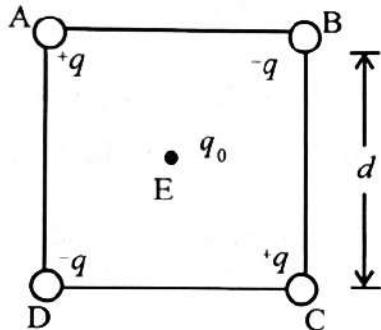
SECTION - C

- Answer any 4 of the following given questions 22 to 27. (Each carries 4 marks.) [16]

- 22) Four charges are arranged at the corners of a square ABCD of side d , as shown in fig.

- Find the work required to put together this arrangement.
- A charge q_0 is brought to the centre E of the square, the four charges being held fixed at its corners. How much extra work is needed to do this?

[4]



(The following question is only for Blind/Visually Impaired Students)

- 22) What is equipotential surface? Derive the relation between electric field and electric potential. Also write two important conclusions concerning this relation. [4]
- 23) What is parallel connection of cells? Obtain equation of equivalent emf and equivalent internal resistance of two cells connected in parallel. [4]

- 24) Write an equation of average power for LCR series AC circuit. What is power factor? Discuss the power in following cases.
- Resistive circuit
 - Purely inductive or capacitive circuit
 - LCR series circuit
 - Power dissipated at resonance in LCR circuit
- [4]
- 25) An angular magnification (magnifying power) of 30X is desired using an objective of focal length 1.25 cm and an eyepiece of focal length 5 cm. How will you setup the compound microscope?
- 26) Monochromatic light of wavelength 632.8 nm is produced by a helium-neon laser. The power emitted is 9.42 mW.
- Find the energy of each photon in light beam.
 - Find the momentum of each photon in light beam.
 - How many photons per second, on the average, arrive at a target irradiated by this beam? (Assume the beam to have uniform cross-section which is less than the target area) and
 - How fast does a hydrogen atom have to travel in order to have the same momentum as that of the photon?
- [4]
- 27) Draw the nature of the graph of binding energy per nucleon (E_{bn}) against atomic mass number (A) and write down 2 main features of the graph? From these two observations, write any two conclusions.
- (The following question is only for Blind/Visually Impaired Students)
- 27) How long can an electric lamp of 100W be kept glowing by fusion of 1.0 kg of deuterium? Take the fusion reaction as
- $${}_1^2\text{H} + {}_1^2\text{H} \rightarrow {}_2^3\text{He} + \text{n} + 3.27 \text{ MeV}$$
- [4]



This Question Paper contains 20 printed pages.

(Part - A & Part - B)

Sl.No. 0500771

054 (G)

(JUNE, 2025)
(SCIENCE STREAM)
(CLASS - XII)

પ્રશ્ન પેપરનો સેટ નંબર જેણી
સામેનું વર્તુળ OMR શીટમાં
ધૂં કરવાનું રહે છે.

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

05

Part - A : Time : 1 Hour / Marks : 50

Part - B : Time : 2 Hours / Marks : 50

(Part - A)

Time : 1 Hour

[Maximum Marks : 50]

સૂચનાઓ :

- 1) આ પ્રશ્નપત્રના ભાગ - A માં હેતુલક્ષી પ્રકારના કુલ 50 પ્રશ્નો છે. બધા જ પ્રશ્નો ફરજિયાત છે.
- 2) પ્રશ્નોની કમ સંખ્યા 1 થી 50 છે અને દરેક પ્રશ્નનો ગુણ 1 છે.
- 3) કાળજીપૂર્વક દરેક પ્રશ્નનો અભ્યાસ કરી સાચો વિકલ્પ પસંદ કરીને OMR શીટમાં જવાબ લખવો.
- 4) આપને અલગથી આપેલ OMR પત્રકમાં જે તે પ્રક્રિયાની નંબર સામે (A) O, (B) O, (C) O, (D) O આપેલા છે. તે પ્રશ્નનો જ જવાબ સાચો હોય તેના વિકલ્પ પરના વર્તુળને બોલપેનથી પૂર્ણ ● ધૂં કરવાનું રહેશે.
- 5) રફ કાર્ય હેતુ આ ટેસ્ટ બુકલેટમાં આપેલી જખ્યા પર કરવાનું રહેશે.
- 6) પ્રશ્નપત્રકમાં ઉપરની જમણી બાજુમાં આપેલા પ્રશ્નપત્રક સેટ નં. ને OMR પત્રકમાં આપેલી જખ્યામાં લખવાનું રહેશે.
- 7) વિદ્યાર્થીઓ જરૂર જણાય ત્યાં સાદા કેલ્ક્યુલેટર અને લોગ ટેબલનો ઉપયોગ કરી શકશે.
- 8) આ પ્રશ્નપત્રમાં વપરાયેલ સંજ્ઞાઓને તેના યોગ્ય પ્રચલિત અર્થ છે.
- 9) આકૃતિવાળા/ચાર્ટ પ્રશ્નોઓં દિલ્હીન વિદ્યાર્થીઓ માટે અલગ પ્રશ્નો આપેલા છે. જેનું ખાસ ધ્યાન રાખવું. આ પ્રશ્નો માત્ર દિલ્હીન વિદ્યાર્થીઓ માટે જ છે.

જરૂરી અચળાંક :

- ઇલેક્ટ્રોનનું દળ $m_e = 9.11 \times 10^{-31} \text{ kg}$
- પ્રોટોનનું દળ $m_p = 1.67 \times 10^{-27} \text{ kg}$
- ઇલેક્ટ્રોન અને પ્રોટોનના વિદ્યુતભારનું માન $e = 1.6 \times 10^{-19} \text{ C}$
- કુલંબ અચળાંક $k = 9 \times 10^9 \text{ Nm}^2/\text{C}^2$
- મુક્ત અવકાશનો પરાવૈદ્યુતાંક (Permittivity) $\epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2/\text{Nm}^2$
- મુક્ત અવકાશની પારગમ્યતા (Permeability) $\mu_0 = 4\pi \times 10^{-7} \text{ Tm/A}$
- પ્લાન્ટ અચળાંક $h = 6.63 \times 10^{-34} \text{ Js}$
- 1eV = $1.6 \times 10^{-19} \text{ J}$

૨૬ કાર્ય

- 1) ગૂંચળા 2 ની સાપેક્ષે ગૂંચળા 1 નું અન્યોન્ય પ્રેરકત્વ M_{12} એ _____.
 (A) જ્યારે તેમને નજીક લાવવામાં આવે ત્યારે ઘટે છે.
 (B) જ્યારે કોઈ એક ને તેની અક્ષને અનુલક્ષીને પરિભ્રમણ કરાવીએ ત્યારે વધે છે.
 (C) ગૂંચળાઓમાંથી પસાર થતા પ્રવાહ પર આધાર રાખે
 (D) ગૂંચળા 1 ની સાપેક્ષે ગૂંચળા 2 ના અન્યોન્ય પ્રેરકત્વ M_{21} જેટલું સમાન હોય છે.
- 2) પૂર્વથી પશ્ચિમ સુધી વિસ્તરેલ 10 m લંબાઈનો એક સમક્ષિતિજ સીધો તાર 5.0 ms^{-1} ની ઝડપથી પૃથ્વીના ચુંબકીયક્ષેત્રના સમક્ષિતિજ ઘટક $0.30 \times 10^{-4} \text{ Wb m}^{-2}$ ને લંબડુપે નીચે પડી રહ્યો હોય તો આ તારમાં પ્રેરિત emf નું તાત્કષણિક મૂલ્ય _____ હશે?
 (A) 0 V
 (B) $1.5 \mu\text{V}$
 (C) 1.5 mV
 (D) 1.5 V
- 3) પરિપથમાં ચુંબકીય ફલક્સના ફેરફારના સમય દર નો SI એકમ _____.
 (A) V
 (B) Tm^2
 (C) Wb
 (D) $\frac{\text{Nm}}{\text{A}}$
- 4) કમલા એક સ્થિર સાયકલને પેડલ મારે છે આ સાયકલના પેડલ્સ 100 આંટાઓ અને 0.10 m^2 ક્ષેત્રફળ ધરાવતા ગૂંચળા સાથે જોડાયેલા છે. આ ગૂંચળું અડધા આંટા પ્રતિ સેકન્ડથી બમણ કરે છે અને તે ગૂંચળાના પરિભ્રમણની ધરીને લંબડુપ 0.01 T ના ચુંબકીયક્ષેત્રમાં મૂકવામાં આવેલ છે તો આ ગૂંચળામાં ઉત્પન્ન થતો મહત્તમ વોલ્ટેજ _____ હશે.
 (A) 314 V
 (B) 0.314 V
 (C) 3.14 V
 (D) 31.4 V

5) 0.5 m લંબાઈના ધાતુના 10 આરા ધરાવતું એક બ્હીલ એક સ્થળ પર પૃથ્વીના ચુંબકીયક્ષેત્રના સમક્ષિતિજ ઘટક H_E ને લંબ એવા સમતલમાં 2 rev/s ની દડપે ફરે છે જો આ સ્થળ પર $H_E = 0.4 \times 10^{-4}$ T હોય તો ધરી અને બ્હીલના રિમ વચ્ચે પ્રેરિત emf _____.

- (A) 6.28×10^{-5} V
 (B) 628×10^{-5} V
 (C) 62.8×10^{-5} V
 (D) 0.628×10^{-5} V

૨૬ કાર્ય

6) X-ray મશીનમાં વપરાતા એક આદર્શ સ્ટેપઅપ ટ્રાન્સફોર્મરમાં ઈનપુટ વોલ્ટેજ 240 V અને આઉટપુટ વોલ્ટેજ 480 kV છે. જો પ્રાથમિક ગૂચળામાં આંટાઓની સંખ્યા 100 હોય અને તેમાંથી વહેતો પ્રવાહ 10 A હોય તો આ ટ્રાન્સફોર્મરમાં આઉટપુટ પાવર કેટલો હશે?

- (A) 240 W
 (B) 24 W
 (C) 2400 W
 (D) 480 W

7) ચોક્કસ અનુનાદીય આવૃત્તિ ω_0 માટે, R-L-C એસી શ્રેણી પરિપથમાં અનુનાદની સ્થિતિમાં પરિપથનો ઈમ્પિન્સ _____.

- (A) 0
 (B) $\sqrt{R^2 + (X_C - X_L)^2}$
 (C) $\sqrt{R^2 + (X_C^2 - X_L^2)}$
 (D) R

8) નીચે આપેલ સમીકરણો માંથી ક્યું સમીકરણ સાચું નથી?

- (A) $\oint \vec{E} \cdot d\vec{A} = \frac{Q}{\epsilon_0}$
 (B) $\oint \vec{E} \cdot d\vec{l} = -\frac{d\phi_B}{dt}$
 (C) $\oint \vec{B} \cdot d\vec{A} = \mu_0 I$
 (D) $\oint \vec{B} \cdot d\vec{l} = \mu_0 i_C + \mu_0 \epsilon_0 \frac{d\phi_E}{dt}$

- 9) એક 25 MHz આવृત્તિ ધરાવતું સમતલ વિદ્યુત ચુંબકીય તરંગ મુક્ત અવકાશમાં X - દિશામાં ગતિ કરે છે. ચોક્કસ સમયે અને અવકાશના એક ચોક્કસ બિંદુ આગળ $\vec{E} = 6.0 \hat{j} \text{ V/m}$ છે તો આ બિંદુ આગળ \vec{B} નું માન _____.
- (A) $2 \times 10^{-8} \text{ T}$
 (B) $5 \times 10^{-7} \text{ T}$
 (C) $1.5 \times 10^{-6} \text{ T}$
 (D) $1.5 \times 10^6 \text{ T}$
- 10) જીરકોન એક પારદર્શક પદાર્થ છે. જેનો ઉપયોગ ધરેણામાં થાય છે. કારણ કે તે હીરા કરતાં સસ્તો છે હીરા અને જીરકોનના વક્તીભવનાંક અનુક્રમે 2.419 અને 1.923 છે. જ્યારે પ્રકાશ હવામાંથી જીરકોનમાં દાખલ થાય ત્યારે જીરકોનમાં પ્રકાશની ઝડપ _____.
- (A) $3 \times 10^8 \text{ m/s}$
 (B) $1.56 \times 10^8 \text{ m/s}$
 (C) $1.24 \times 10^8 \text{ m/s}$
 (D) $2.4 \times 10^8 \text{ m/s}$
- 11) એક નાના ટેલિસ્કોપના ઓફ્ઝેક્ટીવની કેન્દ્ર લંબાઈ 144 cm અને આઈપીસની કેન્દ્ર લંબાઈ 6.0 cm છે ટેલિસ્કોપની માટેવશક્તિ _____.
- (A) 12
 (B) 0.042
 (C) 24
 (D) 0.08
- 12) 1.55 વક્તીભવનાંક ધરાવતા કાચમાંથી બંને સપાટીઓની વક્તાવિજ્યા સમાન હોય તેવો દ્વિ-બહિર્ગોળ લેન્સ બનાવવો છે તો 20 cm કેન્દ્ર લંબાઈ મેળવવા માટે જરૂરી વક્તાવિજ્યા _____.
- (A) 11 cm
 (B) 22 cm
 (C) 20 cm
 (D) 44 cm

13) એક પોલેરોઇડ તકતી P_2 ને એકબીજાને લંબ રાખેલ (Crossed) બીજી બે પોલેરોઇડ P_1 અને P_3 ની વચ્ચે રાખીને ભમણ કરાવવામાં આવે છે. જો ઠ એ P_1 અને P_2 ની ૮૦°-અક્ષો વચ્ચેનો કોણ હોય તો ઠ ના કયા મૂલ્ય માટે નિર્ગમન પામતા પ્રકાશની તીવ્રતા મહત્વમ હશે?

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- (A) 0°
- (B) 45°
- (C) 180°
- (D) 90°

14) બે સુસમ્બદ્ધ ઉદ્ગમો સમાન કળામાં દોતન કરતા હોય તો કોઈ યાદચિછક બિંદુ પાસે જ્યારે પથ તફાવત _____ હોય ત્યારે તે બિંદુએ સહાયક વ્યતિકરણ મળે છે. (જ્યાં, $n = 0, 1, 2, 3, \dots$)

(A) $\left(n + \frac{1}{2}\right)\lambda$

(B) $\frac{\lambda}{n}$

(C) $\frac{3}{2}\lambda$

(D) $n\lambda$

15) ગતિ કરતા એક ઈલેક્ટ્રોન માટે જો તેનું વેગમાન, 500 nm તરંગલંબાઈ ધરાવતા ફોટોના વેગમાન જેટલું હોય તો ઈલેક્ટ્રોનની ઝડપ _____.

- (A) 1455 m/s
- (B) 14550 m/s
- (C) 145.5 m/s
- (D) 1455 km/s

~~14550~~

16) એક પ્રથમાં ફોટો ઇલેક્ટ્રોન કટ ઓફ વોલ્ટેજ 1.5 V હે ઉત્સર્જયેતા ફોટો ઇલેક્ટ્રોનની મહત્વમ ગતિઉન્ન _____.

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- (A) 2.4×10^{-19} eV
 (B) 1.5 J
~~(C)~~ 1.5 eV
 (D) 2.4 J

17) ધાતુના કાર્ય વિધેય (work function) નું પારિમાળિક સૂત્ર _____.

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

18) આપેલ ધાતુમાંથી ફોટો ઇલેક્ટ્રોનનું ઉત્સર્જન શક્ય બને તે માટેની શરત _____.

- (A) $v < \frac{\phi_0}{h}$
 (B) $\lambda > \frac{\phi_0}{h}$
~~(C)~~ $v_0 > v$
 (D) $v > \frac{\phi_0}{h}$

19) 2.2 m/s ની ઝડપથી ગતિ કરતા 1.0×10^{-9} kg દળ ધરાવતા ધૂળના રજકણ માટે ડિ-ભ્રોઝી તરંગ લંબાઈ _____.

- ~~(A)~~ $2.2 \times 10^{-9} m$
 (B) $3.0 \times 10^{-25} m$
 (C) $1.0 \times 10^{-30} m$
 (D) $2.2 \times 10^{-18} m$

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20) હાઈડ્રોજન પરમાણુની ધરા અવસ્થાની કુલ ઊર્જા - E હોય તો આ અવસ્થામાં ઇલેક્ટ્રોનની ગતિ ઊર્જા _____.

(A) $K = -E$

(B) $K = -\frac{E}{2}$

(C) $K = E$

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

21) સંન્મુખ સંઘાતના કિસ્સામાં સંઘાત પ્રાચલ (b) શૂન્ય હોય ત્યારે α - કરણ માટે પ્રક્રિયાના કોણ $\theta \approx$ _____ rad.

(A) π

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

(C) $\frac{\pi}{2}$

(D) 0

22) હાઈડ્રોજન પરમાણુમાં ઇલેક્ટ્રોનને તેની પ્રથમ ઉત્તેજિત અવસ્થા સુધી ઉત્તેજિત કરવા માટે જરૂરી ઊર્જા _____.

(A) 10.2 eV

(B) 13.6 eV

(C) -10.2 eV

(D) 12.09 eV

23) હાઈડ્રોજન પરમાણુમાં પ્રથમ ત્રણ બોલ્ડર કક્ષાઓની વિજ્ઞાઓનો ગુણોત્તર _____.

(A) 1 : 2 : 3

(B) 1 : 8 : 27

(C) 1 : 4 : 9

(D) $1 : \frac{1}{8} : \frac{1}{27}$

૨૬ કાર્ય

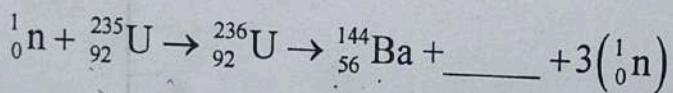
24) ડ્યુટેરિયમ અને ટ્રાટિયમને એક બીજાના _____ કહે છે.

- (A) આઈસોટોન
- (B) આઈસોમર
- (C) સમદળીય
- (D) સમસ્થાનિક

25) જ્યા તત્વના ન્યુકિલિયસ માટે ન્યુકિલિયોન દીઠ બંધન ઉર્જા મહત્વમ મળે છે?

- (A) કાર્બન
- (B) લોઝંડ
- (C) યુરેનિયમ
- (D) સલ્ફર

26) નીચે આપેલ ન્યુકિલિયર વિખંડન પ્રક્રિયા પૂર્ણ કરવા માટે યોગ્ય વિકલ્પ પસંદ કરો.



- (A) ${}_{36}^{99} Kr$
- (B) ${}_{36}^{89} Kr$
- (C) ${}_{38}^{94} Sr$
- (D) ${}_{36}^{90} Kr$

27) આપેલ દ્રવ્યને સમતુલ્ય ઉર્જા $9 \times 10^{13} J$ હોય તો દ્રવ્યનું દળ _____.

- (A) 1.0 g
- (B) 1.0 kg
- (C) 10 g
- (D) 15 kg

$$\begin{array}{r} 1.0 \\ \times 9 \times 10^{13} \\ \hline 9 \times 10^{13} \end{array}$$

28) Atomic mass unit (u) ને _____ પરમાણુના દળના ભારમા ભાગ

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$\left(\frac{1}{12}\right)$ તરફિ વ્યાખ્યાયિત કરવામાં આવે છે.

- (A) ^1_1H
- (B) ^4_2He
- (C) $^{12}_6\text{C}$
- (D) $^{232}_{92}\text{U}$

29) નીચેનામાંથી મિશ્ર (સંયોજન) અર્ધવાહકોની સાચી જોડ પસંદ કરો.

- (A) Si, Ge
- (B) InP, Ge
- (C) CdS, Si
- (D) GaAs, CdSe

30) ધ્યાતુઓની ઉર્જા ગેપ (E_u) એ અવાહકોની ઉર્જા ગેપ (E_g) _____.

- (A) જેટલીજ હોય છે.
- (B) કરતાં વધારે હોય છે.
- (C) કરતાં ઓછી હોય છે.
- (D) કરતાં વધારે અથવા સમાન હોય છે.

31) રેફિલ્ફાયરમાં RC ફિલ્ટર પરિપથ રાખવાનો હેતુ _____.

- (A) આઉટપુટ વોલ્ટેજને વિવર્ધિત (Amplify) કરવા.
- (B) આઉટપુટ વોલ્ટેજની આવૃત્તિ વધારવા માટે.
- (C) AC ને DC માં ડિપાંતરિત કરવા.
- (D) AC રીપલને ફિલ્ટર કરીને ચોખ્ખો (pure) DC મેળવવા માટે.

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- 32) બાયસિંગ કર્યા વગરના $p-n$ જંકશનમાં, હોલ p - વિસ્તારમાંથી n - વિસ્તારમાં વિસરણ (Diffuse) પામે છે કારણ કે, _____.

- (A) n - વિસ્તારના મુક્ત ઈલેક્ટ્રોન તેમને આકર્ષે છે.
 (B) તેઓ સ્થિતિમાનના તફાવતના કારણે જંકશનમાં થઈને ગતિ કરે છે.
 (C) p - વિસ્તારમાં હોલની સંખ્યા ઘનતા n - વિસ્તાર કરતાં વધુ હોય છે.
 (D) ઉપરના બધાજ.

- 33) ઉન સાથે ઘસેલા એક પોલીથીન ટુકડા પર $3.2 \times 10^{-7} \text{ C}$ માણ વિદ્યુતભાર હોય તો ઉન પરથી પોલીથીન ટુકડા પર સ્થાનાંતરિત થયેલા ઈલેક્ટ્રોનની સંખ્યા કેટલી હશે?

- (A) 5×10^{26}
 (B) 5×10^{11}
 (C) 2×10^{12}
 (D) 2×10^{11}

- 34) આવેલ વિદ્યુત-ડાયપોલના કેન્દ્રથી r (જ્યાં, $r >>a$) જેટલા સમાન અંતરે તેના વિષુબરેખીય સમતલ અને તેની અક્ષ પર આવેલ બિંદુઓ પાસે વિદ્યુત ડાયપોલના વિદ્યુતક્ષેત્રની તીવ્રતાઓના માનનો ગુણોત્તર _____.

- (A) $1 : \sqrt[3]{2}$
 (B) $1 : 2$
 (C) $2 : 1$
 (D) $1 : 1$

- 35) સમાન રીતે વિદ્યુતભારિત અનંત લંબાઈના સીધા તારને લીધે તારથી r જેટલા લંબ અંતરે મળતું વિદ્યુતક્ષેત્ર _____.

- (A) r ના સમપ્રમાણમાં હોય છે.
 (B) r^2 ના સમપ્રમાણમાં હોય છે.
 (C) r ના વ્યસ્ત પ્રમાણમાં હોય છે.
 (D) r^3 ના વ્યસ્ત પ્રમાણમાં હોય છે.

$$EA = \frac{\sigma}{\rho_0}$$

$$\leftarrow \frac{k\lambda}{\rho_0}$$

$$EA \frac{k\lambda}{\rho}$$

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રેફ કાર્ય

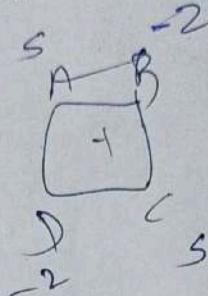
- 36) ચાર બિંદુવટ વિદ્યુતભારો $q_A = 5\mu C$, $q_B = -2\mu C$, $q_C = 5\mu C$ અને $q_D = -2\mu C$, એક 5 cm ની બાજુવાળા ચોરસ ABCD ના રિઝોબિંડ્યુઓ પર અનુકૂળે ખૂલ્લેલા છે. જો ચોરસના કેન્દ્ર પર $-1\mu C$ વિદ્યુતભાર મુકવામાં આવે તો તેના પર લાગતી બળનું માન _____ N હશે.

(A) 2.5×10^{-8}

(B) $\frac{3}{\sqrt{2}} \times 10^{-6}$

(C) $3\sqrt{2} \times 10^{-6}$

(D) 0



- 37) \vec{P} જેટલી ડાયપોલ ચાકમાત્રા ધરાવતી એક વિદ્યુત ડાયપોલ \vec{E} જેટલા સમાન વિદ્યુતક્ષેત્ર સાથે થાં, ખૂલ્લે રહેલી હોય તો તેના પર લાગતું ટોક $\vec{T} = _____$.

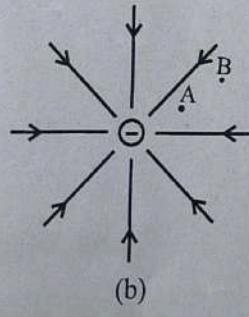
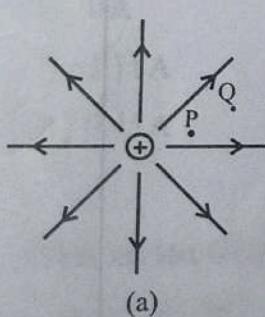
(A) $\vec{E} \times \vec{P}$

(B) $q \vec{E}$

(C) $\vec{P} \times \vec{E}$

(D) $2aq \vec{E}$

- 38) આકૃતિઓ (a) અને (b) અનુકૂળે ઘન અને ઋણ વિદ્યુતભારોની ક્ષેત્ર રેખાઓ દર્શાવે છે.



આકૃતિઓ પરથી સ્થિતિમાન તફાવત $V_Q - V_P$ અને $V_A - V_B$ નાં ચિન્હો અનુકૂળે _____, _____.

(A) ઘન, ઘન

(B) ઘન, ઋણ

(C) ઋણ, ઋણ

(D) ઋણ, ઘન

(નીચેનો પ્રશ્ન ફક્ત દાખિલીન વિદ્યાર્થીઓ માટે છે.)

- 38) 2 pF, 3 pF અને 4 pF કેપેસિટન્સના ત્રણ કેપેસીટરોને શ્રેણીમાં જોડેલ છે તો સંયોજનનું કુલ કેપેસિટન્સ કેટલું હશે?

- (A) $\frac{13}{12}$ pF
 (B) 9 pF
 (C) $\frac{12}{13}$ pF
 (D) 24 pF

- 39) વિધુતક્ષેત્રની ઊર્જા ઘનતા $U = \frac{1}{2} \epsilon_0 E^2$ નું પારિમાળિક સૂત્ર _____.

(જ્યાં, ϵ_0 એ મુક્ત અવકાશનો પરાવૈધુતાંક અને E વિધુતક્ષેત્ર છે)

- (A) $M^1 L^2 T^{-2} A^1$
 (B) $M^1 L^{-1} T^{-2} A^0$
 (C) $M^0 L^1 T^{-2} A^{-1}$
 (D) $M^1 L^{-3} T^0 A^0$

- 40) L લંબાઈ અને A આડહેણનું ક્ષેત્રફળ ઘરાવતા વાહક તારનો અવરોધ R છે. તારને સમાન રીતે ખેચીને તેની લંબાઈ બમણી કરતાં મળતો તારનો નવો અવરોધ _____ હશે.

- (A) $\frac{R}{2}$
 (B) $4R$
 (C) R
 (D) $\frac{R}{4}$

- 41) તાપમાન વધારતા અર્ધવાહક અને સુવાહક દ્રવ્યોની અવરોધકતાઓના ગુણોત્તરનું મૂલ્ય _____.

- (A) વધે
 (B) અચળ રહે
 (C) ઘટે
 (D) શક્તિઆતમાં વધી અચળ બને

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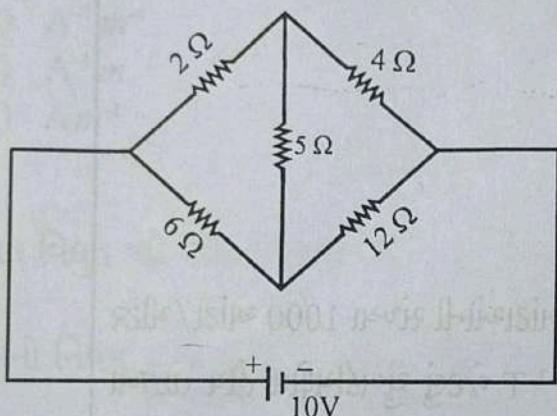
42) નીચે આપેલા સૂત્રો પૈકી ક્યું સૂત્ર ડિફટવેગ દર્શાવતું નથી.

(A) $V_d = \mu E$

(B) $V_d = \frac{I}{neA}$

(C) $V_d = \frac{e\tau E}{m}$

(D) $V_d = \frac{ne\tau}{J}$

43) આપેલ પરિપथમાં 5Ω ના અવરોધમાંથી પસાર થતો પ્રવાહ _____.

(A) 2.22 A

(B) 0 A

(C) 1.11 A

(D) 0.45 A

(નીચેનો પ્રશ્ન ફક્ત દાખિલાન વિદ્યાર્થીઓ માટે છે.)

43) પ્રવાહને લંબડુપે આપેલ એકમ ક્ષેત્રકળ દીઠ પ્રવાહને _____ કહે છે.

(A) વિદ્યુતક્ષેત્ર

(B) પ્રવાહ ઘનતા

(C) મોભીલીટી

(D) વાહકતા

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44) જો ગેલ્વેનોમીટર આંટાઓની સંખ્યા બમણી કરવામાં આવે તો તેની વોલ્ટેજ સંવેદિતા _____.

- (A) અચળ રહે છે.
 (B) અધધી થશે.
 (C) બમણી થશે.
 (D) ચારગણી થાય છે.

45) ચુંબકીય મોમેન્ટ (ચાકમાત્રા) m નું પારિમાણિક સૂત્ર _____.

- (A) $M^0 L^1 T^0 A^{-1}$
 (B) $M^0 L^{-2} T^0 A^1$
 (C) $M^0 L^2 T^0 A^1$
 (D) $M^0 L^1 T^0 A^1$

46) એક સોલેનોઇડ માટે એકમ લંબાઈ ફીડ આંટાઓની સંખ્યા 1000 આંટા/મીટર છે. જો આ સોલેનોઇડમાં 6.28×10^{-3} T જેટલું ચુંબકીયક્ષેત્ર હોય તો આ સોલેનોઇડમાંથી પસાર થતો પ્રવાહ _____.

- (A) 10.0 A
 (B) 5.0 A
 (C) 5.0 mA
 (D) 0.5 A

47) સુવાહક તાર A માં પ્રવાહ પૂર્વથી પદ્ધિમ દિશામાં અને તેને સમાંતર રાખેલ તાર B માં પ્રવાહ પદ્ધિમથી પૂર્વ દિશામાં વહે છે તો આ બંને વાહક તાર _____.

- (A) એક બીજાને આકર્ષે
 (B) તેમની મૂળ સ્થિતીમાં જ રહે
 (C) એક બીજાને અપાકર્ષે
 (D) તાર A તાર B ની આસપાસ પરિભ્રમણ કરશે

- 48) નીચે આપેલ તત્વો પૈકી ક્યું તત્વ ફેરોમેટીક નથી?
- (A) નિકલ
 - (B) ગંડોલિનિયમ
 - (C) કોબાલ્ટ
 - (D) બિસ્મથ

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૨૫ કાંઈ

- 49) મેનેટાઇઝેશન M નો SI એકમ _____.
- (A) $A m^{-2}$
 - (B) $A^{-1} m^{-1}$
 - (C) $A^{-1} m$
 - (D) $A m^{-1}$

- 50) સ્થિત વિદ્યુત માટે ગોસનો નિયમ $\sum \vec{E} \cdot \Delta \vec{s} = \frac{q}{\epsilon_0}$ છે. જ્યારે ચુંબકત્વ માટે

ગોસનો નિયમ $\sum_{all} \vec{B} \cdot \Delta \vec{s} = \text{_____}$ છે.

(A) 0

(B) $\frac{M}{\mu_0}$

(C) $\frac{m}{\mu_0}$

(D) $\frac{m}{\epsilon_0}$

054 (G)

(JUNE, 2025)
 (SCIENCE STREAM)
 (CLASS - XII)

(Part - B)

Time : 2 Hours/

[Maximum Marks : 50]

સૂચનાઓ :

- 1) સ્પષ્ટ વંચાય તેવું હસ્તલેખન જગતવું.
- 2) આ પ્રક્રિમત્રણ ભાગ - B માં ત્રણ વિભાગો A, B અને C છે. અને કુલ 1 થી 27 પ્રશ્નો આપેલા છે.
- 3) બધા જ પ્રક્રિ ફરજિયાત છે. જનરલ વિકલ્પો આપેલા છે.
- 4) પ્રક્રિની જમણી બાજુના અંક તેના ગુણ દર્શાવે છે.
- 5) નવો વિભાગ નવા પાના પર લખવો.
- 6) પ્રક્રોના જવાબ ફરજમાં લખવા.
- 7) વિદ્યાર્થીઓ જરૂર જણાય ત્યાં સાદા કેલ્ક્યુલેટર અને લોગ ટેબલનો ઉપયોગ કરી શકશો.
- 8) આકૃતિવાળા/ચાર્ટ પ્રક્રોમાં દિશાની વિદ્યાર્થીઓ માટે અલગ પ્રક્રો આપેલા છે. જેનું ખાસ ધ્યાન રાખવું. આ પ્રક્રો માત્ર દિશાની વિદ્યાર્થીઓ માટે જ છે.

વિભાગ - A

- નીચે આપેલ પ્રક્રિ નં. 1 થી 12 માંથી માઝ્યા મુજબ ગમે તે 8 પ્રક્રોના ઉત્તર આપો.
 (દરેક પ્રક્રણના 2 ગુણ)

[16]

- 1) 1.2 m ની ત્રિજ્યા ધરાવતા એક સમાન વિદ્યુતભારિત ગોળા પર વિદ્યુતભારની પૃષ્ઠ ઘનતા 80.0 NC/m^2 છે.

- a) ગોળાપરનો વિદ્યુતભાર શોધો.
 b) ગોળાની સપાટીમાંથી બહાર જતું કુલ વિદ્યુત ફલક્સ કેટલું હશે?

115.2
 12.8×10^9 [2]

- 2) ઉગમબિંદુએ એક બિંદુવત્ત વિદ્યુતભાર Q મૂકેલ છે. તેનાથી સ્થાનસંદિશ ન ધરાવતા કોઈપણ બિંદુએ સ્થિતિમાન શોધો.

(નીચેનો પ્રક્રિ ફક્ત દિશાની વિદ્યાર્થીઓ માટે છે.)

[2]

- a) સામાન્ય રબર અવાહક છે. પરંતુ વિમાનના વિશિષ્ટ રબરના ટાયરો સહેજ સુવાહક બનાવવામાં આવે છે આવું શા માટે જરૂરી છે?

- b) ખુલ્લી હાઈપાવર લાઈન પર પક્ષી આરામથી બેસે છે તો પણ તેને કંઈ થતું નથી. જમીન પર ઉલેલો માણસ તે જ લાઈનને સ્પર્શો તો તેને પ્રાણધાતક આંચકો લાગે છે શા માટે?

[2]

- 3) કિર્ચોફના જંક્શન અને લૂપ (બંધગાળા) ના નિયમોના વિધાનો લખો.

[2]

- 4) એક નાના ગજિયા ચુંબકને તેની અક્ષ, 0.25 T ના નિયમિત બાહ્ય ચુંબકીયક્ષેત્ર સાથે 30° નો કોણ બનાવે તે રીતે મુકતાં તે $4.5 \times 10^{-2} \text{ J}$ જેટલું ટોક અનુભવે છે તો ચુંબકની મેન્ઝેટીક મોમેન્ટનું મૂલ્ય કેટલું હશે?

[2]

- 5) 10 cm બાજુવાળી અને 0.5Ω અવરોધ ઘરાવતી એક ચોરસ લૂપ પૂર્વ પણ્ણિમ સમતલમાં ઉભી મુક્કવામાં આવેલ છે. 0.10 T નું એક સમાન ચુંબકીયક્ષેત્ર સમતલ પર ઉત્તર-પૂર્વ દિશામાં લાગુ પડેલ છે. આ ચુંબકીયક્ષેત્ર 0.70 સેકન્ડમાં અચળ હરે ઘટાડીને શૂન્ય કરવામાં આવે છે. આ સમય-અંતરાલ દરમિયાન પ્રેરિત emf અને વિદ્યુતપ્રવાહના માન શોધો. [2]
- 6) એક કેપેસીટરને AC સ્ત્રોત સાથે જોડવામાં આવેલ છે આ પરિપથમાં વિદ્યુતપ્રવાહ i નું સૂત્ર તારવો.
(નીચેનો પ્રશ્ન ફક્ત દિશાની વિદ્યાર્થીઓ માટે છે.) [2]
- 7) 220 V, 50 Hz ના સ્ત્રોત સાથે $15.0 \mu\text{F}$ ના કેપેસીટરને જોડવામાં આવેલ છે. પરિપથમાં કેપેસીટીલ રીએક્ટન્સ અને પ્રવાહનું rms અને મહત્તમ મૂલ્ય શોધો. જો આવૃત્તિને બમણી કરવામાં આવે તો પ્રવાહના મૂલ્ય પર શું અસર થશે? [2]
- 8) એક અંતર્ગતોળ અરીસાની વક્તાત્રિજ્યા 15 cm છે. આ અરીસાની સામે વસ્તુને 10 cm દૂર મૂક્તાં રચાતા પ્રતિબિંબનું સ્થાન, પ્રકાર અને મોટવણી મેળવો. [2]
- 9) a) પ્રકાશ જ્યારે પાતળાથી ઘણુ માધ્યમમાં ગતિ કરે છે ત્યારે તેની ઝડપ અને ઊર્જામાં કેવા પ્રકારનો ફેરફાર થાય છે?
b) આપેલ આવૃત્તિ માટે પ્રકારના ફોટોન સ્વરૂપમાં તીવ્રતા શાનાથી નક્કી થાય છે? [2]
- 10) વિદ્યુત ચુંબકીય વિકિરણના ફોટોન સ્વરૂપને સંક્ષેપમાં દર્શાવતા કોઈપણ ચાર મુદ્દા લખો. [2]
- 11) બોહર મોડેલ અનુસાર, સૂર્યની આસપાસ $3 \times 10^4 \text{ m/s}$ ની ઝડપથી $1.5 \times 10^{11} \text{ m}$ ની વિજ્યા ઘરાવતી કક્ષામાંના પૃથ્વીના ભમણને રજૂ કરતો કર્વાન્ટમ અંક શોધો.
(પૃથ્વીનું દળ = $6.0 \times 10^{24} \text{ kg}$) [2]
12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 146. 147. 148. 149. 150. 151. 152. 153. 154. 155. 156. 157. 158. 159. 160. 161. 162. 163. 164. 165. 166. 167. 168. 169. 170. 171. 172. 173. 174. 175. 176. 177. 178. 179. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190. 191. 192. 193. 194. 195. 196. 197. 198. 199. 200. 201. 202. 203. 204. 205. 206. 207. 208. 209. 210. 211. 212. 213. 214. 215. 216. 217. 218. 219. 220. 221. 222. 223. 224. 225. 226. 227. 228. 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806. 807. 808. 809. 809. 810. 811. 812. 813. 814. 815. 816. 817. 818. 819. 819. 820. 821. 822. 823. 824. 825. 826. 827. 828. 829. 829. 830. 831. 832. 833. 834. 835. 836. 837. 838. 839. 839. 840. 841. 842. 843. 844. 845. 846. 847. 848. 849. 849. 850. 851. 852. 853. 854. 855. 856. 857. 858. 859. 859. 860. 861. 862. 863. 864. 865. 866. 867. 868. 869. 869. 870. 871. 872. 873. 874. 875. 876. 877. 878. 879. 879. 880. 881. 882. 883. 884. 885. 886. 887. 888. 889. 889. 890. 891. 892. 893. 894. 895. 896. 897. 898. 899. 899. 900. 901. 902. 903. 904. 905. 906. 907. 908. 909. 909. 910. 911. 912. 913. 914. 915. 916. 917. 918. 919. 919. 920. 921. 922. 923. 924. 925. 926. 927. 928. 929. 929. 930. 931. 932. 933. 934. 935. 936. 937. 938. 939. 939. 940. 941. 942. 943. 944. 945. 946. 947. 948. 949. 949. 950. 951. 952. 953. 954. 955. 956. 957. 958. 959. 959. 960. 961. 962. 963. 964. 965. 966. 967. 968. 969. 969. 970. 971. 972. 973. 974. 975. 976. 977. 978. 979. 979. 980. 981. 982. 983. 984. 985. 986. 987. 988. 989. 989. 990. 991. 992. 993. 994. 995. 996. 997. 998. 999. 999. 1000. 1001. 1002. 1003. 1004. 1005. 1006. 1007. 1008. 1009. 1009. 1010. 1011. 1012. 1013. 1014. 1015. 1016. 1017. 1018. 1019. 1019. 1020. 1021. 1022. 1023. 1024. 1025. 1026. 1027. 1028. 1029. 1029. 1030. 1031. 1032. 1033. 1034. 1035. 1036. 1037. 1038. 1039. 1039. 1040. 1041. 1042. 1043. 1044. 1045. 1046. 1047. 1048. 1049. 1049. 1050. 1051. 1052. 1053. 1054. 1055. 1056. 1057. 1058. 1059. 1059. 1060. 1061. 1062. 1063. 1064. 1065. 1066. 1067. 1068. 1069. 1069. 1070. 1071. 1072. 1073. 1074. 1075. 1076. 1077. 1078. 1079. 1079. 1080. 1081. 1082. 1083. 1084. 1085. 1086. 1087. 1088. 1089. 1089. 1090. 1091. 1092. 1093. 1094. 1095. 1096. 1097. 1098. 1099. 1099. 1100. 1101. 1102. 1103. 1104. 1105. 1106. 1107. 1108. 1109. 1109. 1110. 1111. 1112. 1113. 1114. 1115. 1116. 1117. 1118. 1119. 1119. 1120. 1121. 1122. 1123. 1124. 1125. 1126. 1127. 1128. 1129. 1129. 1130. 1131. 1132. 1133. 1134. 1135. 1136. 1137. 1138. 1139. 1139. 1140. 1141. 1142. 1143. 1144. 1145. 1146. 1147. 1148. 1149. 1149. 1150. 1151. 1152. 1153. 1154. 1155. 1156. 1157. 1158. 1159. 1159. 1160. 1161. 1162. 1163. 1164. 1165. 1166. 1167. 1168. 1169. 1169. 1170. 1171. 1172. 1173. 1174. 1175. 1176. 1177. 1178. 1179. 1179. 1180. 1181. 1182. 1183. 1184. 1185. 1186. 1187. 1188. 1189. 1189. 1190. 1191. 1192. 1193. 1194. 1195. 1196. 1197. 1198. 1199. 1199. 1200. 1201. 1202. 1203. 1204. 1205. 1206. 1207. 1208. 1209. 1209. 1210. 1211. 1212. 1213. 1214. 1215. 1216. 1217. 1218. 1219. 1219. 1220. 1221. 1222. 1223. 1224. 1225. 1226. 1227. 1228. 1229. 1229. 1230. 1231. 1232. 1233. 1234. 1235. 1236. 1237. 1238. 1239. 1239. 1240. 1241. 1242. 1243. 1244. 1245. 1246. 1247. 1248. 1249. 1249. 1250. 1251. 1252. 1253. 1254. 1255. 1256. 1257. 1258. 1259. 1259. 1260. 1261. 1262. 1263. 1264. 1265. 1266. 1267. 1268. 1269. 1269. 1270. 1271. 1272. 1273. 1274. 1275. 1276. 1277. 1278. 1279. 1279. 1280. 1281. 1282. 1283. 1284. 1285. 1286. 1287. 1288. 1289. 1289. 1290. 1291. 1292. 1293. 1294. 1295. 1296. 1297. 1298. 1299. 1299. 1300. 1301. 1302. 1303. 1304. 1305. 1306. 1307. 1308. 1309. 1309. 1310. 1311. 1312. 1313. 1314. 1315. 1316. 1317. 1318. 1319. 1319. 1320. 1321. 1322. 1323. 1324. 1325. 1326. 1327. 1328. 1329. 1329. 1330. 1331. 1332. 1333. 1334. 1335. 1336. 1337. 1338. 1339. 1339. 1340. 1341. 1342. 1343. 1344. 1345. 1346. 1347. 1348. 1349. 1349. 1350. 1351. 1352. 1353. 1354. 1355. 1356. 1357. 1358. 1359. 1359. 1360. 1361. 1362. 1363. 1364. 1365. 1366. 1367. 1368. 1369. 1369. 1370. 1371. 1372. 1373. 1374. 1375. 1376. 1377. 1378. 1379. 1379. 1380. 1381. 1382. 1383. 1384. 1385. 1386. 1387. 1388. 1389. 1389. 1390. 1391. 1392. 1393. 1394. 1395. 1396. 1397. 1398. 1399. 1399. 1400. 1401. 1402. 1403. 1404. 1405. 1406. 1407. 1408. 1409. 1409. 1410. 1411. 1412. 1413. 1414. 1415. 1416. 1417. 1418. 1419. 1419. 1420. 1421. 1422. 1423. 1424. 1425. 1426. 1427. 1428. 1429. 1429. 1430. 1431. 1432. 1433. 1434. 1435. 1436. 1437. 1438. 1439. 1439. 1440. 1441. 1442. 1443. 1444. 1445. 1446. 1447. 1448. 1449. 1449. 1450. 1451. 1452. 1453. 1454. 1455. 1456. 1457. 1458. 1459. 1459. 1460. 1461. 1462. 1463. 1464. 1465. 1466. 1467. 1468. 1469. 1469. 1470. 1471. 1472. 1473. 1474. 1475. 1476. 1477. 1478. 1479. 1479. 1480. 1481. 1482. 1483. 1484. 1485. 1486. 1487. 1488. 1489. 1489. 1490. 1491. 1492. 1493. 1494. 1495. 1496. 1497. 1498. 1499. 1499. 1500. 1501. 1502. 1503. 1504. 1505. 1506. 1507. 1508. 1509. 1509. 1510. 1511. 1512. 1513. 1514. 1515. 1516. 1517. 1518. 1519. 1519. 1520. 1521. 1522. 1523. 1524. 1525. 1526. 1527. 1528. 1529. 1529. 1530. 1531. 1532. 1533. 1534. 1535. 1536. 1537. 1538. 1539. 1539. 1540. 1541. 1542. 1543. 1544. 1545. 1546. 1547. 1548. 1549. 1549. 1550. 1551. 1552. 1553. 1554. 1555. 1556. 1557. 1558. 1559. 1559. 1560. 1561. 1562. 1563. 1564. 1565. 1566. 1567. 1568. 1569. 1569. 1570. 1571. 1572. 1573. 1574. 1575. 1576. 1577. 1578. 1579. 1579. 1580. 1581. 1582. 1583. 1584. 1585. 1586. 1587. 1588. 1589. 1589. 1590. 1591. 1592. 1593. 1594. 1595. 1596. 1597. 1598. 1599. 1599. 1600. 1601. 1602. 1603. 1604. 1605. 1606. 1607. 1608. 1609. 1609. 1610. 1611. 1612. 1613. 1614. 1615. 1616. 1617. 1618. 1619. 1619. 1620. 1621. 1622. 1623. 1624. 1625. 1626. 1627. 1628. 1629. 1629. 1630. 1631. 1632. 1633. 1634. 1635. 1636. 1637. 1638.

- 14) a) (-9 cm, 0, 0) અને (9 cm, 0, 0) સ્થાનોએ રહેલા બે વિદ્યુતભારો અનુક્રમે $7\mu C$ અને $-2\mu C$ ના તંત્રની (બાહ્યક્ષેત્ર વિના) સ્થિત વિદ્યુત સ્થિતિઓન્ન શોધો.
- b) આ બે વિદ્યુતભારોને એકબીજથી અનંત અંતર સુધી જુદ્ધ પાડવા માટે કેટલું કાર્ય જરૂરી છે?
- c) ધારો કે આ વિદ્યુતભારોના તંત્રને બાહ્ય વિદ્યુતક્ષેત્ર $E = A \left(\frac{1}{r^2} \right)$ માં મૂકવામાં આવે છે.
જ્યાં, $A = 9 \times 10^5 NC^{-1} m^2$ છે, તો આ તંત્રની વિદ્યુત સ્થિતિઓન્ન કેટલી હશે? [3]
- ✓15) ઓહમના નિયમની ત્રણ મર્યાદાઓ લખો. (આલેખ જરૂરી નથી) [3]
- 16) $6 \times 10^{-4} T$ જેટલા ચુંબકીયક્ષેત્રને લંબડુપે $3 \times 10^7 m/s$ ની ઝડપથી ગતિ કરતા ઈલેક્ટ્રોનના માર્ગની વિજ્ઞા કેટલી હશે? તેની (પરિભ્રમણ) આવૃત્તિ કેટલી હશે? તેની ઊર્જા keV માં શોધો. અહીં, $m_e = 9.0 \times 10^{-31} kg$ લો. [3]
- 17) આત્મ-પ્રેરણ એટલે શું? આત્મ-પ્રેરિત emf નું સૂત્ર તારવો. આડછેદનું ક્ષેત્રફળ A, લંબાઈ / અને એકમ લંબાઈ દીઠ n, આંદો ધરાવતા એક લાંબા સોલેનોઇડના આત્મપ્રેરકત્વનું સૂત્ર તારવો. [3]
- 18) ગ જેટલી એકરંગી તરંગલંબાઈ ધરાવતા પ્રકાશ સાથે કરેલા યંગના બે-સિલિન્ડરના પ્રયોગમાં, પડા પરના જે બિંદુએ પથ તફાવત ગ જેટલો થાય ત્યાં તીવ્રતા K એકમ છું. જ્યાં પથ તફાવત $\frac{1}{3}$ થાય તે બિંદુ આગળ પ્રકાશની તીવ્રતા કેટલી હશે? [3]
- 19) બોહરવાહની ત્રણ સ્વીકૃતિઓ લખો. [3]
- 20) $^{239}_{94} Pu$ ના વિખંડન ગુણધર્મો $^{235}_{92} U$ જેવા છે. વિખંડન દીઠ વિમુક્ત થતી સરેરાશ ઊર્જા 180 MeV છે. જો શુદ્ધ $^{239}_{94} Pu$ ના 1 kg માંના બધા પરમાણુઓ વિખંડન પામે તો કેટલી ઊર્જા MeV માં વિમુક્ત થશે? [3]
- 21) અર્ધતરંગ રેફ્લક્શયરનો પરિપથ દોરી તેની કાર્યવિધી સમજાવો અને અર્ધતરંગ રેફ્લક્શયર પરિપથ માટે આપેલ ઈનપુટ એસી વોલ્ટેજ અને આઉટપુટ વોલ્ટેજના તરંગ સ્વરૂપો દોરો. (નીચેનો પ્રશ્ન ફક્ત દર્શાવી વિધાથીઓ માટે છે.) [3]
- 21) a) ધારો કે શુદ્ધ Si સ્ફટીકમાં $5 \times 10^{28} \text{ પરમાણુ}/m^3$ છે. તેને 1 ppm ઘનતા (સાંક્રતા) સાથે પેન્ટાવેલેન્ટ As વડે ડોપ કરવામાં આવે છે. ઈલેક્ટ્રોન અને હોલની સંખ્યા ગણો. $n_i = 1.5 \times 10^{16} m^{-3}$ આપેલ છે.
- b) અર્ધ તરંગ રેફ્લક્ટિક્શનમાં ઈનપુટ આવૃત્તિ 50 Hz હોય તો આઉટપુટ આવૃત્તિ કેટલી હશે? આ જે ઈનપુટ આવૃત્તિ માટે પૂર્ણ તરંગ રેફ્લક્શયરની આઉટપુટ આવૃત્તિ કેટલી હશે? [3]

(1)

વિભાગ - C

■ નીચે આપેલા પ્રશ્ન નં. 22 થી 27 માંથી માઝા મુજબ ગમે તે 4 પ્રશ્નોના ઉત્તરો આપો.
(દરેક પ્રશ્નના 4 ગુણા)

[16]

22) સમાંતર પ્લેટ કેપેસીટર માટે કેપેસીટન્સનું સૂત્ર તારવો. એક બીજાથી 1 cm અંતરે રાખેલ બે ચોરસ પ્લેટોથી બનતા સમાંતર પ્લેટ કેપેસીટરનું કેપેસીટન્સ $4 \mu\text{F}$ હોય, તો પ્લેટોની દરેક બાજુની લંબાઈ કેટલી હશે?

[4]

(નીચેનો પ્રશ્ન ફક્ત દશ્ઠિહીન વિદ્યાર્થીઓ માટે છે.)

22) સુધીલોના સ્થિતિવિદ્યુતસાચ્ચને લગતાં અગત્યનાં કોઈપણ આર પરિણામો લખો.

[4]

23) 8.0 V emf અને $0.5\text{ }\Omega$ નો આંતરિક અવરોધ ધરાવતી સંગ્રહક બેટરીને 120V વાળા AC સપ્લાય વડે $15.5\text{ }\Omega$ ના અવરોધ મારફતે વિદ્યુતભારિત કરવામાં આવે છે. વિદ્યુતભારણની પ્રક્રિયા દરમિયાન બેટરીનો ટર્મિનલ વોલ્ટેજ કેટલો હશે? વિદ્યુતભારણ માટેના પરિપથમાં શ્રેણી અવરોધ રાખવાનો હેતું શો છે? આપેલ સંગ્રહક બેટરી સંપૂર્ણ ચાર્જ સ્થિતિમાં હોય ત્યારે તેમાંથી કેટલો મહત્તમ પ્રવાહ ખેચી શકાય.

[4]

24) RLC શ્રેણી એ.સી. પરિપથ માટે સરેરાશ પાવરનું સૂત્ર મેળવો અને વપરાતા (વ્યય પામતા) પાવરના કોઈપણ બે કિસ્સાઓની ચર્ચા કરો.

[4]

25) સામાન્ય નજીકબિંદુ (25 cm) ધરાવતો એક વ્યક્તિ 8.0 mm કેન્દ્રલંબાઈવાળા ઓફ્જેક્ટીવ અને 2.5 cm કેન્દ્રલંબાઈના આઈપીસ ધરાવતા સંયુક્ત માઈક્રોસ્કોપ વડે, ઓફ્જેક્ટીવથી 9.0 mm દૂર રાખેલી વસ્તુનું સ્પસ્ટ પ્રતિબિંબ મેળવે છે તો બંને લેન્સ વચ્ચેનું અંતર શોધો. માઈક્રોસ્કોપની મોટવણી શક્તિ પણ શોધો.

[4]

26) આપેલ સૂચના મુજબ આદેખ દોરો.

- ફોટો ઇલેક્ટ્રોિક પ્રવાહ વિડ્રેન્ડ પ્રકાશની તીવ્રતા
- સમાન આવૃત્તિ પરંતુ બે જુદી-જુદી તીવ્રતા ધરાવતા આપાત પ્રકાશ માટે, ફોટો ઇલેક્ટ્રોિક પ્રવાહ વિડ્રેન્ડ કલેક્ટર પ્લેટ સ્થિતિમાન
- સમાન તીવ્રતા પરંતુ બે જુદી-જુદી આવૃત્તિ ધરાવતા આપાત પ્રકાશ માટે, ફોટો ઇલેક્ટ્રોિક પ્રવાહ વિડ્રેન્ડ કલેક્ટર પ્લેટ સ્થિતિમાન
- કોઈ એક પ્રકાશ સંવેદી દ્રવ્ય માટે, સ્ટોપીંગ પોટેન્શિયલ વિડ્રેન્ડ આપાત વિકિરણની આવૃત્તિ

[4]

(નીચેનો પ્રશ્ન ફક્ત દશ્ઠિહીન વિદ્યાર્થીઓ માટે છે.)

26) ધાતુનું કાર્ય વિધેય (Work function) કોને કહે છે? તે શાના પર આધાર રાખે છે? ધાતુની સપાટીમાંથી ઈલક્ટ્રોનનું ઉત્સર્જન કરાવવા માટેની કોઈ પણ બે પદ્ધતિઓની સમજૂતી આપો.

[4]

27) $R = R_0 A^{\frac{1}{3}}$ સબંધ, જ્યાં R_0 એ અચળાંક અને A એ ન્યુકિલિયસનો દળાંક છે, પરથી દર્શાવો કે ન્યુકિલિયર દ્રવ્યની ઘનતા લગભગ અચળ હોય છે (એટલે કે A પર આધારિત નથી) અથવા (લોખંડ)ના ન્યુકિલિયસ માટે દળ $55.85\text{ }\mu\text{m}$ અને $A = 56$ છે તો તેના ન્યુકિલિયસની ઘનતા કેટલી હશે?

[4]

This Question Paper contains 20 printed pages.

(Part - A & Part - B)

Sl.No. 0900711

054 (E)

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

પ્રથમ પેપરનો સેટ નંબર જેની
સામેનું વર્તુળ OMR શીટમાં
ઘણું કરવાનું રહે છે.
Set No. of Question Paper,
circle against which is to be
darker in OMR sheet.

09

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

Rough Work

- (A) 484
(B) 242
(C) 222
(D) 311

2) Which wave is used in television communication system?

- (A) Radio wave
- (B) Microwave
- (C) Infrared wave
- (D) Ultraviolet

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

- (A) 25m to 40m
- (B) 30m to 45m
- (C) 15m to 30m
- (D) 20m to 35m

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

$\lambda = \frac{c}{f}$
 $c = \lambda f$
 $\lambda = \frac{c}{f}$
 $\lambda = \frac{3 \times 10^8}{7.5 \times 10^6}$
 $\lambda = 40 \text{ m}$

$n_2 > n_1$
 $n_2 > 1$

5) 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) 22
- (B) 24
- (C) 32
- (D) 20

Rough Work

- 6) 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) 486 nm
 (B) 600 nm
 (C) 500 nm
 (D) 672 nm
- 7) If unpolarized light is incident on polaroid, then intensity of emergent light is _____ of the intensity of incident light.
- (A) Four times
 (B) Double
 (C) Half
 (D) One fourth
- 8) Which phenomena cannot be explain by wave theory of light?
- (A) Diffraction
 (B) Interference
 (C) Polarisation
 (D) Photo-electric effect
- 9) The work function of Caesium is 2.14 eV. Find the threshold cut-off frequency for Caesium.
 $[h = 6.63 \times 10^{-34} \text{ Js}]$
- (A) $5.16 \times 10^{15} \text{ Hz}$
 (B) $3.22 \times 10^{33} \text{ Hz}$
 (C) $3.22 \times 10^{14} \text{ Hz}$
 (D) $5.16 \times 10^{14} \text{ Hz}$

Rough Work

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

- (A) 3.2×10^{-19} J
- (B) 2.4×10^{-19} J
- (C) 4×10^{-19} J
- (D) 2×10^{-19} J

- 11) Which condition is satisfied for photoelectric effect in metal given below?

- (A) Frequency of incident light(v) is greater than threshold frequency (v_0) of metal
- (B) Energy of incident photon (hv) is lesser than work function (ϕ_0) of metal
- (C) Wavelength of incident light(λ) is greater than threshold wavelength (λ_0) of metal

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

- 12) 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?

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

- (A) 3×10^{15}
- (B) 3.98×10^{19}
- (C) 1.99×10^{15}
- (D) 5×10^{15}

Rough Work

- 13) 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) 2.62%
 (B) 10%
 (C) 90%
 (D) 0.14%

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

(A) 3/2
 (B) 2/3
 (C) 4/9
 (D) 9/4

$$\frac{r_3}{r_2} = \frac{n_3^2}{n_2^2}$$

$$= \frac{9}{4}$$

- 15) Potential energy of an electron in first excited state in hydrogen atom is _____ eV.

(A) -10.2
 (B) -3.4
 (C) -6.8
 (D) -13.6

- 16) 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?

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

(A) $3.8 \times 10^{14} \text{ Hz}$
 (B) $1.2 \times 10^{14} \text{ Hz}$
 (C) $5.6 \times 10^{14} \text{ Hz}$
 (D) $1.6 \times 10^6 \text{ Hz}$

$$\Delta E = 1.097 \times 10^{-3} \text{ eV}$$

$$\Delta E = 2.3 \times 1.097 \times 10^{-3} \text{ eV}$$

$$\Delta E = 2.5234 \times 10^{-3} \text{ eV}$$

$$\Delta E = 2.5234 \times 10^{-3} \text{ eV} \times \frac{10^10 \text{ Hz}}{1.097 \times 10^{-3} \text{ eV}}$$

$$\Delta E = 2.26 \times 10^{14} \text{ Hz}$$

- 17) 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) 26.4, 73.6
- (B) 24.6, 75.4
- (C) 70.5, 29.5
- (D) 75.4, 24.6

- 18) Complete the Nuclear fission equation given below.



- (A) ${}_{51}^{133}\text{Sb}$, $4 {}_0^1n$
- (B) ${}_{56}^{144}\text{Ba}$, $3 {}_0^1n$
- (C) ${}_{54}^{140}\text{Xe}$, $2 {}_0^1n$
- (D) ${}_{54}^{140}\text{Xe}$, $3 {}_0^1n$

- 19) The nuclides ${}_{1}^3\text{H}$ and ${}_{2}^3\text{He}$ are _____.

- (A) Isotones
- (B) Isotopes
- (C) Isobar
- (D) Isomer

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

- (A) Decrease
- (B) Increase
- (C) Remain constant
- (D) Decrease for light element & increase for heavier element

Rough Work

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

(A) 1.32

(B) 1.23

(C) 1.83

(D) 2.06

22) 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

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

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

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

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

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

- (A) $10^2 - 10^8 \Omega\text{m}$
- (B) $10^{-2} - 10^{-8} \Omega\text{m}$
- (C) $10^{-5} - 10^6 \Omega\text{m}$
- (D) $10^{11} - 10^{19} \Omega\text{m}$

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

- (A) 0.72 eV
- (B) 1.1 eV
- (C) 0.01 eV
- (D) 0.05 eV

26) 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 $n_i = 1.5 \times 10^{16} \text{ m}^{-3}$)

- (A) $5 \times 10^{16} \text{ m}^{-3}$
- (B) $5 \times 10^{28} \text{ m}^{-3}$
- (C) $4.5 \times 10^9 \text{ m}^{-3}$
- (D) $5 \times 10^{22} \text{ m}^{-3}$

$$n_e = \frac{5 \times 10^{28}}{(1 + 10^{-6})} = 4.5 \times 10^{28}$$

- 27) An electron fall through a distance 2 cm in uniform electric field vertically upward & magnitude $2 \times 10^4 \text{ N/C}$. What is the acceleration of electron in _____ m/s^2 .

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

(A) 1.9×10^{15}

(B) 3.51×10^{15}

(C) Zero

(D) 2.9×10^{15}

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

(A) $15 \text{ Nm}^2/\text{C}$

(B) $30 \text{ Nm}^2/\text{C}$

(C) Zero

(D) $60 \text{ Nm}^2/\text{C}$

- 29) 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) The dipole has a net force in the direction of decreasing field

(B) No net force on the dipole

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

(D) Force on dipole is perpendicular to electric field

$$\begin{aligned} E &= 2 \times 10^4 \text{ N/C} \\ a &\sim \\ a &= \frac{1}{2} at^2 \\ 2d &= at^2 \\ a &= \frac{2d}{t^2} \\ ma &= qE \\ a &= \frac{qE}{m} \\ a &= 1.5 \times 10^{15} \text{ m/s}^2 \\ a &= 3.51 \times 10^{15} \text{ m/s}^2 \end{aligned}$$



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

(A) $q/2\epsilon_0$

(B) q/ϵ_0

(C) $q/6\epsilon_0$

(D) $q/4\epsilon_0$

31) 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) $1.2 m$

(B) $12 m$

(C) $0.12 m$

(D) $0.012 m$

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

(A) $(n_2 - n_1) e$

(B) $(n_1 - n_2) e$

(C) $n_1 n_2 e$

(D) $(n_1 + n_2) e$

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

- 34) Which of the option is incorrect, when a charge is placed on conductor in the static situation?
- The interior of the conductor can have no excess charge
 - Inside the conductor electrostatic field is zero
 - At the surface of charged conductor electrostatic field is normal to the surface at every point
 - Electrostatic potential is zero inside the conductor

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

- 4×10^5 V
- 4×10^4 V
- 4×10^{-4} V
- 4×10^3 V

- 36) 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?

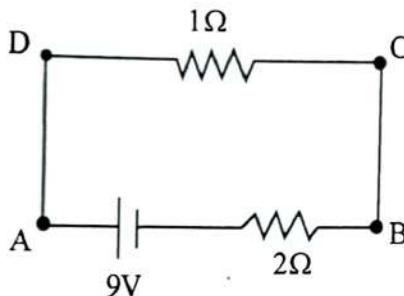
- 4.5×10^{-6} J
- 2.25×10^{-6} J
- 1.125×10^{-6} J
- Zero

- 37) Three capacitors of capacitances $2\mu F$, $3\mu F$ and $4\mu F$ are connected in parallel. What is the equivalent capacitance?

- $\frac{12}{13}\mu F$
- $\frac{13}{12}\mu F$
- $9\mu F$
- $12\mu F$

- 38) Option given below, who's resistivity decrease with increase in temperature.
- Semiconductor
 - Metal
 - Alloy
 - Insulator

- 39) As circuit shown in figure, potential difference between points A & B is $V_A - V_B = \text{_____}$.



- 3V
- 3V
- 6V
- 6V

(Only for Blind Students)

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

- 0.5 mA
- 0.5 A
- $0.5 \mu\text{A}$
- 5 A

Rough Work

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

- (A) 200%
- (B) 100%
- (C) 300%
- (D) 400%

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

- (A) $\frac{\mu_0 I}{2\pi r}$
- (B) $\frac{\mu_0 I}{2r}$
- (C) $\frac{\mu_0 NI}{\pi r}$
- (D) Zero

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

- (A) Energy
- (B) Electric current
- (C) Resistance
- (D) Force

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

($m_e = 9.1 \times 10^{-31} \text{ kg}$, $e = 1.6 \times 10^{-19} \text{ C}$)

- (A) 89.3 cm
 - (B) 0.12 cm
 - (C) 100 m
 - (D) 20 m
- 44) 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) $4 \times 10^{-5} \text{ N}$
 - (B) $2 \times 10^{-5} \text{ N}$
 - (C) $3 \times 10^{-5} \text{ N}$
 - (D) $5 \times 10^{-5} \text{ N}$

- 45) 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) $\mu + 1 < \mu_0$

- 46) Which one is incorrect unit for self-inductance?
- (A) VsA^{-1}
 - (B) JA^{-2}
 - (C) WbA^{-1}
 - (D) NmA^{-1}

- 47) 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) 30
 - (B) 60
 - (C) 20
 - (D) 10
- 48) 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) $\frac{\mu_0 I}{2r}$
 - (B) Bvl
 - (C) $10r$
 - (D) Zero
- 49) Magnetic field inside a current carrying long solenoid is 2×10^{-4} T. Magnetic energy stored per unit volume is _____.
- (A) $1.6 \times 10^{-2} \text{ Jm}^{-3}$
 - (B) $3 \times 10^{-2} \text{ Jm}^{-3}$
 - (C) $9.1 \times 10^{-2} \text{ Jm}^{-3}$
 - (D) $5.8 \times 10^{-2} \text{ Jm}^{-3}$
- 50) In an AC circuit having only inductor, i is connected to v then
- (A) Current lead the voltage by $\pi/2$
 - (B) Current lags behind the voltage by $\pi/2$
 - (C) Current lead the voltage by π
 - (D) Current lags the voltage by π

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. [16]
 (Each question carries 2 marks.)
- 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 $3 \times 10^{-5}\text{T}$. [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]
 - What is the wavelength of the wave?
 - 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]
- 8) (Only for Blind Students)

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]
 - an electron moving with a speed of 5.4×10^6 m/s
 - 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]

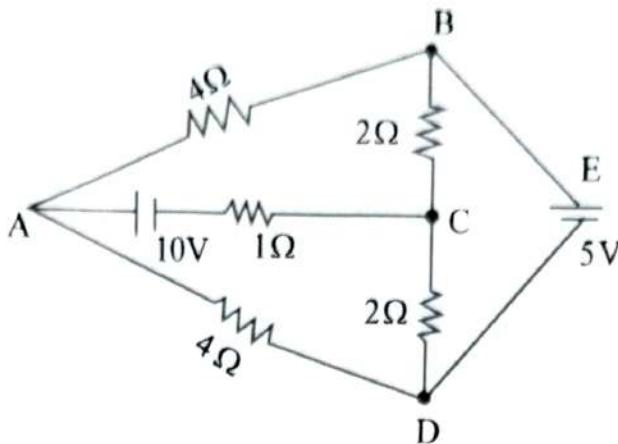
(Only for Blind Students)
- 13) When dielectric is inserted between the parallel plate capacitor then explain the effect of dielectric of capacitance of capacitor. [3]
- 14) Obtain the formula for equivalent emf and equivalent internal resistance of a parallel combination of two cells of emf ϵ_1 and 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.
 - What are the magnitudes of the torque on the coil in the initial & final position?
 - What is the angular speed acquired by the coil when it has rotated by 90° ? The moment of inertia of the coil is 0.1kg 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 $L = 5H$, $C = 80\mu F$ and Resistance $R = 40\Omega$. [3]
- Determine the source frequency which drive the circuit in resonance.
 - Obtain the impedance of the circuit & amplitude of current at the resonating frequency.
 - 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 $\lambda/3$? [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 $3 \times 10^{-7}C$. [4]
- Estimate the number of electrons transferred (from which to which)
 - 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 $6.5 \times 10^{-7}C$? 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 $1.0 \times 10^{-7} \text{ m}^2$ carrying a current 1.5A. Assume that each copper atom contributes roughly one conduction electron. The density of copper is $9 \times 10^3 \text{ kg/m}^3$ & 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 $^{239}_{94}\text{Pu}$ are very similar to those of $^{235}_{92}\text{U}$. 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 $^{239}_{94}\text{Pu}$ 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]

