

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

Sl.No. 1101391

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

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

11

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

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

(Part - A)

Time : 1 Hour]

[Maximum Marks : 50

Instructions :

- 1) There are 50 objective type (M.C.Q.) questions in Part - A and all questions are compulsory.
- 2) The questions are serially numbered from 1 to 50 and each carries 1 mark.
- 3) Read each question carefully, select proper alternative and answer in the O.M.R. sheet.
- 4) The OMR sheet is given for answering the questions. The answer of each question is represented by (A) O, (B) O, (C) O, (D) O. Darken the circle ● of the correct answer with ball-pen.
- 5) Rough work is to be done in the space provided for purpose in the Test Booklet only.
- 6) Set No. of Question Paper printed on the upper-most right side of the Question Paper is to be written in the column provided in the OMR sheet.
- 7) Students may use a 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?

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

Rough Work

✓ 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

$$\frac{\lambda}{2} = m\lambda$$

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

(A) positive

(B) negative

(C) zero

(D) infinite

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- ✓ 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?

(A) 10^{-7} radian
 (B) 2.9×10^{-7} radian
 (C) 2.9×10^{-5} radian
 (D) 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?

(A) 37°
 (B) 33°
 (C) 53°
 (D) 57°



- ✗ 7) Work function of _____ is the lowest.

(A) Platinum
 (B) Caesium
 (C) Nickel
 (D) Copper

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- ✓ 8) By applying electric field of the order of _____ Vm^{-1} to a metal, electrons can be pulled out of the metal.

(A) 10^6
 (B) 10^5
 (C) 10^8
 (D) 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}

$$\frac{37.5 \times 10^{20}}{6.625 \times 10^{-23}}$$

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) $5.3 \times 10^{-11} \text{m}$
- (B) $10.6 \times 10^{-11} \text{m}$
- (C) $2.65 \times 10^{-11} \text{m}$
- (D) $1.33 \times 10^{-11} \text{m}$

$$v^2 = \frac{e^2}{4\pi\epsilon_0 r}$$

$$\times \frac{3}{2}$$

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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

$$13.6$$

Rough Work

✓ 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

$$R \left(\frac{1}{9} - \frac{1}{\infty} \right)$$

✓ 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

$$\begin{aligned} &2637.492 \\ &909.204 \\ &3547.2 \end{aligned}$$

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Rough Work

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) $156 < A < 192$

$$\frac{Bm}{A}$$

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) $\frac{1}{4}$

$$t_{1/2} = \frac{0.693}{\lambda}$$

0	0
12.5	$\frac{1}{2}$
25	$\frac{1}{4}$
50	$\frac{1}{8}$

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

$$6 \times 10^{18} \\ \times 1.6 \times 10^{-19}$$

(P.T.O.)

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

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

$$\frac{F_e}{F_g} = \frac{k e^2}{G m_e m_p}$$

$$= \frac{9 \times 1.6 \times 10^9}{6.6 \times 10^{-11} \times 1.6 \times 10^{-27}}$$

$$= \frac{1.44 \times 10^{10}}{1.056 \times 10^{-38}} = 1.36 \times 10^{48}$$

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) $\frac{1}{r^4}$

$$\frac{2kpz}{(z^2 - a^2)^{3/2}}$$

$$\frac{kp}{(z^2 + a^2)^{3/2}}$$

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

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

- 2 (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) $1\ \Omega, 0.2\ \Omega$

$$\frac{1}{1} + \frac{1}{4}$$

$$\frac{5}{4}$$

✓ 32) A straight wire of mass 200 g and length 1.5 m carries a current of 2 A . To suspend it in a 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

$$m = 200$$

$$l = 1.5$$

$$i = 2\text{ A}$$

$$ilB = mg$$

$$B = \frac{mg}{il}$$

α 33) Unit of Bohr magneton is _____

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

Q A

✓ 34) Current sensitivity of galvanometer is inversely proportional to _____ **For More Papers Visit VisionPapers.in !!!**

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

$$\frac{2l}{2 - 2g}$$

$$\frac{1}{r_s} \cdot \tau_s$$

Rough Work

35) Frequency of cyclotron is independent of ____.

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

$$r = \frac{qBr}{2m}$$

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}

$$N = 100$$

$$r = 0.02$$

$$I = 0.2$$

$$\frac{2 \times 100 \times 0.2 \times 10^{-2}}{2 \times 0.02}$$

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

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(P.T.O.)

Rough Work

✓ 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

$$\frac{B_h}{B_v} = \sqrt{3}$$

$$\cot \theta = \sqrt{3}$$

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 **For More Papers Visit VisionPapers.in !!!**

✓ (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) $\frac{B^2}{\mu_0}$

$$\frac{1}{2} \epsilon_0 E^2$$

43) A 15 μF 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

$$= \frac{1}{2\pi fC}$$

$$= \frac{1}{2 \times 3.14 \times 50 \times 15 \times 10^{-6}}$$

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 $\left(\frac{1}{C}\right)$

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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

$$N_p = 2000$$

$$\frac{E_s}{E_p} = \frac{N_s}{N_p}$$

$$\frac{1}{\mu\epsilon} = \frac{1}{\mu_0 \epsilon_0 \epsilon_r} = \frac{1}{\mu_0 \epsilon_0} \epsilon_r$$

$$B = \frac{\mu_0 N I}{2a}$$

$$\frac{V_m}{B} = \frac{AS}{BT}$$

$$B = \frac{F}{Il}$$

- ✓ 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

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

(Part - B)

[Maximum Marks : 50]

Time : 2 Hours]

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.

$Q = \sigma A$

2) Write a note on Mobility.

OR

$\frac{q_0 A}{d}$

$C = \frac{Q}{V}$

$\epsilon = \frac{d}{\epsilon_0}$

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 $U_m = -\vec{m} \cdot \vec{B}$, 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?

$\frac{6.3}{B} \sim c$

- 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.

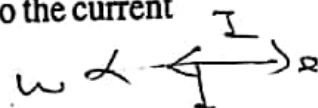
$$\frac{2 \cdot 01 \times 10^{-10}}{1.6 \times 10^{-19}}$$

- 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.

$$\frac{\lambda d \times \lambda}{r^2}$$

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- 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?



$$\frac{6 \times 10^{-10} \times 2 \times 10^4}{1.2 \times 10^{10}} = 1.2 \times 10^{-10} \text{ s}$$

$$\frac{1.2 \times 10^{-10}}{1.6 \times 10^{-19}} = 7.5 \times 10^8$$

$$\frac{1.2 \times 10^{-10}}{1.6 \times 10^{-19}} = 7.5 \times 10^8$$

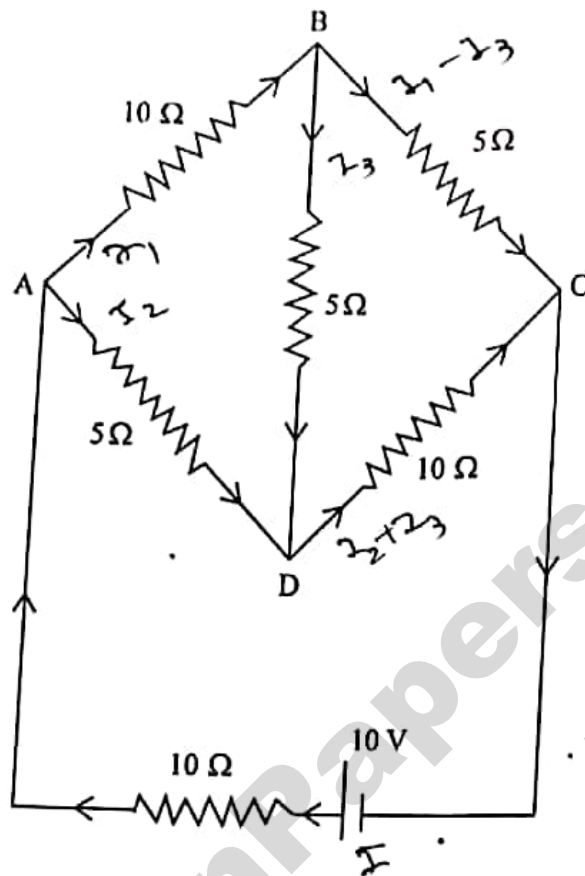
$$\frac{1.2 \times 10^{-10}}{1.6 \times 10^{-19}} = 7.5 \times 10^8$$

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 \AA . Calculate the distance between third bright and fifth dark fringes, obtained on the screen.

OR

Explain polarisation by scattering.

