ST. JOSEPH PUBLIC SCHOOL

Kota Barrage Road, Kota-6 (Raj.)

C.B.S.E. New Delhi, **PHYSICS**	**GUESS PAPER**
Class: **XII**	**2025-26**
Time: **3 HRS**	MM: **70**

General Instructions:

1. There are 33 questions in all. All questions are compulsory.
2. This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
3. All the sections are compulsory.
4. **Section A** contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, **Section B** contains five questions of two marks each, **Section C** contains seven questions of three marks each, **Section D** contains two case study based questions of four marks each and **Section E** contains three long answer questions of five marks each.
5. There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.
6. Use of calculators is not allowed.

Section A

1. C and Si both have the same lattice structure, having 4 bonding electrons in each. However, C is an insulator whereas Si is an intrinsic semiconductor. This is because **[1]**

   A. In case of C the valence band is not completely filled at absolute zero temperature.
   B. In case of C the conduction band is partly filled even at absolute zero temperature.
   C. The four bonding electrons in the case of C lie in the second orbit, whereas in the case of Si they lie in the third.
   D. The four bonding electrons in the case of C lie in the third orbit, whereas for Si they lie in the fourth orbit.

   a) Option D
   b) Option B
   c) Option A
   d) Option C

2. An electron beam has an aperture 1.0 mm^2. A total of 6.0×10^{16} electrons go through any unit square meter perpendicular cross section per second. Find the current density in the beam: **[1]**

   a) $9.6 \times 10^{-5}\ A\,m^{-2}$
   b) $9.2 \times 10^{+6}\ A\,m^{-2}$
   c) $9.2 \times 10^{-3}\ A\,m^{-2}$
   d) $9.6 \times 10^{+3}\ A\,m^{-2}$

3. The focal length (f) of spherical mirror of radius curvature R is: **[1]**

   a) 2R
   b) $\frac{R}{2}$
   c) $\frac{3}{2R}$
   d) R

4. A bar magnet has magnetic dipole moment $\vec{M}$. Its initial position is parallel to the direction of uniform magnetic field $\vec{B}$. In this position, the magnitudes of torque and force acting on it respectively are **[1]**

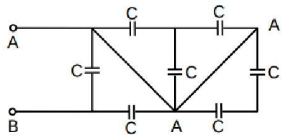
a) MB and MB

b) 0 and 0

c) $|\vec{M} \times \vec{B}|$ and 0

d) 0 and MB

5. Find equivalent capacitance between A and B. **[1]**



a) 4 C

b) 2 C

c) 6 C

d) 8 C

6. A current carrying wire kept in a uniform magnetic field, will experience a maximum force when it is **[1]**

a) perpendicular to the magnetic field

b) at an angle of 60^o to the magnetic field

c) parallel to the magnetic field

d) at an angle of 45^o to the magnetic field

7. Two ends of a horizontal conducting rod of length l are joined to a voltmeter. The whole arrangement moves with a horizontal velocity v, the direction of motion being perpendicular to the rod. Vertical component of the earth's magnetic field is B. The voltmeter reads **[1]**

a) Blv if the rod moves in any direction

b) Blv only if the rod moves eastward

c) Blv only if the rod moves westward

d) Zero

8. The μ_0 is also known as : **[1]**

a) Magnetic dipole moment

b) Magnetic flux

c) magnetic dipole

d) Absolute Permittivity

9. Interference was observed in interference chamber, when air was present. Now, the chamber is evacuated and if the same light is used, a careful observer will see **[1]**

a) no interference

b) interference, in which width of the fringe will be slightly increased

c) interference with bright bands

d) interference with dark bands

10. Gauss' law of electrostatics would be invalid if: **[1]**

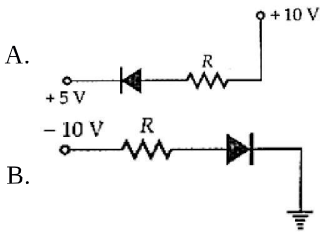
a) the inverse square law was not exactly true

b) there were magnetic monopoles

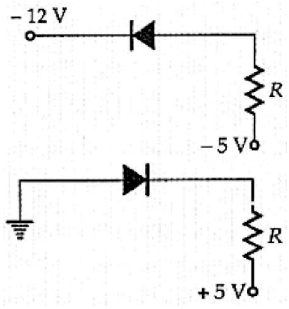
c) the electrical charge was not quantized

d) the speed of light was not a universal constant

11. In the following figure, the diodes which are forward biased, are **[1]**



C.



D.

a) C only

b) A, C and D

c) B and C

d) C and A

12. A beam of monochromatic light is refracted from vacuum into a medium of refractive index $1 \cdot 5$. The wavelength of refracted light will be **[1]**

a) dependent on intensity of refracted light

b) same

c) larger

d) smaller

13. **Assertion (A):** A photocell is called an electric eye. **[1]**

Reason (R): When light is incident on some semiconductor, its electrical resistance is reduced.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

14. **Assertion (A):** Two adjacent conductors of unequal dimensions, carrying the same positive charge have a potential difference between them. **[1]**

Reason (R): The potential of a conductor depends upon the charge given to it.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

15. **Assertion (A):** When a light wave travels from a rarer to denser medium, it loses speed. The reduction in speed imply a reduction in energy carried by the light wave. **[1]**

Reason (R): The energy of a wave is proportional to velocity of wave.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) Both A and R are false.

16. **Assertion (A):** Ac is more dangerous than dc. **[1]**

Reason (R): The frequency of ac is dangerous for the human body.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

Section B

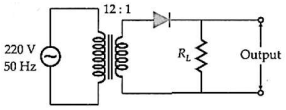
17. The charge on a parallel plate capacitor varies as $q = q_0 \cos 2\pi\nu t$. The plates are very large and close together (area = A, separation = d). Neglecting the edge effects, find the displacement current through the capacitor? **[2]**

18. A magnetised steel wire 31.4 cm long has a pole strength of 0.2 Am. It is bent in the form of a semicircle. Calculate the magnetic moment of the steel wire. **[2]**

OR

A bar magnet with poles 25 cm apart and of pole strength 14.4 Am rests with its centre on a frictionless pivot. It is held in equilibrium at 60° to a uniform magnetic field of induction 0.25 T by applying a force F, at right angles to its axis, 12 cm from its pivot. Calculate F. What will happen if the force F is removed?

19. Find the average value of dc voltage that can be obtained from the half-wave rectifier of Figure. Assume the diode to be ideal one. **[2]**



20. Monochromatic radiation of wavelength 975 $\overset{o}{A}$ excites the hydrogen atom from its ground state to a higher state. How many different spectral lines are possible in the resulting spectrum? Which transition corresponds to the longest wavelength amongst them. **[2]**

21. What information would you wish to know about the galvanometer before converting it into an ammeter or voltmeter? **[2]**

Section C

22. a. Use Kirchhoff's rules to obtain the balance condition in Wheatstone bridge. **[3]**
    b. Give one practical application that is based on this principle.

23. Ultra-violet light of wavelength 200 nm from a source is incident on a metal surface. If the stopping potential is -2.5 V, **[3]**
    a. Calculate the work function of the metal, and
    b. How would the surface respond to a high intensity red light of wavelength 6328 A produced by a laser?

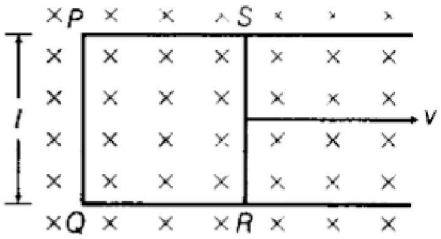
24. Explain briefly with the help of necessary diagrams, the forward and the reverse biasing of a p-n junction diode. Also, draw their characteristic curves in the two cases. **[3]**

25. i. Write three characteristic properties of nuclear force. **[3]**
    ii. Draw a plot of potential energy of a pair of nucleons as a function of their separation. Write two important conclusions that can be drawn from the graph.

26. The total energy of an electron in the first excited state of the hydrogen atom is about –3.4 eV. **[3]**
    a. What is the kinetic energy of the electron in this state?
    b. What is the potential energy of the electron in this state?
    c. Which of the answers above would change if the choice of the zero of potential energy is changed?

27. Two narrow slits are illuminated by a single monochromatic source. Name the pattern obtained on the screen. One of the slits is now completely covered. What is the name of the pattern now obtained on the screen? Draw intensity pattern obtained in the two cases. Also, write two differences between the patterns obtained in the above two cases. **[3]**

28. Figure shows a rectangular conducting loop PQRS in which arm RS of length I is movable. The loop is kept in a uniform magnetic field B directed downward perpendicular to the plane of the loop. The arm RS is moved with a uniform speed v. **[3]**



Deduce an expression for

i. the emf induced across the arm RS

ii. the external force required to move the arm and

iii. the power dissipated as heat.

OR

Define self-inductance of a coil. Obtain the expression for the energy stored in an inductor L connected across a source of emf.

Section D

29. **Read the text carefully and answer the questions:** **[4]**

In an electromagnetic wave both the electric and magnetic fields are perpendicular to the direction of propagation, that is why electromagnetic waves are transverse in nature. Electromagnetic waves carry energy as they travel through space and this energy is shared equally by the electric and magnetic fields. Energy density of an electromagnetic waves is the energy in unit volume of the space through which the wave travels.

(a) The electromagnetic waves propagated perpendicular to both $\vec{E}$ and $\vec{B}$. The electromagnetic waves travel in the direction of

a) $\vec{E} \cdot \vec{B}$ b) $\vec{B} \times \vec{E}$

c) $\vec{B} \cdot \vec{E}$ d) $\vec{E} \times \vec{B}$

(b) Fundamental particle in an electromagnetic wave is

a) proton b) photon

c) phonon d) electron

(c) Electromagnetic waves are transverse in nature is evident by

a) polarisation b) diffraction

c) reflection d) interference

OR

The electric and magnetic fields of an electromagnetic waves are

a) in phase and parallel to each other. b) in phase and perpendicular to each other

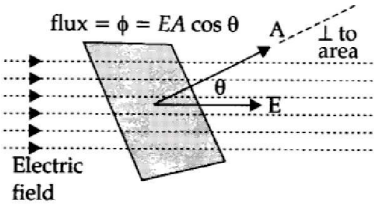
c) in opposite phase and parallel to each other d) in opposite phase and perpendicular to each other

(d) For a wave propagating in a medium, Name the property that is independent of the others.

a) wavelength b) all these depend on each other

c) velocity d) frequency

30. The total number of electric field lines passing a given area in a unit time is defined as the electric flux. **[4]**



If the plane is normal to the flow of the electric field, the total flux is given as:

ϕ = EA

When the same plane is tilted at an angle θ, the projected area is given as A cos θ and the total flux through this surface is given as:

ϕ = EA cos θ

where, E is the magnitude of the electric field. A is the area of the surface through which the electric flux is to be calculated.

i. If a unit positive charge is kept in the air, then what is the total flux coming out of unit charge?

ii. What is the value of electric flux (φ) on a plane of area 1 m^2 on which an electric field of 2 V/m crosses with an angle of 30^o.

iii. When is the flux through a surface taken as positive?

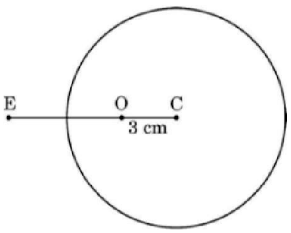
iv. On which factor the net flux through a closed surface in a given medium depends?

v. A plane surface is rotated in a uniform electric field. When is the flux of the electric field through the surface maximum?

Section E

31. i. A spherical surface of radius of curvature R separates two media of refractive indices n_1 and n_2. A point object is placed in front of the surface at distance u in medium of refractive index n_1 and its image is formed by the surface at distance v, in the medium of refractive index n_2. Derive a relation between u and v. **[5]**

ii. A solid glass sphere of radius 6.0 cm has a small air bubble trapped at a distance 3.0 cm from its centre C as shown in the figure. The refractive index of the material of the sphere is 1.5. Find the apparent position of this bubble when seen through the surface of the sphere from an outside point E in air.



OR

i. State Huygen's principle. With the help of a diagram, show how a plane wave is reflected from a surface. Hence verify the law of reflection.

ii. A concave mirror of focal length 12 cm forms a three times magnified virtual image of an object. Find the distance of the object from the mirror.

32. i. Derive the expression for the energy stored in parallel plate capacitor. Hence, obtain the expression for the energy density of the electric field. **[5]**

ii. A fully charged parallel plate capacitor is connected across an uncharged identical capacitor. Show that the energy stored in the combination is less than the energy stored initially in the single capacitor.

OR

a. If two similar large plates, each of area A having surface charge densities $+\sigma$ and $-\sigma$ are separated by a distance d in air, then find the expression for

i. the field at points between the two plates and on the outer side of the plates. Specify the direction of the field in each case.

ii. the potential difference between the plates.

iii. the capacitance of the capacitor so formed.

b. Two metallic spheres of radii R and 2R are charged so that both of these have the same surface charge density σ. If they are connected to each other with a conducting wire, in which direction will the charge flow and why?

33. A circuit containing a 80 mH inductor and a 60 μF capacitor in series is connected to a 230 V, 50 Hz supply. **[5]** The resistance of the circuit is negligible.

a. Obtain the current amplitude and rms values.

b. Obtain the rms values of potential drops across each element.

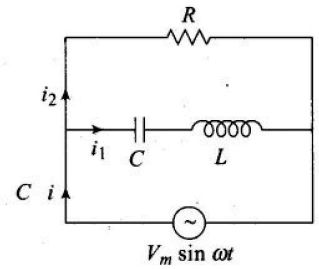
c. What is the average power transferred to the inductor?

d. What is the average power transferred to the capacitor?

e. What is the total average power absorbed by the circuit? ['Average' implies 'averaged over one cycle'.]

OR

Consider the LCR circuit shown in Figure. Find the net current i and the phase of i. Show that $i = \frac{v}{Z}$. Find the impedance Z for this circuit.



Note: This guess paper has been prepared with the aim of helping students score good marks; however, it does not guarantee that the Board examination will contain exactly the same questions.