RBSE Class 12 Physics Question Paper 2026 with Solutions (Memory Based)

Time Allowed : 3 Hour	**Maximum Marks :** 70	**Total Questions :** 10

General Instructions

Read the following instructions very carefully and strictly follow them:

1. Each activity has to be answered in full sentence/s. One word answers will not be given complete credit. Just the correct activity number written in case of options will not be given credit.
2. Web diagrams, flow charts, tables, etc. are to be presented exactly as they are with answers.
3. In point 2 above, just words without the presentation of the activity format, will not be given credit. Use of colour pencils/pens etc. is not allowed. (Only blue/black pens are allowed.)
4. Multiple answers to the same activity will be treated as wrong and will not be given any credit.
5. Maintain the sequence of the Sections/Question Nos./Activities throughout the activity sheet.

1. What is the SI unit of electric flux?

Correct Answer: Volt–meter (V·m)

Solution:

Step 1: Understanding the Question:
The question asks for the standard international (SI) unit for electric flux (Φ_E). Electric flux is a measure of the electric field passing through a given surface.

Step 2: Key Formula or Approach:
The SI unit can be derived from the definition of electric flux, which is the product of the electric field magnitude and the area perpendicular to the field.

$$\Phi_E = E \times A$$

Where E is the electric field and A is the area.

Step 3: Detailed Explanation:

- **Unit of Electric Field (E):** The SI unit for the electric field can be expressed in two common ways: Volts per meter (V/m) or Newtons per Coulomb (N/C).

- **Unit of Area (A):** The SI unit for area is square meters (m^2).

- **Deriving the Unit of Flux:** By multiplying the units of electric field and area, we can find the unit for electric flux.

Method 1: Using Volts per meter

$$\text{Unit of } \Phi_E = (\text{Unit of E}) \times (\text{Unit of A}) = \left(\frac{V}{m}\right) \times (m^2) = \mathbf{V{\cdot}m}$$

Method 2: Using Newtons per Coulomb

$$\text{Unit of } \Phi_E = \left(\frac{N}{C}\right) \times (m^2) = \frac{N \cdot m^2}{C}$$

Both V·m and N·m²/C are correct SI units for electric flux, but Volt-meter is more commonly used.

Step 4: Final Answer:
The SI unit of electric flux is the **Volt-meter (V·m)**.

Quick Tip

Electric flux unit can be quickly remembered as:

$$\text{Electric field} \times \text{Area}$$

So just multiply the unit of E (V/m) by m^2.

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2. Define the dielectric constant of a medium.

Correct Answer: The dielectric constant of a medium is the ratio of the permittivity of the medium to the permittivity of free space.

Solution:

Step 1: Understanding the Question:
The question asks for the definition of the dielectric constant. This is a fundamental property of a dielectric (insulating) material that describes its effect on an electric field.

Step 2: Key Formula or Approach:
The dielectric constant, often denoted by K or ε_r (relative permittivity), is defined by the formula:

$$K = \frac{\varepsilon}{\varepsilon_0}$$

where ε is the permittivity of the dielectric medium and ε_0 is the permittivity of free space (vacuum).

Step 3: Detailed Explanation:

- When a dielectric material is placed in an external electric field, it becomes polarized, creating an internal electric field that opposes the external field. This reduces the net electric field within the material.

- **Permittivity (ε)** is a measure of how much a material resists the formation of an electric field within it. A higher permittivity means more resistance and a greater reduction in the field.

- The **dielectric constant (K)** is a dimensionless factor that quantifies this effect. It compares the permittivity of the material (ε) to the permittivity of a vacuum (ε_0).

- For example, if a material has a dielectric constant of K=2, it means it can reduce the electric field to half its strength compared to a vacuum. It also means a capacitor with this material can store twice the charge for the same voltage.

Step 4: Final Answer:
The dielectric constant of a medium is defined as the ratio of the absolute permittivity of that medium to the absolute permittivity of free space. It indicates by what factor the electric field is reduced inside the medium compared to a vacuum.

Quick Tip

Dielectric constant is also called **relative permittivity**.

$$K = \frac{\text{Permittivity of medium}}{\text{Permittivity of vacuum}}$$

It has **no unit**.

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3. Define Curie temperature in magnetism.

Correct Answer: Curie temperature is the temperature above which a ferromagnetic material loses its permanent magnetism and becomes paramagnetic.

Solution:

Step 1: Understanding the Question:
The question asks for the definition of "Curie temperature" (T_C). This is a critical temperature that marks a phase transition in the magnetic properties of certain materials.

Step 2: Detailed Explanation:
The concept of Curie temperature is related to the behavior of ferromagnetic materials like iron, nickel, and cobalt.

- **Below Curie Temperature ($T < T_C$):** In a ferromagnetic material, the magnetic moments of atoms align spontaneously in regions called magnetic domains. This alignment creates a strong, permanent magnetic field. The material is **ferromagnetic**.

- **Effect of Increasing Temperature:** As the temperature of the material increases, the atoms gain thermal energy. This energy causes random vibrations (thermal agitation), which works against the alignment of the magnetic moments.

- **At the Curie Temperature ($T = T_C$):** The Curie temperature is the specific point where the thermal energy becomes powerful enough to completely disrupt the long-range ordering of the magnetic domains.

- **Above Curie Temperature ($T > T_C$):** The spontaneous magnetization disappears. The material loses its ferromagnetic properties and starts behaving like a **paramagnetic** substance, where it is only weakly attracted to an external magnetic field.

Step 3: Final Answer:
The Curie temperature is the characteristic temperature for a ferromagnetic material above which it undergoes a phase transition and loses its permanent magnetic properties, becoming paramagnetic.

Quick Tip

Below Curie temperature: Ferromagnetic behavior
Above Curie temperature: Paramagnetic behavior
Curie temperature is a characteristic property of each material.

4. Using Gauss's law, obtain an expression for the electric field at a point due to a uniformly charged infinite plane sheet.

Correct Answer: The electric field due to an infinite plane sheet of charge is

$$E = \frac{\sigma}{2\varepsilon_0}$$

where σ is surface charge density.

Solution:

Step 1: Understanding the Question:
The task is to derive the mathematical expression for the electric field (E) produced by an infinite, flat sheet with a uniform surface charge density (σ), using Gauss's law.

Step 2: Key Formula or Approach:
The fundamental principle to be used is Gauss's law, which states:

$$\oint \vec{E} \cdot d\vec{A} = \frac{Q_{\text{enc}}}{\varepsilon_0}$$

The strategy involves choosing an appropriate Gaussian surface that simplifies the calculation of the electric flux.

Step 3: Detailed Explanation:
1. Symmetry and Choice of Gaussian Surface:
For an infinite plane sheet, the electric field lines must be uniform and perpendicular to the sheet due to symmetry. A convenient Gaussian surface is a cylinder (or "pillbox") of cross-sectional area A that pierces the sheet, with its flat faces parallel to the sheet.

2. Calculate the Electric Flux (Φ_E):
The total flux is the sum of the flux through the two flat faces and the curved side of the cylinder.

- **Flux through the curved side:** The electric field $\vec{E}$ is parallel to the curved side, meaning it is perpendicular to the area vector of the curved side. Therefore, $\vec{E} \cdot d\vec{A} = 0$ for the curved surface, and the flux is zero.

- **Flux through the flat faces:** The electric field $\vec{E}$ is perpendicular to both flat faces and points outward (for $\sigma > 0$). The flux through each face is $E \times A$. Since there are two faces, the total flux is:

$$\Phi_E = EA + EA = 2EA$$

3. Calculate the Enclosed Charge (Q_{enc}):
The charge enclosed within the Gaussian surface is the charge on the area of the sheet that is inside the cylinder. Given the surface charge density σ (charge per unit area), the enclosed

charge is:

$$Q_{\text{enc}} = \sigma \times A$$

4. Apply Gauss's Law:
Now, we substitute the expressions for flux and enclosed charge into Gauss's law:

$$2EA = \frac{\sigma A}{\varepsilon_0}$$

5. Solve for the Electric Field (E):
We can cancel the area A from both sides of the equation and solve for E:

$$2E = \frac{\sigma}{\varepsilon_0} \implies E = \frac{\sigma}{2\varepsilon_0}$$

Step 4: Final Answer:
The electric field at any point due to a uniformly charged infinite plane sheet is $E = \frac{\sigma}{2\varepsilon_0}$. The field is uniform and does not depend on the distance from the sheet.

> **Quick Tip**
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> Electric field of an infinite plane sheet is **uniform** and does not depend on distance from the sheet.
>
> $$E = \frac{\sigma}{2\varepsilon_0}$$
>
> This is a standard Gauss's law result.

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5. State Gauss's law. Determine the electric field intensity at a point due to an infinitely long uniformly charged straight wire.

Correct Answer: Gauss's law states that the total electric flux through a closed surface equals the charge enclosed divided by ε_0. The electric field at distance r from an infinite line charge is:

$$E = \frac{\lambda}{2\pi\varepsilon_0 r}$$

where λ is linear charge density.

Solution:

Step 1: Understanding the Question:
This question has two parts. First, it requires a formal statement of Gauss's law in electrostatics. Second, it asks for the derivation of the electric field produced by an infinitely long straight wire with a uniform linear charge density (λ).

Step 2: Detailed Explanation - Part 1 (Statement of Gauss's Law):
Gauss's law states that the total electric flux (Φ_E) passing through any closed surface (known as a Gaussian surface) is equal to $\frac{1}{\varepsilon_0}$ times the total net electric charge (Q_{enc}) enclosed within that surface.
Mathematically, it is expressed as:

$$\Phi_E = \oint \vec{E} \cdot d\vec{A} = \frac{Q_{\text{enc}}}{\varepsilon_0}$$

Step 3: Detailed Explanation - Part 2 (Derivation for an Infinite Wire):
1. Symmetry and Choice of Gaussian Surface:
An infinitely long charged wire possesses cylindrical symmetry. The electric field at any point must be directed radially outward (for $\lambda > 0$) from the wire, and its magnitude can only depend on the radial distance r. The appropriate Gaussian surface is a cylinder of radius r and length L, coaxial with the wire.

2. Calculate the Electric Flux (Φ_E):
The total flux is the sum of fluxes through the two flat end caps and the curved side of the cylinder.

- **Flux through the flat ends:** The electric field $\vec{E}$ is parallel to the flat ends (perpendicular to their area vectors). Thus, the flux through them is zero.

- **Flux through the curved side:** The electric field $\vec{E}$ is perpendicular to the curved surface at every point. The magnitude E is constant on this surface. The area of the curved surface is $2\pi rL$. Therefore, the flux is:

$$\Phi_E = E \times (\text{Area of curved surface}) = E(2\pi rL)$$

3. Calculate the Enclosed Charge (Q_{enc}):
The linear charge density is λ (charge per unit length). The charge enclosed in the Gaussian cylinder of length L is:

$$Q_{\text{enc}} = \lambda \times L$$

4. Apply Gauss's Law:
Equating the expressions for flux and enclosed charge:

$$E(2\pi rL) = \frac{\lambda L}{\varepsilon_0}$$

5. Solve for the Electric Field (E):
Cancel the length L from both sides and rearrange to solve for E:

$$E = \frac{\lambda}{2\pi\varepsilon_0 r}$$

Step 4: Final Answer:
The electric field intensity at a distance r from an infinitely long uniformly charged wire is

$E = \frac{\lambda}{2\pi\varepsilon_0 r}$. The field strength is inversely proportional to the distance from the wire.

Quick Tip

Remember standard Gauss law results:
Line charge: $E \propto \frac{1}{r}$
Plane sheet: Constant field
Point charge: $E \propto \frac{1}{r^2}$

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6. State Huygens' Principle. Use it to prove the laws of reflection or laws of refraction at a plane surface.

Correct Answer: Huygens' principle states that every point on a wavefront acts as a source of secondary wavelets which spread in all directions with the speed of the wave. Using Huygens' construction, we obtain: - Law of reflection: $i = r$ or - Law of refraction: $n_1 \sin i = n_2 \sin r$

Solution:

Step 1: Understanding the Question:
The question asks for two things: first, to state Huygens' Principle, which describes how waves propagate. Second, to use this principle to geometrically prove either the law of reflection ($i = r$) or the law of refraction (Snell's Law).

Step 2: Detailed Explanation - Part 1 (Huygens' Principle):
Huygens' Principle is a method for analyzing wave propagation and can be stated in two parts:

1. Every point on a given wavefront acts as a source of new disturbances, called secondary wavelets, which spread out in all directions with the same speed as the original wave.

2. The new position of the wavefront at any later time is the forward envelope (the surface tangent to all the secondary wavelets).

Step 3: Detailed Explanation - Part 2 (Proof of Law of Reflection):
Let's prove the law of reflection ($i = r$) using Huygens' principle.
1. Setup:
Consider a plane wavefront AB incident at an angle i on a reflecting surface XY. Let v be the speed of the wave. The incident rays are perpendicular to the wavefront AB.

2. Wave Propagation:
As the wavefront advances, point A touches the surface at time $t = 0$ and starts to emit a secondary wavelet. Let the wavefront take a time τ for point B to reach point C on the surface.

During this time, the distance traveled by this part of the wave is $BC = v\tau$.

3. Constructing the Reflected Wavefront:
In the same time τ, the secondary wavelet originating from A will have spread out into a hemisphere of radius $AD = v\tau$. The new, reflected wavefront is the tangent surface CD drawn from point C to this wavelet.

4. Geometric Proof:
Now, consider the two right-angled triangles, $\triangle ABC$ and $\triangle ADC$.

- The side AC is common to both triangles.
- The side lengths $BC = v\tau$ and $AD = v\tau$ are equal.
- Both are right-angled triangles ($\angle B = \angle D = 90°$).

By the Right-angle-Hypotenuse-Side (RHS) congruence rule, $\triangle ABC \cong \triangle ADC$.
Therefore, the corresponding angles must be equal. The angle of incidence is $i = \angle BAC$, and the angle of reflection is $r = \angle DCA$.
Hence, $\mathbf{i} = \mathbf{r}$. This proves the law of reflection.

Step 4: Final Answer:
Huygens' principle states that every point on a wavefront is a source of secondary wavelets, and the new wavefront is their tangent envelope. Using this principle, by constructing the reflected wavefront from an incident wavefront, we can geometrically prove that the angle of incidence i is equal to the angle of reflection r.

Quick Tip
Huygens' principle explains wave behavior geometrically. Reflection: $i = r$ Refraction: $n_1 \sin i = n_2 \sin r$ It proves light behaves as a wave.