Case Based Questions

Solution 1

(i) The charge given to a conductor resides on the surface of the conductor. So the total charge inside the conductor is zero. Thus, option (b) is the correct answer.

(ii) Electric field is Perpendicular to the surface of the conductor. Thus, option (a) is the correct answer.

(iii) The first condition to be applied while using the gauss law is first to choose the gaussian surface. Thus, option (a) is the correct answer.

(iv) The amount of flux moving out of a closed Gaussian surface is only dependent on the charge placed inside the Gaussian surface. Thus, option (b) is the correct answer.

(v) The flux of the electric field through a closed Gaussian surface is

$\phi = \frac{q}{\varepsilon_0} = \frac{2\times10^{-6}}{8.85\times10^{-12}} = 2.25 \times 10^5\ Nm^2/C$

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Thus, option (a) is the correct answer.

Solution 2

(i) The relationship between the critical angle and the refractive index of the medium is given by $\mu = \frac{1}{\sin i_c}$. Thus, option (b) is the correct answer.

(ii) The total internal reflection of light takes place only when the light ray is incident on the denser to rarer interface. Thus, option (b) is the correct answer.

(iii) The outer concentric shell in the fiber optic is called cladding. Thus, option (a) is the correct answer.

(iv) $n_1 > n_2$ is the correct relationship between the refractive index of the inner and the outer material. Thus, option (a) is the correct answer.

(v) Snell's law can be used to calculate the index of refraction for the water the second medium is air and the first medium is water

$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$
$$n_1 = \frac{n_2 \sin\theta_2}{\sin\theta_1} = \frac{1 \sin 90^0}{\sin 25^0} = 2.37$$

Thus, option (a) is the correct answer.

Solution 3

(i) The necessary condition for interference is that the two sources must be coherent. Thus, option (a) is the correct answer.

(ii) The sources originating from the same parent source are known as the coherent source. Thus, option (a) is the correct answer.

(iii) Superposition of light is the basic principle that is used in the interference of light. Thus, option (b) is the correct answer.

(iv) The intensity is dependent on the square of the amplitude if the two waves. If the two waves adds constructively then there intensity is four times the original value. Thus, option (c) is the correct answer.

(v) The shape of the pattern depends on the shape of the slits. Thus, option (d) is the correct answer.