

CBSE Sample Paper 5

General Instruction:

1. Answer all questions
2. Internal choices are provided for some questions
3. Question numbers 1 to 8 are very short answer questions and carry 1 mark each.
4. Question numbers 8 to 18 are short answer questions and carry 2 marks each.
5. Question numbers 19 to 27 are also short answer questions and carry 3 marks each.
6. Question numbers 28 to 30 are long answer questions and carry 5 marks each.
7. Use log tables if necessary.

Very Short Answer type questions

Question 1

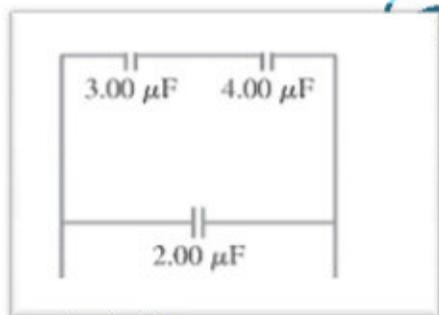
Let v_1 and v_2 are the velocities of light rays of wavelength 300 \AA and 400 \AA in vacuum. What can be said about the expression $v_1 - v_2$?

Question 2

Two wires X and Y are of same metal. They have same area of cross-section. The length of the wires are L_1 and L_2 such that $L_1 = 2L_2$. A potential difference V is applied across the two wires one by one and current reading are noted. Let I_1 and I_2 are current respectively. What will be the relation between the I_1 and I_2 ?

Question 3

Find the equivalent capacitance in the circuit



Question 4

What is the name of the temperature where ferromagnetism vanishes in the substance and the substance becomes paramagnetic ?

Question 5

What is the unit of magnetic moment?

Question 6

A capacitor of capacity $10 \mu\text{F}$ is connected in series with an inductance of 1 henry having an AC source of frequency 50 Hertz. What is the impedance of the circuit?

Question 7

State Wien's displacement Law

Question 8

Define activity of the radioactive substance?

Short Answer type questions**Question 9**

The energy of the photon is 10eV . Calculate following

- i) Momentum
- ii) Wavelength of the photon
- iii) Rest mass and Kinetic mass of the photon

Question 10

The radii of two concentric spherical conducting shell are R and r ($R > r$). The charge on the outer shell is Q . What will be the charge on inner shell which is connected to the earth?

Question 11

What is Laser radiation ? and explain its usage in medicine and surgery?

Question 12

- a) What is wattless current?
- b) What is the expression for power in AC circuit.?

Question 13

A radioactive substance N disintegrates to N_0 for the time interval equal to its average life. What is the value $N - N_0$

Question 14

Two resistance r and R are connected in parallel ($r > R$). The equivalent resistance is R_{eq} . State true or false

- 1) $R > R_{eq}$
- 2) Voltage drop is same across both
- 3) Current is lower in higher resistance

Question 15

Write the formula for the magnetic force acting between two parallel moving charges, explaining the meaning of the symbols used?

Question 16

An electron is passing through a field

Please answer these question with reason

- The electron comes out of field with out any deflection and field present is magnetic field. Can this be true?
- The electron comes out of field with deflection. Is it necessary that Field is definitely magnetic ?

Question 17

What is photoelectric cell's? Explain the working of Photovoltaic cell

Question 18

A bulb and a capacitor are connected in series to a source of AC source

- What will happen to impedance of circuit on increasing the frequency of the AC circuit.? Will the bulb will glow more ?
- What will happen to impedance of circuit on decreasing the frequency of the AC circuit.? Will the bulb will glow more ?

Question 19

What is electric dipole? Derive an expression for the electrostatic potential at a point on the axis of the dipole?

Question 20

Two parallel plate capacitor $20\mu\text{F}$ and $30\mu\text{F}$ are charged to 30 V and 20 V respectively. Now they are connected in parallel, Find out following

- The common Potential difference
- The charge on each capacitor initially and after they are connected in parallel

Question 21

- A $2\mu\text{F}$ capacitor is connected to 5 Henry coil of resistance 3 ohm . What is the resonant frequency of the circuit.?
- What is the impedance of the above circuit at resonance?

Question 22

What is wheatstone bridge .Draw the neat diagram and obtain the balance equation?

Question 23

A convex lens of focal length 20 cm and made of glass of refractive index 1.5 is immersed in water. Find the change in the focal length of the lens. Refractive index of water is 1.33

Question 24

- What is truth table of a logic gate?
- Write Boolean expression and truth table for AND gate

Question 25

An alternating voltage given by

$$V(t) = 10\sqrt{2} \sin(2500t + 45^\circ)$$

It is applied across a series combination of Resistance $R=3K$ ohm and Capacitor of capacitance $C=.1\mu F$

Find out following things from the above given values

- i) The peak value and rms value of the current in the circuit
- ii) The phase difference between current and voltage
- iii) The power factor of the circuit

Question 26

The ground state energy of hydrogen atom is -13.6 eV. If an electron makes a transition from a energy level -0.85 eV to -3.4 eV, Calculate the wavelength of the spectral line emitted. To which series of hydrogen spectrum does this wavelength belong?

Question 27

What is polaroid? How is plane polaroid light obtained with its help? How will you use it to distinguish between unpolarised light and plane polarized light?

Question 28

- i) Define the dispersive power of an optical medium. Obtain a formula for the dispersive power of the material of a prism in terms of refractive index.
- ii) The refractive indices of crown glass for violet and red colors are respectively 1.523 and 1.513. Determine the dispersive power of this glass

OR

- i) The focal lengths of the objective and the eyepiece of an astronomical telescope are 200 cm and 5cm respectively. What is the magnifying power if the final image is formed at infinity?
- ii) You are given three convex lens of focal length 20 cm, 2 cm and 3 cm which two lens should be used for the construction of a telescope in order to obtain maximum magnification?

Question 29

What is mean by the half life of a radioactive element? Establish the relation between half life and decay constant?

Question 30

Explain with the help of a labeled diagram the working principle of a cyclotron. Show that cyclotron frequency does not depend on the speed of the particle

OR

- i) Derive the expression for current carrying conductor in the magnetic field
- ii) A current of 3.0 A is flowing through a wire of length 100cm. The wire is placed at right angle with the direction of the Uniform magnetic Field of 5.0×10^{-4} N/Am. What force will act on the wire?

Solutions

Solution 1

1) Zero as velocities of light is constant in vacuum

Solution 2

$$I_1 = \frac{V}{R_1} = \frac{VA}{\rho L_1}$$

$$I_2 = \frac{V}{R_2} = \frac{VA}{\rho L_2}$$

$$\frac{I_1}{I_2} = \frac{L_2}{L_1} = \frac{1}{2}$$

Solution 3

The equivalent capacitance is found by combining the 3 and 4 resistors in series, and then adding the 2 capacitor in parallel with that series combination.

$$C_{eq} = \left(\frac{1}{3} + \frac{1}{4} \right)^{-1} + 2 = 26/7 \mu F$$

Solution 4

Curie temperature

Solution 5

Ampere-m²

Solution 6

The impedance of the circuit is given by

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

Here

$$\omega = 2\pi f = 314 \text{ s}^{-1}$$

Substituting the values, we get

$$Z = 4.5 \Omega$$

Solution 9

The formula are

$$E = \frac{hc}{\lambda} \quad (1)$$

$$p = \frac{h}{\lambda} \quad (2)$$

$$m = \frac{hc}{\lambda} \quad (4)$$

The wavelength can be found from equation 1, and then momentum can be found from equation 2. Rest mass is zero and kinetic mass can be found from equation 3

Solution 10

Let q be the charge on the inner shell, The potential would be then

$$V = \frac{1}{4\pi\epsilon_0} \left(\frac{q}{r} + \frac{Q}{R} \right)$$

Since this must be zero, we get

$$q = -Qr/R$$

Solution 13

$$\frac{1}{e} - 1$$

Solution 14

True

True

True

Solution 15

$$F_m = \frac{\mu_0 q_1 q_2 v_1 v_2}{4\pi r^2}$$

Solution 23

For the lens in air

$$\frac{1}{f_a} = (\mu - 1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

Where $f_a = 20$ cm and $\mu = 1.5$, Thus we have

$$\frac{1}{20} = (1.5 - 1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right) \quad \text{---(1)}$$

For the lens in water

$$\frac{1}{f_w} = \left(\frac{\mu_g - \mu_w}{\mu_w} \right) \left(\frac{1}{R_1} - \frac{1}{R_2} \right) \quad \text{---(2)}$$

Now $\mu_g = 1.5$ and $\mu_w = 1.33$

From equation (1) and (2), we get

$$f_w = 78.2 \text{ cm}$$

So change in focal length = 58.2 cm

Solution 25

The voltage is given by

$$V(t) = 10\sqrt{2} \sin(2500t + 45^\circ)$$

Comparing it with the standard equation

$$V = V_0 \sin(\omega t + \phi)$$

We get

$$V_0 = 10\sqrt{2} \text{ Volt}$$

$$\omega = 2500 \text{ rad / se}$$

Now the impedance of the circuit is given by

$$Z = \sqrt{R^2 + \left(\frac{1}{\omega C}\right)^2}$$

Substituting the above values

$$Z = 5000 \Omega$$

The rms Value of the current in the circuit is given by

$$i_{rms} = \frac{V_{rms}}{Z} = \frac{V_0}{Z\sqrt{2}} = 2 \times 10^{-3} \text{ A}$$

$$i_0 = i_{rms} \sqrt{2} = 2\sqrt{2} \times 10^{-3} \text{ A}$$

The phase difference between the current and voltage is

$$\phi = \tan^{-1}\left(\frac{1/\omega C}{R}\right) = \tan^{-1}(4/3)$$

The power factor of the circuit is

$$\cos \phi = \frac{R}{Z} = .6$$

Solution 26

Energy of the emitted photon

$$= 0.85 - (-3.4) = 2.55 \text{ eV}$$

Now

$$h\nu = hc/\lambda = E_2 - E_1$$

or

$$\lambda = hc/(E_2 - E_1)$$

Substituting all the values

$$\lambda = 4.853 \times 10^{-7} \text{ m} = 4853 \text{ \AA}$$

This wavelength belongs to balmer series of hydrogen atom