CBSE Sample Paper 1

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

Two charges Q_1 and Q_2 are placed close to each other
What is the nature of force between them?
a) $Q_1Q_2 < 0$
b) $Q_1Q_2 > 0$
c) $Q_1+Q_2=0$

Question 2

What is the relation between electric field E and current density **j** inside a conductor?

Question 3

A quantity Y is given by $Y = \varepsilon_0 L \frac{\Delta V}{\Delta t}$ Where

ε_0 -> permittivity of free space, L -> Length
ΔV -> potential difference , Δt -> Time interval
The dimensional formula for Y is same of quantity ……

Question 4

What are the maximum and minimum values of power factor in a LCR circuit and under what conditions?

Question 5

Two plane mirrors are placed at 90^0 to each other. How many numbers of images would be formed?

Question 6

What is the de Broglie wavelength of a 3 Kg object moving with a speed of 2 m/s?

Question 7

In a common –base transistor amplifier, the input and the output resistances are 500 ohm and 400 kilo ohm respectively and the emitter current is 1.0 mA. Find the input and output voltages .Given α.=.95

Question 8
What is amplitude modulation?

Short Answer type questions

Question 9
An electric heater is connected turn by turn to DC and AC sources of equal voltages. Will the rate of heat production be same in the two cases? Explain

Question 10
Explain how the width of the depletion layer in p-n junction diode changes when the junction is
i) Forward biased ii) Reverse biased

Question 11
What is photoelectric effect? A metal has threshold frequency $5X10^{14}$ Hz, find the work function of the metal?

Question 12
Explain why nichrome is used standard resistance coils?

Question 13
What type of materials is used for making?
a) permanent magnets
b) Transformer cores

Question 14
Explain why a potentiometer is preferred over a voltmeter for measuring the potential difference

Question 15
What is Hall effect? And what information is drawn from Hall's effect?

Question 16
A square coil of side 10cm is placed in the east west plane. A magnetic field of 0.1T is set up in 0.7s and in the north-east direction through the coil. The coil has a resistance of 0.7 Ω, what is the magnitude of the induced emf and current?

Question 17
A uniformly wound solenoidal coil of self inductance $1.8X10^{-4}$ Henry and resistance 6 ohm is broken up into two identical coils. These identical coils are then connected in parallel across a 12 V battery of negligible resistance.
1) The time constant for the current in the circuit
2) Steady state current through the battery

Question 18

How does the stopping-potential depend upon the frequency and intensity of the incident light? Explain by drawing graph

Question 19

Cell X has an emf E_1 and internal resistance r_1 while Cell Y has emf E_2 and internal resistance r_2. Find the expression for equivalent emf and internal resistance?

Question 20

What is photo electric effect? Explain the effect of increase of (I) frequency (ii) intensity of radiation on photo electrons emitted by a photo tube

Question 21

The ionization energy of the Hydrogen atom is given to be 13.6 eV. A photo falls on a hydrogen atom which is initially in the ground state and excites it to the n=4 state.

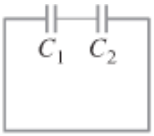
a) Show this transition in the energy –level diagram

b) Calculate the wavelength of the photon

Given $h=4.14X10^{-15}$ eV-sec

$c=3X10^{8}$ m/s

Question 22



A capacitor of Capacitance C_1 carries a charge q .it is then directly connected to an uncharged capacitor of capacitance C_2

a) What charge each capacitor will carry b) what will be the PD of each capacitor

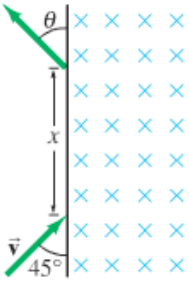
Question 23

Describe and prove both the laws of Kirchhoff's Law

Question 24

With the help of circuit diagram explain the process of amplitude modulation and demodulation.

Question 25



A proton moving with velocity v=2X10^5 m/s enters a magnetic field as shown in figure above at 45^0
a) Find out the value of x
b) Find out the value of θ

Question 26
Derive the relation $N_t = N_0 e^{-\lambda t}$ for radio active decay. Obtain the relation between disintegration constant and half-life.

Question 27
Explain why hydrogen spectrum cannot be explained on the basis of Rutherford model of atom. Explain the origin of any two series of the hydrogen spectrum

Question 28
i) Explain the emission of $\alpha-$ and $\beta-$particles from the nucleus of a radioactive substance.
ii) In the series of radio-active disintegration of ${}_{92}U^{238}$ first an alpha particle and then a beta particle is emitted. What are the atomic and mass numbers of the new nucleus formed by these successive disintegrations

Question 29
i) Explain the construction and working of a moving coil galvanometer using a labeled diagram. Define its current and voltage sensitivity and explain how they can be increased
ii) A galvanometer having 20 divisions on its scale and resistance of 50 ohm when joined in series to a 1.5 Volt cell through a resistance of 100 ohm gives full scale deflection. Find the figure of merit of the galvanometer?

Question 30
Derive a relation between focal length of a double convex lens and its radii of curvature.

Solutions

Solution 1:
For $Q_1Q_2 < 0$
Both the charges will have to be of different sign. So it means force of attraction

For $Q_1Q_2 > 0$

Both the charges will have to be of same sign. So it means force of repulsion

For $Q_1+Q_2=0$

Both the charges will have to be of different sign. So it means force of attraction

Solution 2:
J=σE
Where σ is the specific conductance

Solution 3:
On giving a charge q to a sphere of radius L,the potential at its surface is given by

$$V = \frac{1}{4\pi\varepsilon_0}\frac{q}{L}$$

$$\therefore \frac{\Delta V}{\Delta t} = \frac{1}{4\pi\varepsilon_0}\frac{\Delta q}{L\Delta t}$$

Now

$$Y = \varepsilon_0 L\frac{\Delta V}{\Delta t}$$

Or

$$Y = \frac{1}{4\pi}\frac{\Delta q}{\Delta t} = \frac{1}{4\pi}i$$

So dimension are same as that of current

Solution 4:
Power factor is given by

$$\cos\phi = \frac{R}{\sqrt{R^2 + (\omega L - \frac{1}{\omega C})^2}}$$

The maximum value of cosΦ is 1 which occurs when

$\omega L = \frac{1}{\omega C}$ i.e. at resonance

The minimum value of cosΦ is 0 which occurs when R=0 but $\omega L \neq \frac{1}{\omega C}$

Solution 5:
The formula to be used is

$$n = \frac{360}{\theta} - 1$$

Here $\theta = 90^0$
So
N=3

Solution 6:
de Broglie wavelength is given by

$$\lambda = \frac{h}{mv}$$

Here m=3 kg and v=2m/s
Also $h = 6.6 \times 10^{-34}$
So
$\lambda = 1.1 \times 10^{-34}$ m

Solution 7:
The input voltage is emitter current multiplied by input resistance that is
$V_{in} = I_e X R_{in} = (1.0 \times 10^{-3}\ A) \times 500 = .5\ V$

Similarly ,the output voltage is
$V_{out} = i_c X\ R_{out} = \alpha i_e X R_{out} = 380\ V$

Solution 9:
The element of the heater is a coil having inductance L besides the resistance R. Hence for AC,its effective resistance $\sqrt{R^2 + (\omega L)^2}$ will be larger than its resistance R for DC. Hence the heat production per sec for the same voltage will be less in case of AC

Solution 11:
Work function is given by
$W_0 = h\nu_0 = 2eV$

Solution 17
The solenoidal coil is a series combination of the two smaller coils in which it is broken up. Therefore the inductance of both the coil will be $.9 \times 10^{-4}$ Henry and resistance is 3 ohm.
In parallel, The effective inductance of the circuit would be
$L = .45 \times 10^{-4}$ H
The effective resistance would be
R= 1.5 ohm

Therefore Time constant would be given as

$$\tau = \frac{L}{R} = 3.0X10^{-4}s$$

And the steady state current is

$$i = \frac{V}{R} = 8.0A$$

Solution 18

The stopping potential is the measure of the maximum kinetic energy E_k of the photo electrons. Hence according to Einstein's equation

$$E_k = h(v - v_0)$$

The graph between E_k and frequency of light v will be a straight line whose slope is h. Now it also infers that stopping –potential does not depend upon the intensity of light . So the graph between stopping potential and intensity of light will be straight line parallel to the intensity axis

Solution 21:

E_1 =-13.6 eV,

$$E_4 = \frac{-13.6}{4^2} = -.85eV$$

Therefore the photon energy

$$\Delta E = E_4 - E_1 = 12.75eV$$

The wavelength corresponding to its is

$$\lambda = \frac{hc}{\Delta E} = 973.5A$$

Solution 22

There is no other source of charge except for the original capacitor. Thus the total charge must remain at q Also, since the plates of the one capacitor are connected via equipotential wires to the plate of the other capacitor, the two capacitors must have the same voltage across their plates. Use the total charge and fact of equal potentials to find the charge on each capacitor and the common potential difference

Let Q_1 and Q_2 be the charged after it

Then

$q=Q_1+Q_2$

$Q_1=C_1V$ and $Q_2=C_2V$

From the above equation ,we can easily conclude that

$$V = \frac{q}{C_1 + C_2}$$

$$Q_1 = q\frac{C_1}{C_1 + C_2}$$

$$Q_2 = q\frac{C_2}{C_1 + C_2}$$

Solution 25:
In the magnetic field, the proton will move along an arc of a circle. The distance *x* in the diagram is a chord of that circle, and so the center of the circular path lies on the perpendicular bisector of the chord. That perpendicular bisector bisects the central angle of the circle which subtends the chord. Also recall that a radius is perpendicular to a tangent. Applying geometry and comparing angles, it can be easily concluded that
$\theta = 45^0$
Also the radius of curvature or circle is given by

$$r = \frac{mv}{qB}$$

The chord (x) is given by

$$x = 2r\cos\theta$$

$$x = 2\frac{mv}{qB}\cos\theta$$

Substituting all the values
$x=3.5X10^{-3}$ m

Solution 28
i) From the chapter
ii) When an alpha particle is emitted from the nucleus of a radioactive atom, its atomic number is reduced by 2 and the mass number is reduced by 4.The atomic number of Uranium is 92 which on emission of a alpha particle becomes 90 and its mass number reduces to 234 from 238
On the emission of the beta particle, the atomic number is increased by 1 whereas the mass number remains unchanged. Thus after the emission of a beta particle from the nucleus of atomic number 90 and mass number 234,the atomic number of the new nucleus will be 91 while the mass number will remain same

Solution 29:
i) As described in notes
ii) The current giving full scale deflection in the galvanometer is given by

$$i = \frac{emf}{totalresis\tan ce} = \frac{1.5}{(50+100)} = .01A$$

The figure of merit is defined as current per unit deflection and give by

$$\frac{i}{\phi} = \frac{.01}{20} = 5X10^{-4}\,A/div = .5mA/div$$