# CBSE Sample Paper 2

***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.

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**Very Short Answer type questions**

**Question 1**

1 A spherical conducting shell of inner radius $R_1$ and outer radius $R_2$ has a charge Q A charge q is placed at the center of the shell .What is the surface charge density on the inner and outer surfaces of the shell

**Question 2**

Find the unit of specific conductivity

**Question 3**

Three electric lamps A,B and C are marked (220V,100W) ,(220V,60W) and (220V,40W). Write down the lamps in decreasing order of their resistance?

**Question 4**

Find the inductance of the inductor that would have a reactance of 50 ohm when used with an a.c source of frequency $(10/\pi)$ kHz.

**Question 5**

What is the resolving power of a microscope?

**Question 6**

The maximum KE of the electrons emitted in a photocell is 10eV. What is the stopping potential?

**Question 7**

What is frequency modulation?

**Question 8**

Why is the conductivity of n –type semi conductor greater than p-type semiconductor even when both of these have same level of doping?

**Short Answer type questions**

**Question 9**
With the help of a diagram ,show the biasing of a light emitting diode (LED). Give its two advantage over conventional incandescent lamps

**Question 10**
A bulb is connected in series with variable capacitor
a) Will the bulb glow when connected to DC source supply?
b) Will the bulb glow when connected to AC source supply
c) what will be the effect on both the above if the capacitance is reduced

**Question 11**
i)An electron beam passes through certain of crossed electric and magnetic field of intensities $E_0$ and $B_0$ respectively, for what value of electron speed,will the beam remains undeflected?
ii) A beam of alpha particles and of protons of same kinetic energy enters a uniform magnetic field at right angles to the field lines. The particles describe circular paths . Calculate the ratio of the two paths

**Question 12**
State Faraday's law of electromagnetic induction. Express it mathematically.

**Question 13**
Connect three capacitors of 3μF , 3μF and 6μF such that their equivalent capacitance is 5 μF

**Question 14**
Draw a circuit diagram of a common-emitter amplifier using a n-p-n transistor. Prove that in this amplifier, the output voltage is $180^0$ out of phase with the input voltage.

**Question 15**
What is Wien's displacement Law?

**Question 16**
A point change q is surrounded by a spherical Gaussian surface of radius r and now if the sphere is replaced by the cube of side r,will the electric flux through this surface will be larger then spherical surface ?. Explain

**Question 17**
In a car spark –coil,when the current in the primary is reduced from 4.0 A to zero in 10μs ,an emf of 40,000 V is induced in the secondary . Find the mutual inductance M of the primary and secondary winding of the spark coil?

**Question 18**
In a common –emitter amplifier the load resistance of the output circuit is 1000 times the load resistance of the input circuit . If $\alpha = .98$ ,the calculate the voltage gain

**Question 19**
What is transistor ? Describe the working n-p-n transistor.Why is it more useful in comparison to p-n-p transistors?

**Question 20**
The half life of radium is 1600 years.After how many years 25% of a radium block remains undecayed?

**Question 21**
What is the path of the charged particle in the uniform magnetic field if its velocity is not perpendicular to the magnetic field? Explain

**Question 22**
Explain the meaning of photo electric work function by giving necessary equation?

**Question 23**
When a current flows in the coil of a transformer, its core become hot ?

**Question 24**
Two inductance $L_1$ and $L_2$ are connected in parallel and are separated by large distance. Find the equivalent inductance of the arrangement? How will the result be affected if the separation is not large?

**Question 25**
The energy of an electron in an excited hydrogen atom is -3.4 eV. Calculate the angular momentum of the electron according to Bohr's theory
Plank constant (h) $=6.626X10^{-34}$ J-s

**Question 26**
The resistance of a tungsten filament at $150^0$ C is 133 ohm. What will be the resistance at $500^0$ C? The temperature coefficient of resistance of tungsten is 0.0045 per$^0$C.

**Question 27**
Two bulbs are marked 60W-220 V and 100W-220V. They are connected in parallel to the 220V mains. Which bulb will glow brighter ? if the one of the bulb is switched off,will the light in the room increase or decrease?

**Question 28**
i)What are eddy currents ? how are they produced? Give two applications of eddy current?
ii) A metal plate oscillates about a horizontal axis.A strong magnetic field is applied on the oscillating plate. What will happen?

**Question 29**

i) Define capacitance. Derive an expression for the capacitance of a parallel plate capacitor.

ii) Find out the energy density in a parallel plate capacitor in terms of electric field between the plates

**Question 30**

Explain the construction .principle and working of a DC motor .Find its efficency?

# Solutions

**Solution 1**
Uniform on both inner and outer shell

**Solution 2**
$Ohm^{-1}\ m^{-1}$

**Solution 3**
$$P = \frac{V^2}{R}$$
As V is constant
$$P\alpha \frac{1}{R}$$
So resistance in decreasing order
C>B>A

**Solution 4**
$$X_L = 2\pi\nu L$$
Or
$$L = \frac{X_L}{2\pi\nu} = \frac{50X10^{-3}}{2\pi(\frac{10}{\pi})} = 2.5X10^{-3}\,H$$

**Solution 5**
Resolving power of the microscope
$$= \frac{2\mu\sin\theta}{1.22\lambda}$$
Where
μ is the refractive index of the medium between the object and objective lens ,θ is the semi –solid angle of the cone of light subtended by the point object on the objective

**Solution 6**
$$\frac{1}{2}mv^2 = eV_0$$
So $V_0$=10 V

**Solution 8**
In n-type of semi-conductor, the conduction is due to electrons while p-type conductor has holes for conduction. The mobility of electron are higher for electrons then holes so that whys n-type are more conductive then p –type semiconductor

**Solution 10**
a) No current will flow in the circuit as the capacitor offer infinite reactance ( $X_c=1/\omega C =\infty$ as ω=0 for DC circuit

And this will not change if we reduce the capacitance also

b) Current will flow in the circuit as capacitor offers finite reactance.On reducing capacitance,reactance will increase thereby decreasing the current in the circuit and bulb will glow less brightly

**Solution 11**

i) When the electron passes undeflected through mutually perpendicular electric and magnetic field then

Then

Electric force = Lorentz force

$eE_0=evB_0$

or

$v=E_0/B_0$

ii) The radius of circular path followed by a charged particle in a uniform magnetic field B is given by

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

Now if K is the kinetic energy ,then

$$K = \frac{1}{2}mv^2 = \frac{m^2v^2}{2m}$$

$$mv = \sqrt{2mK}$$

So radius

$$r = \frac{\sqrt{2mK}}{qB}$$

So for protons

$$r_p = \frac{\sqrt{2m_pK}}{q_pB}$$

For alpha particles

$$r_a = \frac{\sqrt{2m_aK}}{q_aB}$$

Now

$$\frac{m_p}{m_a} = \frac{1}{4}$$

$$\frac{q_a}{q_p} = \frac{2}{1}$$

So

$$\frac{r_p}{r_a} = \frac{1}{1}$$

**Solution 13**

Capacitor connected in parallel give maximum equivalent capacitance and in series gives minimum equivalent capacitance, Thus

$$C_{\max} = 3 + 3 + 6 = 12\mu F$$

$$\frac{1}{C_{\min}} = \frac{1}{3} + \frac{1}{3} + \frac{1}{6} = \frac{5}{6}$$

$$C_{\min} = \frac{6}{5} = 1.2\mu F$$

The required capacitance 5μF is between $C_{max}$ and $C_{min}$ . Let it is C

$$C = 5\mu F = 3\mu F + 2\mu F = 3\mu F + \left( \frac{1}{\frac{1}{3} + \frac{1}{6}} \right)$$

Thus we shall connect 3μF and 6 μF in series and the remaining 3μF in parallel of the series combination

**Solution 16**

The electric flux depends only on the charge enclosed by the gaussian surface, not on the shape of the surface. Φ will be the same for the cube as for the sphere

**Solution 17**

The emf induced in the secondary is given by

$$e_2 = -M \frac{\Delta i_1}{\Delta t}$$

Where $\frac{\Delta i_1}{\Delta t}$ is the rate of change of current in the primary,Thus

$$M = -\frac{e_2}{\Delta i_1 / \Delta t}$$

Substituting the values given in question ,we get

M=.1H

**Solution 18**

$$\beta = \frac{\alpha}{1-\alpha} = \frac{.98}{1-.98} = 49$$

Therefore Voltage gain is given by

$$V_{gain} = \beta \frac{R_2}{R_1} = 49X1000 = 49X10^3$$

**Solution 20**

Suppose the initial quantity of radium is $N_0$ .Then the quantity left after n half lives will be

$$N = N_0\left(\frac{1}{2}\right)^n$$

Now here N=25% of $N_0$=$N_0$/4

So

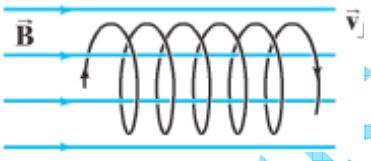
$$\frac{N_0}{4} = N_0\left(\frac{1}{2}\right)^n$$

Or n=2

Therefore time of disintegration =half-life X number of half lives
=1600X2=3200 years

**Solution 21**

The velocity vector can be broken into horizontal and vertical components parallel and perpendicular to the magnetic field . The velocity vector parallel to magnetic field results in no force and thus remain constant. The velocity components perpendicular to the magnetic field results in circular motion about the field lines.Putting these two motion together produces a helical motion around the field lines




**Solution 25**

In hydrogen aton,the energy of electron is the nth energy level is

$$E_n = -\frac{13.6}{n^2} eV$$

Here $E_n$ =.3,.4 eV,from this we n=2

According to Bohr's Model ,the angular momentum of the electron is

$$n\frac{h}{2\pi} = 2.11X10^{-34} J - s$$

**Solution 26**

If the resistance of wire at $0^0$C be $R_0$ and at $t^0$C be $R_t$ , then
$R_t$=$R_0$(1+αt)

Or,

$$R_0 = \frac{R_t}{1+\alpha t}$$

Where α is the temperature coefficient of resistance. The resistance of filament at $150^0$C is 133 ohm. Therefore its resistance at $0^0$C will be

$$R_0 = \frac{133}{1+(0.0045)\times 150} = 79.0 ohm$$

Now the resistance of filament at $500^0$C will be

$$R_{500} = R_0(1+\alpha t_{500}) = 257\Omega$$

**Solution 27**

100W bulb