

Q. 1. Write the S.I. unit of (i) electric field intensity and (ii) electric dipole moment.

Q. 2. What are superconductors?

Q. 3. Name the temperature for a thermocouple, at which its (i) thermo emf changes its sign, (ii) thermoelectric power becomes zero,

Q. 4. What should be the orientation of a magnetic dipole in a uniform magnetic field so that its potential energy is maximum?

Q. 5. An object is placed at the focus of concave lens. Where will its image be formed?

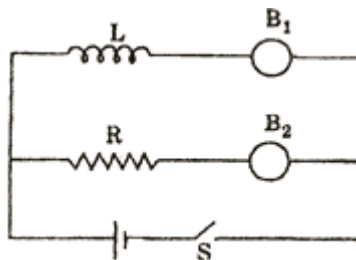
Q. 6. Two point charges $q_A = +3 \mu\text{C}$ and $q_B = -3 \mu\text{C}$ are located 20 cm apart in vacuum, (i) Find the electric field at the mid point of the line AB joining the two charges, (ii) If a negative test charge of magnitude $1.5 \times 10^{-9} \text{ C}$ is placed at the centre, find the force experienced by the test charge.

Q. 7. What is a button cell? Name any two types of button cells.

Or

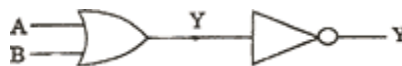
Write the equations for chemical reactions taking place at the (i) anode and (ii) cathode of a lead accumulator during its charging.

Q. 8. In a given circuit, inductor L and resistor R have identical resistance. Two similar electric lamps B_1 and B_2 are connected as shown. When switch S is closed, (i) which one of the lamps lights up earlier, (ii) will the lamps be equally bright after some time? Justify your answer.



Q. 9. Explain with an example, whether the neutron - proton ratio in a nucleus increases or decreases due to beta (β) decay.

Q. 10. Name the gate obtained from the combination of gates shown in the figure. Draw its logic symbol. Write the truth table of the combination.



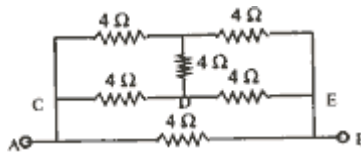
Q. 11. How is a p-type semiconductor formed? Name the major charge carriers in it. Draw the energy band diagram of a p-type semiconductor.

Q. 12. What is an 'analog signal' and a 'digital signal'? How can an analog signal be converted into a digital signal?

Q. 13. Are the paths of electrons straight lines between successive collisions (with positive ions of the metal) in the (i) absence of electric field (ii) presence of electric field?

Establish a relation between drift velocity ' v_d ' of an electron in a conductor of cross-section 'A', carrying current 'I' and concentration 'n' of free electrons per unit volume of conductor. Hence obtain the relation between current density and drift velocity.

Q. 14. Six resistors, each of value $4\ \Omega$, are joined together in a circuit as shown in the figure. Calculate equivalent resistance across the points A and B. If a cell of emf 2V is connected across AB, compute the current through the arms AB and DF of the circuit.



Q. 15. Derive an expression for the force acting on a current carrying conductor placed in a uniform magnetic field. Name the rule which gives the direction of the force. Write the condition for which this force will have (i) maximum, (ii) minimum value.

Q. 16. Where on the earth's surface is the value of vertical component of the earth's magnetic field zero?

The horizontal component of the earth's magnetic field at a given place is

$0.4 \times 10^{-4}\ \text{Wb/m}^2$ and angle of dip is 30° . Calculate the value of (i) vertical component, (ii) the total intensity if the earth's magnetic field.

Q. 17. A pure inductor is connected across an a.c. source. Show mathematically that the current in it lags behind the applied emf by a phase angle or $\pi/2$. What is its inductive reactance? Draw a graph showing the variation of inductive reactance with the frequency of the a.c. source.

Or

An alternating emf is applied across a capacitor. Show mathematically that current in it leads the applied emf by a phase angle of $\pi/2$. What is its capacitive reactance? Draw a graph showing the variation of capacitive reactance with the frequency of the a.c. source.

Q. 18. A town situated 20 km away from a power plant generating power at 440 V, requires 600 kW of electric power at 200 V. The resistance of the two wire line carrying

power is 0.4Ω per km. The town gets power from the line through a 3000 - 220 V step down transformer at a substation in the town.

(i) Find the line power losses in the form of heat.

(ii) How much power must the plant supply, assuming there is negligible power loss due to leakage?

Q. 19. What is a wave front? What is the geometrical shape of a wave front of light emerging out of a convex lens, when point source is placed at its focus? Using Huygens' principle show that, for a parallel beam incident on a reflecting surface, the angle of reflection is equal to the angle of incidence.

Q. 20. Two slits in Young's double slit experiment are illuminated by two different lamps emitting light of the same wavelength. Will you observe the interference pattern? Justify your answer.

Find the ratio of intensities at two points on a screen in Young's double slit experiment, when waves from the two slits have path difference of (i) 0, (ii) $\lambda/4$.

Q. 21. A converging lens of focal length 6.25 cm is used as a magnifying glass. If the near point of the observer is 25 cm from the eye and lens is held close to the eye, calculate (i) the distance of the object from the lens, (ii) the angular magnification (magnifying power). Also find the angular magnification (magnifying power) when the final image is formed at infinity.

Q. 22. Draw a graph to show the variation of the angle of deviation 'D' with that of the angle of incidence 'i' for a monochromatic ray of light passing through a glass prism of refracting angle 'A'. Hence deduce the relation

$$\frac{\sin\left(\frac{D_m + A}{2}\right)}{\sin\frac{A}{2}}$$

Q. 23. Draw a labelled circuit diagram of a common base amplifier using a p-n-p transistor. Define the term 'voltage gain' and write an expression for it.

Q. 24. Define Modem & Explain how its work.

Q. 25. Give the principle of working of a Van de Graff generator. With the help of a labelled diagram, describe its construction and working. How is the leakage of charge minimised from the generator?

Or

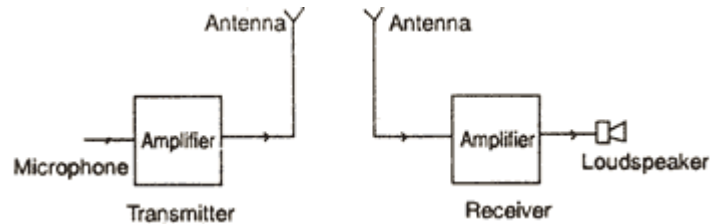
Obtain the expression for the capacitance of a parallel plate capacitor.

Three capacitors of capacitances C_1 , C_2 and C_3 are connected (i) in series, (ii) in parallel.

Show that the energy stored in the series combination is the same as that in the parallel combination.

Q. 26. A schematic arrangement for transmitting a message signal (20 Hz to 20 kHz) is given below:

Give two drawbacks from which this arrangement suffers.



Describe briefly with the help of a block diagram the alternative arrangement for the transmission and reception of the message signal.

Q. 27. Derive the expression for the de Broglie wavelength of an electron moving under a potential difference of V volt.

Describe Davisson and Germer experiment to establish the wave nature of electrons.

Draw a labelled diagram of the apparatus used.