

**Army Public School, Kota**  
**Unit Test – I**  
**XII-Physics Practice Paper (2019-20)**

Time Allowed : 3 Hrs.

Maximum Marks : 70

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**General Instruction**

- (a) All questions are compulsory.
- (b) There are 26 questions in total. Questions 1 to 20 carry one mark each, questions 21 to 27 carry two marks each, questions 28 to 34 carry three marks each and questions 35 to 37 carry five marks each.
- (c) There is no overall choice. However, an internal choice has been provided in question of two marks, one question of three marks and all three questions of five marks each. You have to attempt only one of the given choices in such questions.
- (d) Use of calculators is not permitted.
- (e) You may use the following physical constants wherever necessary.

$$c = 3 \times 10^8 \text{ ms}^{-1}$$

$$h = 6.6 \times 10^{-34} \text{ Js}$$

$$e = 1.6 \times 10^{-19} \text{ C}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ TmA}^{-1}$$

$$\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2\text{C}^{-2}$$

Boltzmann's constant  $k = 1.38 \times 10^{-23} \text{ JK}^{-1}$

Avogadro's number  $N_A = 6.023 \times 10^{23} / \text{mole}$

Mass of neutron  $m_n = 1.67 \times 10^{-27} \text{ kg}$

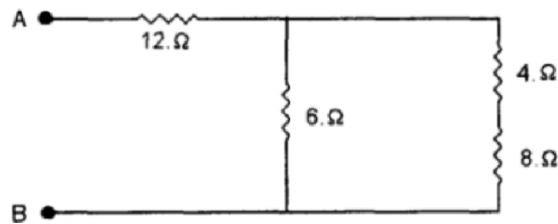
Mass of electron  $m_e = 9.1 \times 10^{-31} \text{ kg}$

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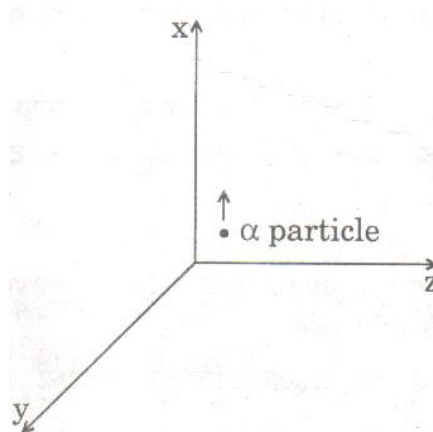
**SECTION A**

- Q.1 An electrical dipole of dipole moment  $20 \times 10^{-6} \text{ C m}$  is enclosed by closed surface. What is the net electric flux coming out of this surface?
- Q.2 Draw an equipotential surface in a uniform electric field.
- Q.3 Define the unit of electric potential.
- Q.4 Draw an equipotential surface for uniform electric field.
- Q.5 What is the number of electric field lines of force that radiate outwards from 1 C of charge in vacuum?
- Q.6 What is meant by quantization of charge?
- Q.7 Is the force acting between two point charge  $q_1$  and  $q_2$  kept at some distance in air, attractive or repulsive when :  
(i)  $q_1q_2 > 0$  (ii)  $q_1q_2 < 0$
- Q.8 Define electric dipole moment. Write its SI unit.
- Q.9 In which orientation, a dipole placed in a uniform field is in (i) stable (ii) unstable equilibrium.

- Q.10 The electric potential  $V$  at a point  $(x, y, z)$  in space is given by  $V = 4x^2$  Volt. Calculate electric intensity at the point  $(1\text{ m}, 0, 2\text{ m})$ .
- Q.11 A carbon resistor is marked in colour bands of red, black, orange and silver. What is the resistance and tolerance value of the resistor?
- Q.12 What is the principle of working of meter bridge?
- Q.13 State the Kirchoff's law for electrical network.
- Q.14 Why do we prefer a potentiometer to measure emf of a cell rather than a voltmeter.
- Q.15 Calculate the equivalent resistance between points A and B of the network shown in figure



- Q.16 A beam of  $\alpha$  particles projected along  $+x$ -axis, experiences a force due to a magnetic field along the  $+y$ -axis. What is the direction of the magnetic field?



- Q.17 Using the concept of force between two infinitely long parallel current carrying conductors, define one ampere of current.
- Q.18 Define current sensitivity of a moving coil galvanometer and state its SI unit.
- Q.19 Can moving coil galvanometer be used to detect an AC in a circuit? Give reason.
- Q.20 State the principle of working of cyclotron.

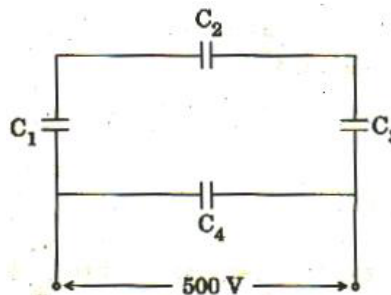
#### SECTION B

- Q.21 A uniformly charged conducting sphere of  $2.4\text{ m}$  diameter has a surface charge density of  $80.0\ \mu\text{ C/m}^2$ .
- Find the charge on the sphere.
  - What is the total electric flux leaving the surface of the sphere?

- Q.22 Obtain the expression for the potential energy of an electric dipole of dipole moment  $\vec{p}$  placed in an electric field  $\vec{E}$ .
- Q.23 A parallel plate capacitor with air between the plates has a capacitance 8 pF. What will be the capacitance if the distance between the plates is reduced by half and the space between them is filled with a substance of dielectric constant 6?
- Q.24 Obtain an expression for the energy stored per unit volume in a charged parallel plate capacitor.
- Q.25 Estimate the average drift speed of conduction electrons in a copper wire of cross-sectional area  $2.5 \times 10^{-7} \text{ m}^2$  carrying a current of 1.8 A. Assume the density of conduction electrons to be  $9 \times 10^{28} \text{ m}^{-3}$ .
- Q.26 A cell of emf 'E' and internal resistance 'r' is connected across a variable resistor 'R'. Plot a graph showing variation of terminal voltage 'V' of the cell versus the current 'I'. Using the plot, show how the emf of the cell and its internal resistance can be determined
- Q.27 Write the expression for Lorentz magnetic force on a particle of charge 'q' moving with velocity  $\vec{v}$  in a magnetic field  $\vec{B}$ . Show that no work is done by this force on the charged particle.

### SECTION C

- Q.28 Calculate the electric field at the axial point of electric dipole.
- Q.29 An electric dipole is held in a uniform electric field.  
 (i) Show that the net force acting on it is zero.  
 (ii) The dipole is aligned parallel to the field. Find the work done in rotating it through the angle of  $180^\circ$ .
- Q.30 A network of four capacitors each of  $12 \mu\text{F}$  capacitance is connected to a 500 V supply as shown in the figure. Determine  
 (a) equivalent capacitance of the network and  
 (b) charge on each capacitor.



- Q.31 A parallel plate capacitor is charged by a battery, which is then disconnected. A dielectric slab is then inserted in the space between the plates. Explain what changes, if any, occur in the value of :  
 (i) capacitance (ii) potential difference between the plates  
 (iii) electric field between the plates

Q.32 Describe briefly, with the help of a circuit diagram, how a potentiometer is used to determine the internal resistance of a cell.

Q.33 Answer the following.

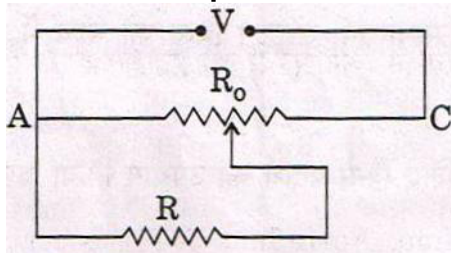
(a) Why are the connections between the resistors in a meter bridge made of thick copper strips?

(b) Why is it generally preferred to obtain the balance point in the middle of the meter bridge wire?

(c) Which material is used for the meter bridge wire and why?

OR

A resistance of  $R \Omega$  drawn current from a potentiometer as shown in the figure. The potentiometer has a total resistance  $R_0 \Omega$ . A voltage  $V$  is supplied to the potentiometer. Derive an expression for the voltage across  $R$  when the sliding contact is in the middle of the potentiometer.



Q.34 A cyclotron's oscillator frequency is 10 MHz. What should be the operating magnetic field for accelerating protons? If the radius of its 'dees' is 60 cm, calculate the kinetic energy (in MeV) of the proton beam produced by the accelerator.

#### SECTION D

Q.35 (a) Define electric dipole moment. Is it scalar or a vector? Derive the expression for the electric field of a dipole at a point on the equatorial plane of the dipole.

(b) Draw the equipotential surfaces due to an electric dipole. Locate the points where the potential due to the dipole is zero.

OR

Using Gauss' law deduce the expression for the electric field due to a uniformly charged spherical conducting shell of radius  $R$  at a point (i) outside and (ii) inside the shell.

Plot a graph showing variation of electric field as a function of  $r > R$  and  $r < R$ . ( $r$  being the distance from the centre of the shell)

Q.36 (a) State, with the help of circuit diagram, the working principle of a meter bridge. Obtain the expression used for determining the unknown resistance.

(b) What happens if the galvanometer and cell are interchanged at the balance point of the bridge.

OR

(a) State the working principle of a potentiometer. Draw a circuit diagram to

- compare emf of two primary cells. Derive the formula used.  
(b) Which material is used for potentiometer wire and why?

- Q.37 (a) Deduce an expression for the frequency of revolution of a charged particle in a magnetic field and show that it is independent of velocity of the particle.  
(b) Draw a schematic sketch of a cyclotron. Explain, giving the essential details of its construction, how it is used to accelerate the charged particles.

OR

- (a) Draw a labeled diagram of a moving coil galvanometer. Describe briefly its principle and working.  
(b) Answer the following :  
(i) Why is it necessary to introduce a cylindrical soft iron core inside the coil of a galvanometer?  
(ii) Increasing the current sensitivity of a galvanometer may not necessarily increase its voltage sensitivity. Explain, giving reason.