APEEJAY SCHOOL, PITAMPURA

FIRST TERMINAL EXAMINATION, 2016-17

CLASS XII

PHYSICS

Time allotted : 3 hrs M.M: 70

General Instructions:

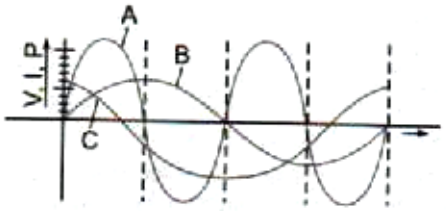
(i) All questions are compulsory

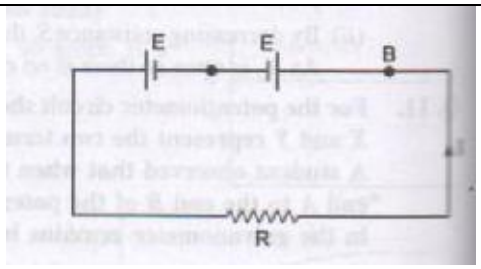
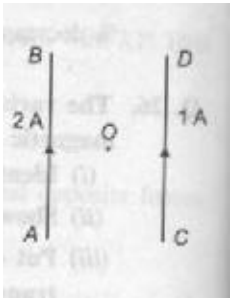
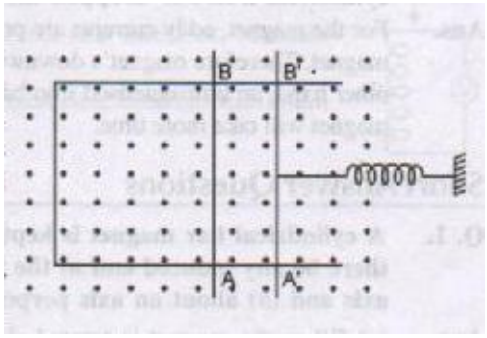
(ii) Question numbers 1 to 5 are very short answer questions and carry 1 mark each.

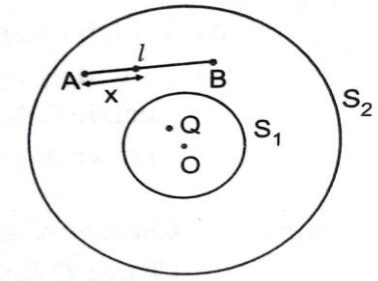
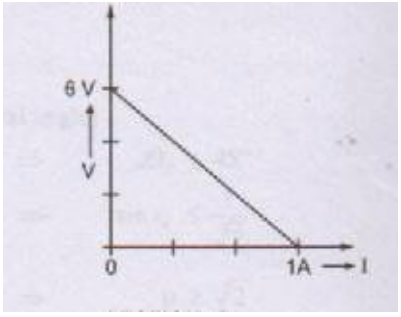
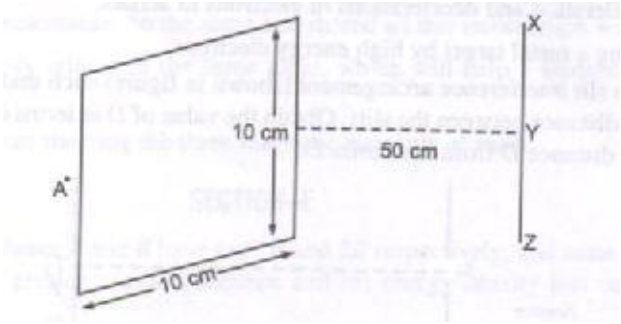
(iii) Question numbers 6 to 12 are short answer questions and carry 2 marks each

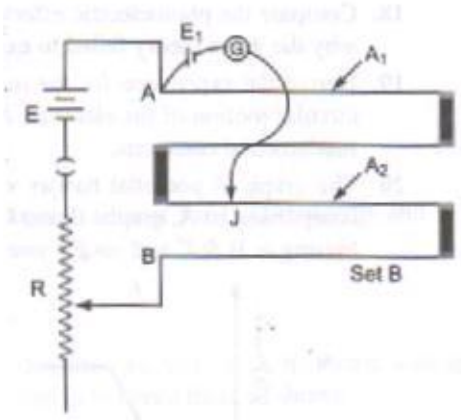
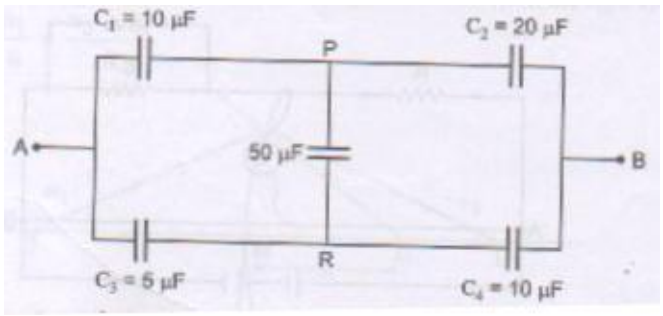
(iv) Question numbers 13 to 24 are also short answer questions and carry 3 marks each.

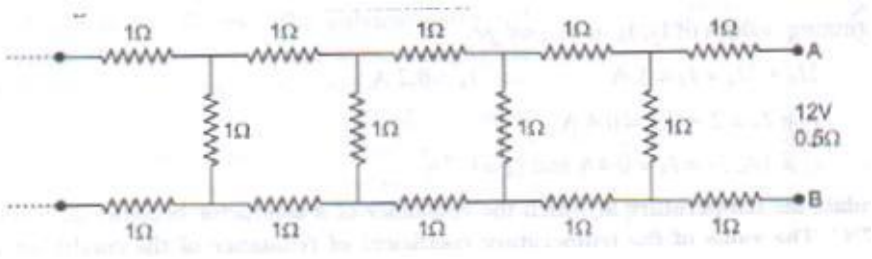
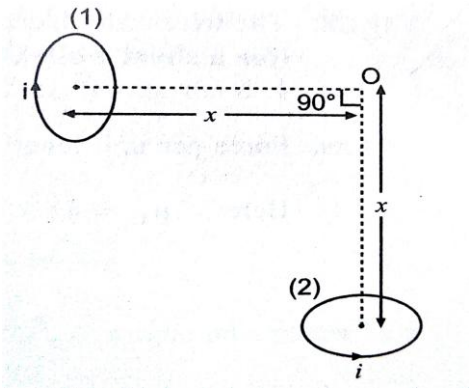
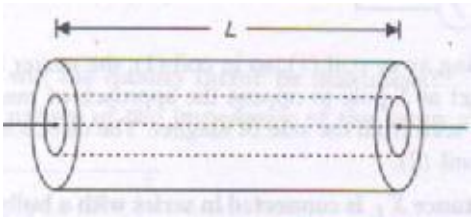
(v) Question number 25 to 27 are long answer questions and carry 5 marks each.

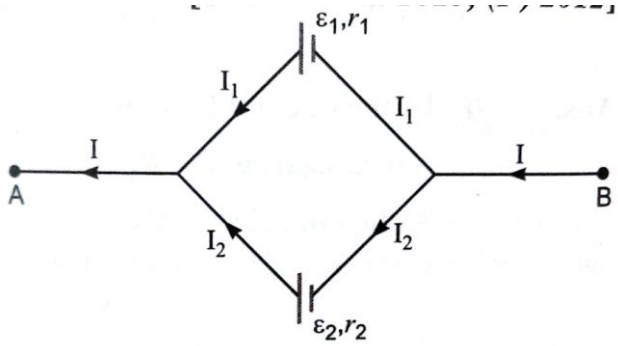
1.	A device 'X' is connected to an ac source $V=V_0\sin\omega t$. The variation of voltage, current and power in one complete cycle is shown in the figure. (i) Which curve shows power consumption over a full cycle? (ii) Identify the device 'X'. 	1
2.	A point charge +Q is placed at a point O as shown in the figure. Is the potential difference $V_A - V_B$ positive, negative or zero? Give reason. 	1
3.	Magnetic field lines can be entirely confined within the core of a torroid, but not within a straight solenoid, why?	1
4.	Long distance radio broadcasts use short wave bands. Why?	1
5.	The metallic conductor is at temperature T1. The temperature of this conductor is increased to T2. How will the product of its resistivity and conductivity change? Give reason.	1
6.	Distinguish between any two types of propagation of electromagnetic waves with respect to (i) frequency range over which they are applicable (ii) communication systems in which they are used.	2
7.	Two cells of same emf E but internal resistance r_1 and r_2 are connected in series to an external resistor R as shown in the figure. What should be the value of R so that the potential difference across the terminals of the first cell becomes zero?	2

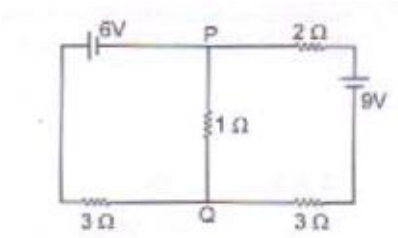
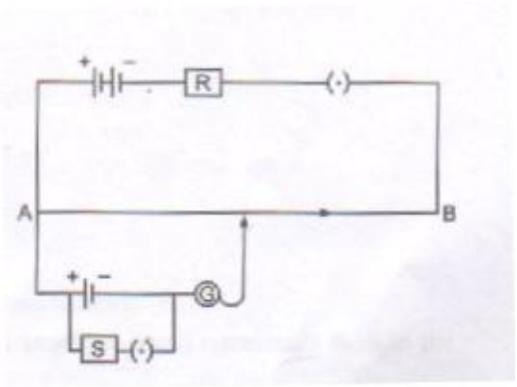
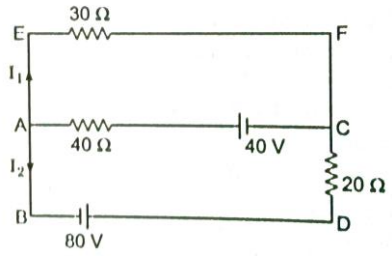
		
8.	AB and CD are long parallel conductors separated by same distance. O is the midpoint between them. Net magnetic field due to current in the two conductors is B. The current in wire AB is now switched off. Calculate the magnetic field at O in this case in terms of B.  OR A compass needle, free to turn in the vertical plane orients itself with its axis vertical at a certain place on the earth. Find out the values of (i) horizontal component of earth's magnetic field and (ii) the angle of dip at the place.	2
9.	A rectangular wire frame shown in the figure, is placed in a uniform magnetic field directed upwards and normal to the plane of the paper. The part AB is connected to a spring. The spring is stretched and released when the wire AB has come to position A'B' (t=0). How would the induced emf vary with time? Neglect damping. 	2
10.	In the figure shown, calculate the total flux of the electrostatic field through the spheres S_1 and S_2. The wire AB of length 'l' shown here has a linear charge density λ given by $\lambda = kx$ where x is the distance measured along the wire, from the end A.	2

		
11.	The plot of the variation of potential difference across a combination of three identical cells in series, versus current is shown below. What is the emf and internal resistance of each cell? 	2
12.	You are given an air coil, a bulb, an iron rod and a source of electricity. Suggest a method to find whether the given source is d.c or a.c. Explain your answer.	2
13.	Given a uniformly charged plane sheet of surface charge density $\sigma = 2X\ 10^{17}\ C/m^2$.  (i) Find the electric field intensity at a point A, 5 mm away from the sheet on the left side. (ii) Given a straight line with three points X,Y and Z placed 50 cm away from the charged sheet on the right side . At which of these points, the field due to sheet remain the same as that of point A and why?	3
14.	The potential difference across a resistor 'r' carrying current 'I' is Ir. (i) Now if the potential difference across 'r' is measured using a voltmeter of resistance 'R_v', show that the reading of the voltmeter is less than the true value. (ii) Find the percentage error in measuring the potential difference by a voltmeter. (iii) At what value of R_v,does the voltmeter measures the true potential difference? OR	3

	You are given two sets of potentiometer circuits to measure the emf E_1 of a cell. Set A: consists of potentiometer wire of a material of resistivity ρ_1, area of cross-section A_1 and length l. Set B: consists of a potentiometer of two composite wire of equal length l/2 each, of resistivity ρ_1, ρ_2 and area of cross sections A_1, A_2 respectively. (i) Find the relation between resistivity of the two wires with respect to their area of cross section, if the current flowing in the two sets is same. (ii) Compare the balancing length obtained in the two sets. 	3
15.	A sample of paramagnetic salt contains 2X 10^{24} atomic dipoles each of dipole moment 1.5X 10^{-23} J/T. The sample is placed under homogenous magnetic field of 0.84 T and cooled to the temperature of 4.2K. The degree of magnetic saturation achieved is 15%. What is the total dipole moment of the sample of magnetic field of 0.98 T and a temperature of 2.8 K(assume curie's law)?	3
16.	Draw a schematic arrangement of winding of primary and secondary coils in a transformer with the two coils on separate limbs of the core. State the underlying principle and find the relation between the primary and secondary voltages in terms of the number of the primary and secondary windings. How are the currents in the primary and secondary coils related to the voltages in case of an ideal transformer?	3
17.	Calculate the equivalent capacitance between points A and B in the circuit below. If a battery of 10V is connected across A and B, calculate the charge drawn from the battery by the circuit. 	3
18.	How is a galvanometer converted into a voltmeter and an ammeter? Draw the relevant diagrams and find the resistance of the arrangement in each case. Take resistance of galvanometer as G.	3

19.	Write Maxwell's generalisation of Ampere's Circuital Law. Show that in a process of charging a capacitor, the current produced within the plates of the capacitor is $i=\varepsilon_0 d\varphi_E/dt$ where φ_E electric flux produced during the charging of the capacitor plates.	3
20.	Determine the current drawn from a 12V supply with internal resistance 0.5Ω by the infinite network shown in the figure. Each resistor has 1Ω resistance. 	3
21.	Two small identical circular loops marked (1) and (2) , carrying equal currents , are placed in the geometrical axes perpendicular to each other as shown in the figure. Find the magnitude and direction of the net magnetic field produced at the point O. 	3
22.	Figure shows two coaxial solenoids , each of length 'L' . The outer solenoid has an area of cross section A_1 and number of turns/ length n_1. The corresponding values for inner solenoid are A_2 and n_2. Write the expression for self inductance L_1, L_2 of the two coils and their mutual inductance M. Hence show that $M< \sqrt{L_1 L_2}$. 	3

23.	Two cells of emf ε_1 and ε_2 and internal resistance r_1 and r_2 respectively are connected in parallel as shown in the figure. Deduce the expression for (i) the equivalent emf of the combination (ii) the equivalent resistance of the combination and (iii) the potential difference between the two points A and B.  	3
24	(i) Name the machine which uses crossed electric and magnetic fields to accelerate the ions to high energies. With the help of the diagram explain the resonance condition. (ii) What will happen to the motion of the charged particle if the frequency of the alternating voltage is doubled?	3
25.	(a) An ac source of voltage $V=V_0 \sin\omega t$ is connected to a series combination of L,C and R. Use the phasor diagram to obtain the expressions for the impedance of the circuit and the phase angle between voltage and current. Find the condition when the current will be in phase with the voltage. What is the circuit in this condition called? (b) In a series LR circuit $X_L = R$ and power factor of the circuit is P_1. When capacitor with capacitance C such that $X_L = X_C$ is put in series , the power factor becomes P_2. Calculate P_1 / P_2 . OR State the law which relates to generation of induced emf in a conductor being moved in a magnetic field. Apply this law to obtain the expression for the induced emf when 'one' rod of a rectangular conductor is free to move in a uniform , time independent and normal magnetic field. Apply the concept of Lorentz (magnetic) force acting on a moving charge to justify the expression obtained above. .	5 5
26.	(i) Use Gauss's Law to find the electric field due to uniformly charged infinite plane sheet. What is the direction of field for positive and negative charge densities? (ii) Find the ratio of potential differences that must be applied across the parallel and series combination of two capacitors C_1 and C_2 with their capacitances in the ratio of 1:2 so that the energy stored in the two cases becomes the same. OR (i) If two similar large plates , each of area A having surface charge densities $+\sigma$ and $-\sigma$ are separated by a distance 'd' in air, find the expressions for (a) field at the points between the two plates and on outer sides of the plates. Specify the direction of the field in each case. (b) the potential difference between the plates.	5 5

	(c) the capacitance of the capacitor so formed. (ii) Two metallic sphere of radii R and 2R are charged so that both of these have same surface charge density σ. If they are connected to each other with a conducting wire, in which direction will the charge flow and why?	
27	(i) Find the magnitude and direction of current in 1Ω resistor in the given circuit.  (ii) Two students X and Y perform an experiment on potentiometer separately using the circuit diagram shown below:  Keeping other things unchanged (a) X increases the value of resistance R , (b) Y decreases the value of resistance S in the set up. How will these changes affect the position of null point in each case and why? OR  (a) Using Kirchoff's rules calculate the current in arm AC of the given circuit. (b)On what principle does the meter bridge work? Why are the metal strips used in the bridge?	5 5