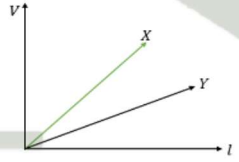
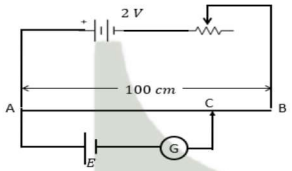
Day- 5, 6 & 7

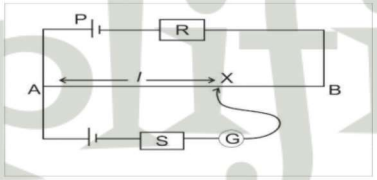
1. The emf of battery A is balanced by a length of 75 cm on a potentiometer wire. The standard cell of emf 1.02 V is balanced by a length of 50 cm. The emf of cell A is,
   a. $1.25\ V$ b. $1.35\ V$ c. $1.53\ V$ d. $2.05\ V$
2. If specific resistance of a potentiometer wire is $10^{-7}\Omega m$, current flowing through it is $0.1A$ and cross sectional area of wire is $10^{-6}m^2$, then potential gradient will be,
   a. $10^{-2}V/m$ b. $10^{-4}V/m$ c. $10^{-6}V/m$ d. $10^{-8}V/m$
3. A potentiometer is properly set the balancing length (L) for a cell is obtained. If the current through the potentiometer wire is decreased, then the balancing length is,
   a. Increased b. Decreased c. not changed d. becomes half
4. AB is a wire of potentiometer with the increase in the value of resistance R, the shift in the balance point J will be
   a. Towards B c. Towards A
   b. Remains constant d. First towards B then back towards A.
5. Potentiometer is an ideal voltmeter that measures the emf of the cell very accurately,
   a) How is it superior to the voltmeter in the accurate measurement of emf?
   b) What is the working principle of potentiometer?
   c) The driver cell of a potentiometer has an emf of 2 V and negligible internal resistance. The potentiometer wire has a resistance of 3 Ω. Calculate the resistance needed in series with the wire if a p.d. 5 mV is required across the whole wire. The wire is 100 cm long and a balanced length of 60 cm is obtained for a thermocouple of emf E. What is the value of E?
6. a) If the length of the wire be doubled, what will be the effect on the position of zero deflection in a potentiometer?
   b) How sensitivity of potentiometer can be increased?
   c) The variation of potential difference V with length L in case of two potentiometers X and Y is as shown in diagram. Which one of these two will you prefer for comparing the emf of two cell? Justify your logic.



   d) The potentiometer wire has resistance of 10Ω. If the resistance R is maintained to be 40Ω, the source of unknown resistance E is balanced by 40 cm length of the potentiometer wire. What is the value of E?



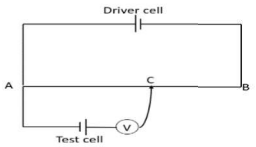
   e) A 2.0 V potentiometer used for the determination of internal resistance of a 1.5 V cell. The balance point of the cell in open circuit is 76.3 cm. When a resistor of 9.5 Ω is used in the external circuit of the cell the balance point shifts to 64.8 cm length of the potentiometer wire. Determine the internal resistance of the cell.
   f) Conclude with the reason, where the balance point will be shifted, towards A or B when,
      i. Resistance R is increased, keeping all other parameters constant.
      ii. Resistance S is decreased, keeping R constant.



   f) Explain how you compare the emfs of two cells using potentiometer.
   g) The total length of the wire of a potentiometer is $10m$. A potential gradient of $0.0015V/cm$ is obtained when a steady current is passed through this wire.

Calculate,
   i) The distance of null point on connecting standard cell of $1.018V$.
   ii) The unknown p.d. if the null point is obtained at a distance of $940cm$,
   iii) The maximum p.d. which can be measured by this instrument.

7. A student sets up a circuit as shown in figure below to measure the emf of a test cell.
   a. Explain why he is unable to find a balance point and state the change he must make in order to achieve the balance.
   b. He could have used an ordinary voltmeter to measure the emf of the test cell directly. The student however, argues that the above instrument is more precise than an ordinary voltmeter. Justify his logic.



Day-8 & 9

1. a) What difference are there between super conductor and conductor? Discuss with necessary plots.
   b) What is Meissner effect? Why does super conductor show this effect?
   c) Write two applications of superconductor.
   d) What is perfect conductor?
2. a) A galvanometer of resistance 5 Ω can bear a maximum current of 25 mA. Find the suitable resistance to convert it into,
   i. An ammeter of range (0-10A) [Ans: 0.0125 Ω]
   ii. Voltmeter of range (0-2V) [Ans: 75 Ω]
3. Galvanometer is a very useful device, it can be used in various ways,
   a) How galvanometer can be converted into voltmeter & ammeter.
   b) A shunt must have very low resistance. Why?
   c) Why ammeter is always connected in series and voltmeter in parallel with load resistance.
   d) The resistance of a galvanometer coil is 9.36 ohm, and the current required for full-scale deflection is 0.0224A. We want to convert this galvanometer to an ammeter reading 20 A full scale. The only shunt available has a resistance of 0.025 ohm. What resistance must be connected in series with the coil?
   e) While converting the galvanometer of resistance 10Ω into an ammeter in the range 1A, a very small resistance 0.1Ω in parallel and a resistor 89.9Ω in series are required with the galvanometer. What is full-scale reading in the galvanometer?
4. Electric current has several effect, one of which is heating effect,
   a. State and explain Joule's law of heating?
   b. Calculate the heat energy produced in resistance of $5\ \Omega$ when $3\ A$ current flows through it for $2\ minutes$. Also calculate the rate at which heat energy is produced in the resistor.