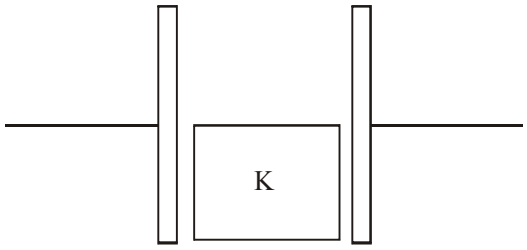
CLASS TEST

PHYSICS CLASS TEST # 35

SECTION-I

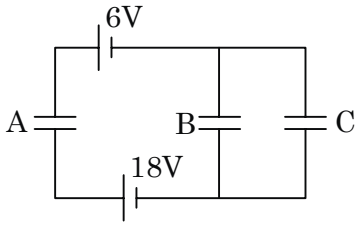
Single Correct Answer Type **1 Q. [3 M (–1)]**

1. A parallel plate capacitor is charged from a battery and then isolated from it. Now a dielectric slab of dielectric constant K is introduced in the region between plates, filling half of it as shown. The electric field intensity in dielectric region is E_1 & that in air between plates is E_2.



(A) $E_1 = \frac{E_2}{K}$ (B) $E_1 = \frac{E_2}{K-1}$ (C) $E_1 = E_2\left(1-\frac{1}{K}\right)$ (D) $E_1 = E_2$

2. Three capacitors A, B and C each of capacitance 1 μF are connected in a circuit as shown in figure. The energy stored in the capacitor C is

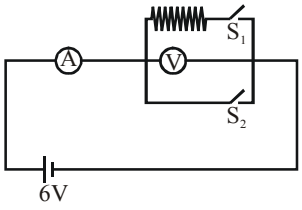


(A) 4 μJ (B) 6 μJ (C) 8 μJ (D) 2 μJ

3. In a planar vacuum diode, the dependence of the current on voltage has the form $I = cV^{3/2}$ where c is a constant. How many times will the pressure on the anode arising from the impact of electrons on its surface increase, if the voltage on the diode were to double? Initial velocity of electrons emitted from the cathode is negligible.

(A) four times (B) two times (C) $\sqrt{2}$ times (D) $2\sqrt{2}$ times

4. An ammeter and a voltmeter are initially connected in series to a battery of zero internal resistance. When switch S_1 is closed the reading of the voltmeter becomes half of the initial, whereas the reading of the ammeter becomes double. If now switch S_2 is closed then reading of ammeter becomes :-



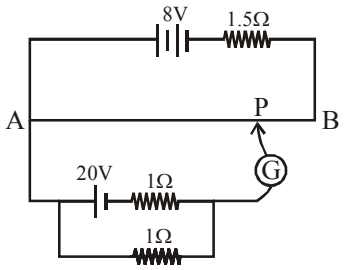
(A) $\frac{3}{2}$ times the initial value (B) $\frac{3}{2}$ times the value after closing S_1

(C) $\frac{3}{4}$ times the value after closing S_1 (D) $\frac{3}{4}$ times the initial value

5. Between the plates of a parallel-plate capacitor, there is a metallic plate whose thickness takes up 60% of the capacitor gap. When that plate is absent the capacitor has a capacity C = 20nF. The capacitor is connected to a dc voltage source of voltage =100 V. The metallic plate is slowly extracted from gap. Find the mechanical work (in μJ) performed in the process of plate extraction.

(A) 150 (B) 100 (C) 200 (D) 250

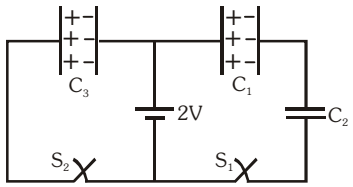
6. A potentiometer wire has length of 10 m and resistance 10Ω as shown in figure. A circuit is setup as shown. For null deflection in galvanometer length AP is :



(A) 2m (B) 4.5 m (C) 6.5 m (D) None of these

Multiple Correct Answer Type 5 Q. [4 M (–1)]

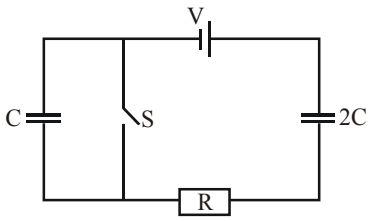
7. Three capacitors $C_1 = 2\mu F$, $C_2 = 2\ \mu F$ and $C_3 = 3\mu F$ having initial charges 4μC, zero and 1μC connected through a battery of emf 2V as shown, on closing the switches S_1 and S_2.



(A) charge on capacitor C_1 is 4μC (B) charge on capacitor C_2 is 0

(C) charge on capacitor C_3 is 6μC (D) charge flown through S_2 is 5μC

8. A series circuit consists of two capacitors, a resistor, and an ideal voltage source.



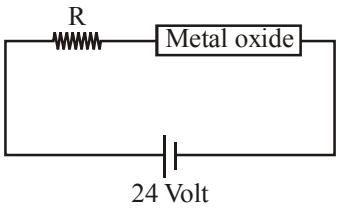
(A) The charge flown through the battery after closing the switch is $\frac{4CV}{3}$.

(B) Work done by the battery after closing the switch is $\frac{4CV^2}{3}$

(C) The change in potential energy of the capacitors after closing the switch is $\frac{2CV^2}{3}$

(D) Heat generated in the circuit after closing the switch is $\frac{2CV^2}{3}$

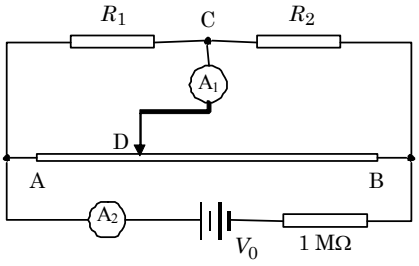
9. In the circuit shown potential difference across the rod of metal oxide varies as $V = Ki^2$. Where i is current in the rod and K = 1 volt/amp^2. It is given that power dissipated in rod is double the power dissipated in R. Then :

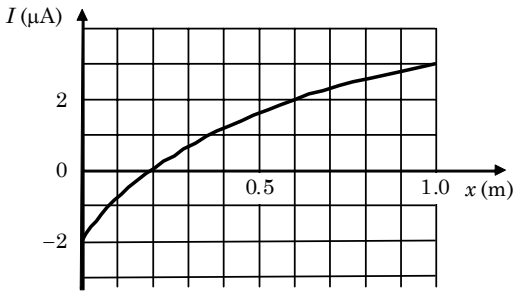


(A) Value of R = 2Ω (B) Current in the circuit is 2A

(C) Power dissipated in R is 32 W (D) If R is increased current in the circuit decreases.

10. In the network shown, R_1 and R_2 are unknown resistances, uniform rod AB is of length 1.0 m and resistance 1.0 kΩ and A_1 and A_2 are ideal ammeters. The adjacent graph shows relation between current in the ammeter A_1 and distance x of the jockey D from the end A. Based on the above information, mark ***CORRECT*** statements.

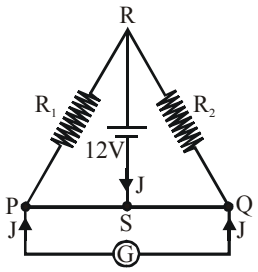




(A) Resistance R_1 is closest to 0.2 kΩ (B) Ratio of resistance R_1 to R_2 is equal to 1 : 4.

(C) Emf V_0 of the battery is closest to 3.6 V (D) None of the above is correct.

11. In the circuit shown $R_1 = R_2 = 10\Omega$ and resistance per unit length of wire PQ = 1Ω/cm and lengthPQ = 10 cm. If R_2 is made 20 Ω then to get zero deflection in galvanometer. S is midpoint of wire PQ :-



(A) The jockey at P can be moved towards S by 2 cm

(B) The jockey at Q can be moved towards S by 2cm

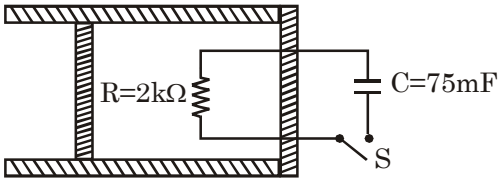
(C) The jockey at S can be moved towards P by a distance of 5/3 m

(D) The jockey at all position fixed and R_1 should be made 20Ω

Linked Comprehension Type (1 Para × 3Q.) (1 Para × 2Q.) [3 M (-1)]
(Single Correct Answer Type)

Paragraph for Question Nos. 12 to 14

A cylinder fitted with a piston which can slide without friction contains one mole of an ideal gas. The walls of the cylinder and piston are adiabatic. The cylinder contains a resistor of resistance R = 2 kΩ which is connected to a capacitor of capacity C = 75 mF. Initially potential difference across capacitor is $\left(\frac{640}{3}\right)$V and switch is open. When switch is closed for (2.5 ln 4) min, the gas expands isobarically and its temperature increases by 72 K. Heat loss through the wires is negligible. (R = 8.3 J mole^{-1} k^{-1})



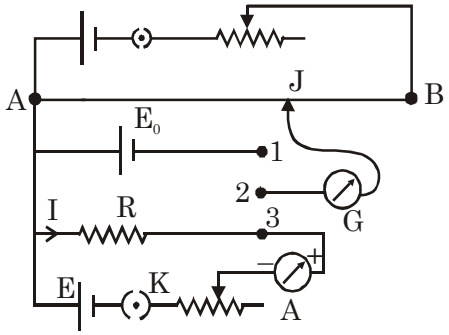
12. Work done by the gas is approximately
(A) 0.2 kJ (B) 0.4 kJ (C) 0.6 kJ (D) 0.8 kJ

13. Increment in internal energy of gas is
(A) 1 kJ (B) 2 kJ (C) 3 kJ (D) 4 kJ

14. The value of adiabatic exponent γ for gas is
(A) 1.1 (B) 1.3 (C) 1.6 (D) 2.5

Paragraph from Question no. 15 and 16

A potentiometer can also be used to calibrate an ammeter or a voltmeter. Here we require a standard cell of which emf is known say E_0. This cell is connected to secondary branch of potentiometer and we balance this standard cell against a length ℓ_0 on potentiometer wire. (by connecting 1 & 2). Now standard cell is removed and the galvanometer end 2 is connected to point 3 on circuit and balanced against length ℓ_1. Current I can be obtained using principle of potentiometer as well as from ammeter. I as given by potentiometer is true value and ammeter reading may have error.



15. If resistance R is 15Ω, E_0 = 5V, ℓ_0 = 2.5m, ℓ_1 = 3m, current I as read by ammeter is 0.45 A
(A) The ammeter reads more than true value by 0.05 A
(B) The ammeter reads less than true value by 0.01A
(C) The ammeter reads less than true value by 0.05A
(D) The ammeter reads more than true value by 0.01 A

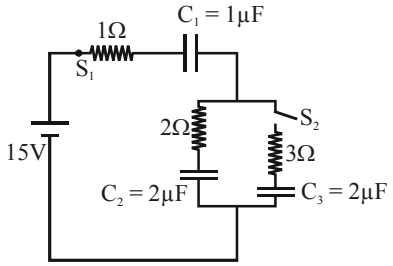
16. If the same error is obtained for another circuit where E_0 = 10V, ℓ_0 = 3m, ℓ_1 = 1.5m, current I in ammeter is 0.55A, the resistance R used is :

(A) 10 Ω (B) 8 Ω (C) $\frac{100}{9}$Ω (B) 8.1 Ω

SECTION-III

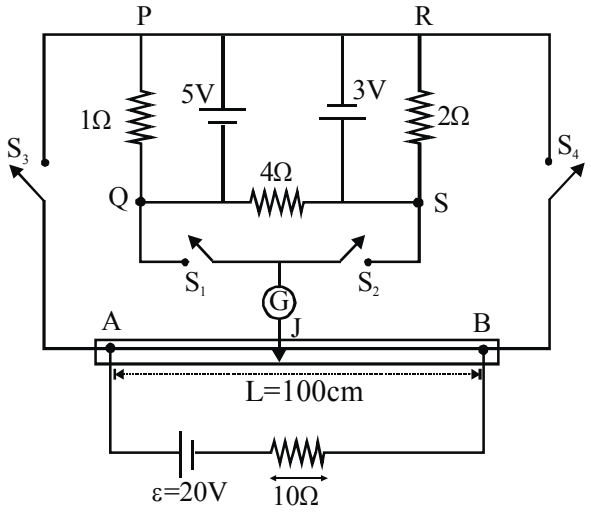
Numerical Grid Type (Ranging from 0 to 9) 3 Q. [4 M (0)]

1. In the following circuit, switch S_1 remains closed for a long time and switch S_2 remains open. The system reaches a steady state. Now we close switch S_2 also, keeping S_1 close. In the new steady state the magnitude of change in charge on capacitor C_2 of 2 μF is q μC. Find q.



2. Two wires of the same length but of different square cross sections are made from the same material. The sides of the cross sections of the first and second wires are $d_1 = 1$ mm and $d_2 = 4$ mm. The current required to fuse the first wire is $I_1 = 1.0$ A. Determine the least current I_2 (in A) required to fuse the second wire, assuming that the amount of heat dissipated to the ambient per second obeys the law $Q = kS(T - T_{am})$, where S is the surface area of the wire, T is its temperature, T_{am} is the temperature of the ambient away from the wire, and k is the proportionality factor which is the same for the two wires.

3. Figure shows a potentiometer connected to an external circuit. At an instant either switch S_1 and S_3 is closed or S_2 and S_4 is closed. When switch S_1 and S_3 is closed null point is attained at $J_1(AJ_1 = \ell_1)$ and when S_2 and S_4 is closed it is attained at $J_2(BJ_2 = \ell_2)$. Find the value of $3\left(\frac{\ell_1}{\ell_2}\right)$.



CLASS TEST # 35 **ANSWER KEY**

SECTION-I

Single Correct Answer Type **1 Q. [3 M (–1)]**

1. Ans. (D) **2. Ans. (C)** **3. Ans. (A)** **4. Ans. (B)**
5. Ans. (A) **6. Ans. (D)**

Multiple Correct Answer Type **5 Q. [4 M (–1)]**

7. Ans. (A,B,C) **8. Ans. (A,B,C,D)** **9. Ans. (A,C,D)** **10.-Ans. (A, B, C)**
11. Ans. (A, C, D)

Linked Comprehension Type **(1 Para × 3Q.) (1 Para × 2Q.) [3 M (-1)]**
(Single Correct Answer Type)

12. Ans. (C) **13. Ans. (A)** **14. Ans. (C)** **15. Ans. (A)**
16. Ans. (A)

SECTION-III

Numerical Grid Type (Ranging from 0 to 9) **3 Q. [4 M (0)]**

1. Ans. 4 **2. Ans. 8** **3. Ans. 5**