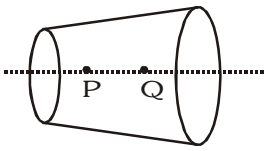
SELECT THE CORRECT ALTERNATIVE (ONLY ONE CORRECT ANSWER)

1. Two wires each of radius of cross section r but of different materials are connected together end to end (in series). If the densities of charge carries in the two wires are in the ratio 1:4, the drift velocity of electrons in the two wires will be in the ratio :
(A) 1:2 (B) 2:1 (C) 4:1 (D) 1:4

2. A current I flows through a uniform wire of diameter d when the mean electron drift velocity is v. The same current will flow through a wire of diameter d/2 made of the same material if the mean drift velocity of the electron is
(A) v/4 (B) v/2 (C) 2v (D) 4v

3. A wire has a non–uniform cross–section as shown in figure. A steady current flows through it. The drift speed of electrons at points P and Q is v_P and v_Q



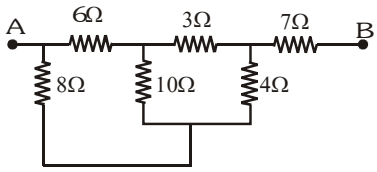
(A) $v_P = v_Q$ (B) $v_P < v_Q$ (C) $v_P > v_Q$ (D) data insufficient

4. An insulating pipe of cross–section area 'A' contains an electrolyte which has two types of ions : their charges being –e and +2e. A potential difference applied between the ends of the pipe result in the drifting of the two types of ions, having drift speed = v (–ve ion) and v/4 (+ve ion). Both ions have the same number per unit volume = n. The current flowing through the pipe is
(A) nev A/2 (B) nev A/4 (C) 5nev A/2 (D) 3nev A/2

5. Three copper wires have their lengths in the ratio 5 : 3 : 1 and their masses are in the ratio 1 : 3 : 5. Their electrical resistance will be in the ratio
(A) 5 : 3 : 1 (B) 1 : 3 : 5 (C) 125 : 15 : 1 (D) 1 : 15 : 125.

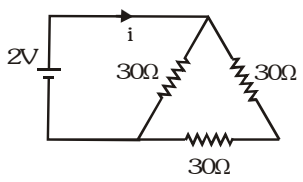
6. A wire of resistance R is stretched to double its length. Its new resistance is
(A) R (B) R/2 (C) 4R (D) R/4

7. The equivalent resistance between the points A and B is–



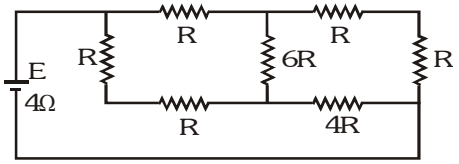
(A) $\frac{36}{7}\Omega$ (B) 10 Ω (C) $\frac{85}{7}\Omega$ (D) none of these

8. The current i in the circuit (see figure) is :



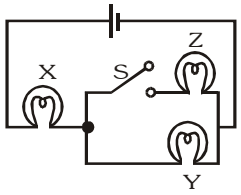
(A) $\frac{1}{45}$ A (B) $\frac{1}{15}$ A (C) $\frac{1}{10}$ A (D) $\frac{1}{5}$ A

9. A battery of internal resistance 4Ω is connected to the network of resistance as shown. In order that the maximum power can be delivered to the network, the value of R in Ω should be :–



(A) $\frac{4}{9}$ (B) 2 (C) $\frac{8}{3}$ (D) 18

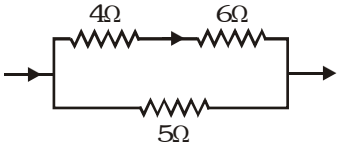
10. If X, Y and Z in figure are identical lamps, which of the following changes to the brightness of the lamps occur when switch S is closed?



(A) X stays the same, Y decreases
(B) X increases, Y decreases
(C) X increases, Y stays the same
(D) X decreases, Y increases

11. A battery of internal resistance 2Ω is connected to a variable resistor whose value can vary from 4Ω to 10 Ω. The resistance is initially set at 4Ω. If the resistance is now increased then–
(A) power consumed by it will decrease
(B) power consumed by it will increase
(C) power consumed by it may increase or may decrease
(D) power consumed will first increase then decrease

12. In the circuit shown in figure the heat produced in the 5Ω resistor due to the current flowing through it is 10 cal/s. The heat generated in the 4Ω resistor is :

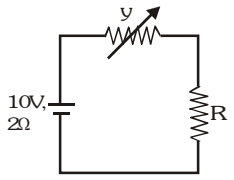


(A) 1 cal/s (B) 2 cal/s (C) 3 cal/s (D) 4 cal/s

13. Two heating coils, one of fine wire and the other of thick wire made of same material and of same length are connected in series and then in parallel. Which of the following statements is correct
(A) In series fine wire liberates more energy while in parallel thick wire liberates more energy
(B) In series fine wire liberates less energy while in parallel thick wire liberates less energy
(C) In series thick wire liberates more energy while in parallel it liberates less energy
(D) Both wires liberates equal energies in series and in parallel

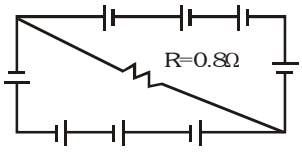
14. A storage battery is connected to a charger for charging with a voltage of 12.5 volts. The internal resistance of the storage battery is 1Ω.When the charging current is 0.5 A, the emf of the storage battery is
(A) 13 volts (B) 12.5 volts (C) 12 volts (D) 11.5 volts

15. In the figure shown the power generated in y is maximum when y=5Ω then R is



(A) 2Ω (B) 6Ω (C) 5Ω (D) 3Ω

16. A circuit is comprised of eight identical batteries and a resistor R = 0.8Ω. Each battery has an emf of 1.0 V and internal resistance of 0.2Ω. The voltage difference across any of the battery is



(A) 0.5 V (B) 1.0V (C) 0V (D) 2V

17. A galvanometer has a resistance of 20Ω and reads full-scale when 0.2V is applied across it. To convert it into a 10A ammeter, the galvanometer coil should have a

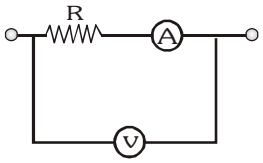
(A) 0.01 Ω resistor connected across it (B) 0.02 Ω resistor connected across it

(C) 200 Ω resistor connected in series with it (D) 2000 Ω resistor connected in series with it

18. A galvanometer coil has a resistance 90Ω and full scale deflection current 10mA. A 910 Ω resistance is connected in series with the galvanometer to make a voltmeter. If the least count of the voltmeter is 0.1V, the number of divisions on its scale is

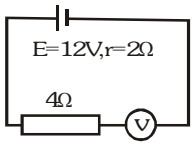
(A) 90 (B) 91 (C) 100 (D) None

19. In the circuit shown the resistance of voltmeter is 10,000 ohm and that of ammeter is 20 ohm. The ammeter reading is 0.10 Amp and voltmeter reading is 12 volt. Then R is equal to



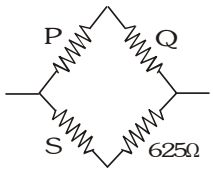
(A) 122 Ω (B) 140Ω (C)116 Ω (D) 100Ω

20. By error, a student places moving-coil voltmeter V (nearly ideal) in series with the resistance in a circuit in order to read the current, as shown. The voltmeter reading will be



(A) 0 (B) 4V (C) 6V (D) 12V

21. A Wheatstone's bridge is balanced with a resistance of 625Ω in the third arm, where P, Q and S are in the 1st, 2nd and 4th arm respectively. If P and Q are interchanged, the resistance in the third arm has to be increased by 51Ω to secure balance. The unknown resistance in the fourth arm is

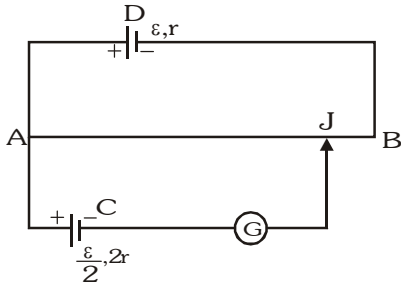


(A) 625 Ω (B) 650Ω (C) 676Ω (D) 600Ω

22. The length of a potentiometer wire is ℓ. A cell of emf E is balanced at a length $\ell/3$ from the positive end of the wire. If the length of the wire is increased by $\ell/2$ at what distance will the same cell give a balanced point

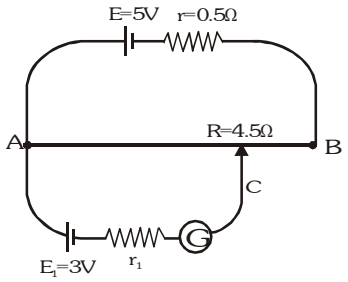
(A) $\frac{2\ell}{3}$ (B) $\frac{\ell}{2}$ (C) $\frac{\ell}{6}$ (D) $\frac{4\ell}{3}$

23. In the figure, the potentiometer wire AB of length L and resistance 9r is joined to the cell D of emf ε and internal resistance r. The cell C's emf is $\frac{\varepsilon}{2}$ and its internal resistance is 2r. The galvanometer G will show no deflection when the length AJ is



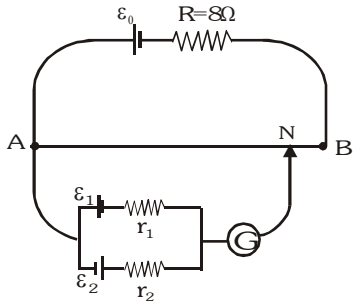
(A) $\frac{4L}{9}$ (B) $\frac{5L}{9}$ (C) $\frac{7L}{18}$ (D) $\frac{11L}{18}$

24. In the given potentiometer circuit length of the wire AB is 3m and resistance is R=4.5Ω. The length AC for no deflection in galvanometer is



(A) 2m (B) 1.8m (C) dependent on r_1 (D) None of these

25. A battery of emf E_0 =12V is connected across a 4m long uniform wire having resistance $\frac{4\Omega}{m}$. The cells of small emfs ε_1=2V and ε_2=4V having internal resistance 2Ω and 6Ω respectively, are connected as shown in the figure. If galvanometer shows no deflection at the point N, the distance of point N from the point A is equal to



(A) $\frac{1}{6}$m (B) $\frac{1}{3}$m (C) 25cm (D) 50cm

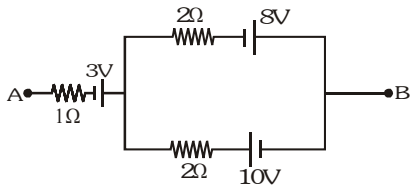
26. A constant voltage is applied between the two ends of a uniform metallic wire. Some heat is developed in it. The heat developed is doubled if
(A) both the length and the radius of the wire are halved
(B) both the length and the radius of the wire are doubled
(C) the radius of the wire is doubled
(D) the length of the wire is doubled

27. Two bulbs rated (25W– 220V) and (100W–220V) are connected in series to a 440 V line. Which one is likely to fuse?
(A) 25W bulb (B) 100 W bulb (C) both bulbs (D) None

28. If the length of the filament of a heater is reduced by 10%, the power of the heater will
(A) increase by about 9% (B) increase by about 11%
(C) increase by about 19% (D) decrease by about 10%

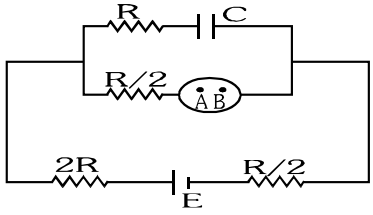
29. The equivalent resistance of a group of resistances is R. If another resistance is connected in parallel to the group, its new equivalent becomes R_1 and if it is connected in series to the group, it new equivalent becomes R_2 we have
(A) $R_1>R$ or $R_2>R$ (B) $R_1<R$ or $R_2>R$ (C) $R_1>R$ or $R_2<R$ (D) $R_1<R$ or $R_2<R$

30. The net emf and internal resistance of three batteries as shown in figure is :



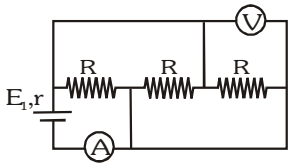
(A) 2V, 1Ω (B) 2V, 2Ω (C) 2V, 1.5Ω (D) 4V, 2Ω

31. A conducting solid sphere is joined in an electrical circuit as shown in figure. Two imaginary points A and B are taken inside the sphere. For given conditions-



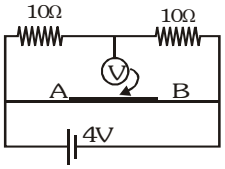
(A) $V_A > V_B$ (B) $V_A < V_B$ (C) $V_A = V_B$ (D) Data insufficient

32. In the circuit shown in figure, ammeter and voltmeter are ideal. If E = 4V, R = 9Ω and r = 1Ω, then readings of ammeter and voltmeter are



(A) 1A, 3V (B) 2A, 3V (C) 3A, 4V (D) 4A, 4V

33. In the adjacent circuit, AB is a potentiometer wire of length 40 cm and resistance per unit length 50 Ω/m. As shown in the figure, the free end of an ideal voltmeter is touching the potentiometer wire. What should be the velocity of the jockey as a function of time so that reading in the voltmeter varies with time as (2 sin πt)?



(A) (10 π sin πt) cm/s (B) (10 π cos πt) cm/s (C) (20π sin πt) cm/s (D) (20 π cos πt) cm/s

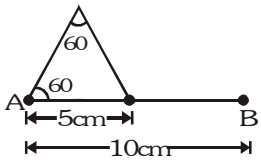
34. In the diagram shown, all the wires have resistance R. The equivalent resistance between the upper and lower dots shown in the diagram is

(A) R/8 (B) R (C) 2R/5 (D) 3R/8

35. An electric bell has a resistance of 5Ω and requires a current of 0.25 A to work it. Assuming that the resistance of the bell wire is 1Ω per 15m and that the bell push is 90m distance from the bell. How many cells each of emf1.4V and internal resistance 2Ω, will be required to work the circuit-

(A) 3 (B) 4 (C) 5 (D) Can't be determined

36. A wire has resistance of 24 Ω is bent in the following shape. The effective resistance between A and B is-



(A) 24 Ω (B) 10 Ω (C) $\frac{16}{3}\Omega$ (D) None of these

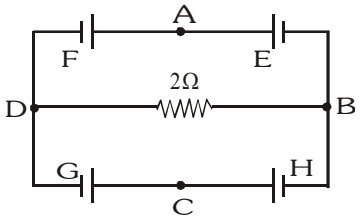
ANSWER KEY — LEVEL –1

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	C	D	C	D	C	C	C	C	B	B	A	B	A	C	D	C	B	C	D	D
Que.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36				
Ans.	B	B	B	A	C	B	A	B	B	B	A	A	D	D	C	B				

Select the correct alternatives (one or more than one correct answers)

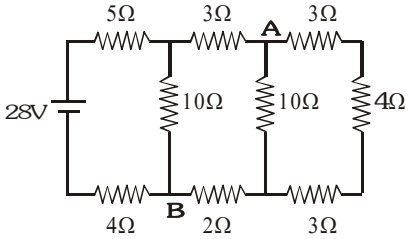
1. A current passes through a wire of nonuniform cross section. Which of the following quantities are independent of the cross-section?
(A) The charge crossing in a given time interval
(B) Drift speed
(C) Current density
(D) Free-electron density

2. In the circuit shown E, F, G and H are cells of e.m.f. 2V, 1V, 3V and 1V respectively and their internal resistances are 2Ω, 1Ω, 3Ω and 1Ω respectively then-



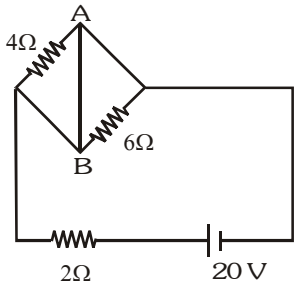
(A) $V_D - V_B = -2/13$V
(B) $V_D - V_B = 2/13$ V
(C) $V_G = 21/13$V = potential difference across G
(D) V_H = 19/13 V = potential difference across H

3. Consider the circuit shown in the figure



(A) The current in the 5Ω resistor is 2A
(B) The current in the 5Ω resistor is 1A
(C) The potential difference $V_A - V_B$ is 7V
(D) The potential difference $V_A - V_B$ is 5V

4. In the circuit shown in figure-



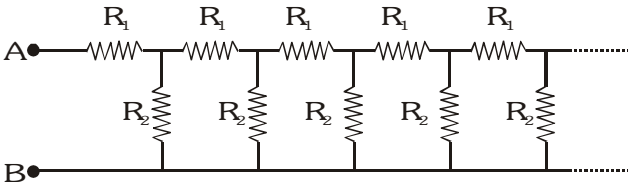
(A) Power supplied by the battery is 200 watt
(B) Current flowing in the circuit is 5 A
(C) Potential difference across 4 Ω resistance is equal to the potential difference across 6Ω resistance
(D) Current in wire AB is zero

5. The charge flowing through a resistance R varies with time as $Q = 2t - 8t^2$. The total heat produced in the resistance is (for $0 \le t \le \frac{1}{8}$)

(A) $\frac{R}{6}$ joules
(B) $\frac{R}{3}$ joules
(C) $\frac{R}{2}$ joules
(D) R joules

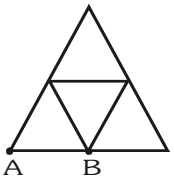
6. In a potentiometer arrangement E_1 is the cell establishing current in primary circuit E_2 is the cell to be measured. AB is the potentiometer wire and G is a galvanometer. Which of the following are the essential condition for balance to be obtained
(A) The emf of E_1 must be greater than the emf of E_2
(B) Either the positive terminals of both E_1 and E_2 or the negative terminals of both E_1 and E_2 must be joined to one end of potentiometer wire
(C) The positive terminals of E_1 and E_2 must be joined to one end of potentiometer wire
(D) The resistance of G must be less than the resistance of AB

7. Consider an infinite ladder network shown in figure. A voltage V is applied between the points A and B. This applied value of voltage is halved after each section. Then-



(A) $\frac{R_1}{R_2}=1$ (B) $\frac{R_1}{R_2}=\frac{1}{2}$ (C) $\frac{R_1}{R_2}=2$ (D) $\frac{R_1}{R_2}=3$

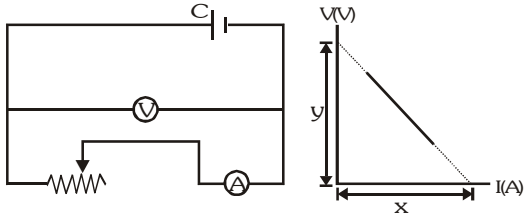
8. In the diagram resistance between any two junctions is R. Equivalent resistance across terminals A and B is



(A) $\frac{11R}{7}$ (B) $\frac{18R}{11}$ (C) $\frac{7R}{11}$ (D) $\frac{11R}{18}$

9. In a balanced wheat stone bridge, current in the galvanometer is zero. It remains zero when
(A) battery emf is increased (B) all resistances are increased by 10 ohms
(C) all resistances are made five times (D) the battery and the galvanometer are interchanged

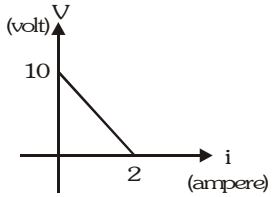
10. The diagram besides shows a circuit used in an experiment to determine the emf and internal resistance of the cell C. A graph was plotted of the potential difference V between the terminals of the cell against the current I, which was varied by adjusting the rheostat. The graph is shown on the right; x and y are the intercepts of the graph with the axes as shown. What is the internal resistance of the cell?



(A) x (B) y (C) $\frac{x}{y}$ (D) $\frac{y}{x}$

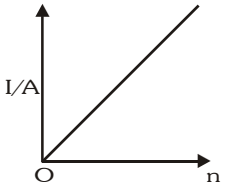
11. A battery is of emf E is being charged from a charger such that positive terminal of the battery is connected to terminal A of charger and negative terminal of the battery is connected to terminal B of charger. The internal resistance of the battery is r
(A) Potential difference across points A and B must be more than E
(B) A must be at higher potential than B
(C) In battery, current flows from positive terminal to the negative terminal
(D) No current flows through battery

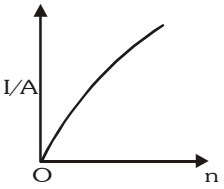
12. A battery of emf E and internal resistance r is connected across a resistance R. Resistance R can be adjusted to any value greater than or equal to zero. A graph is plotted between the current (i) passing through the resistance and potential difference (V) across it. Select the correct alternative(s)

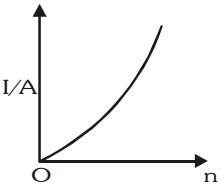


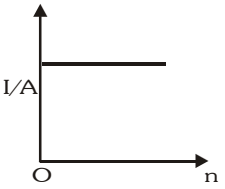
(A) Internal resistance of battery is 5Ω
(B) Emf of the battery is 20V
(C) Maximum current which can be taken from the battery is 4A
(D) V–i graph can never be a straight line as shown in figure

13. A battery consists of a variable number n of identical cells having internal resistance connected in series. The terminals of the battery are short circuited and the current I measured. Which one of the graph below shows the correct relationship between I and n?

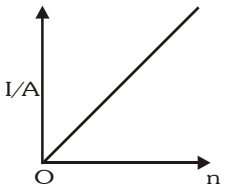
(A) 

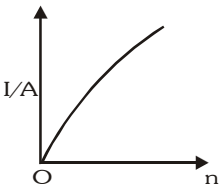
(B) 

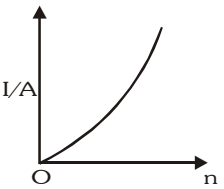
(C) 

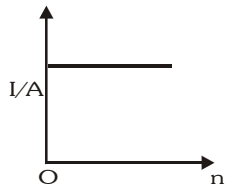
(D) 

14. In previous problem, if the cell had been connected in parallel (instead of in series) which of the above graphs would have shown the relationship between total current I and n?

(A) 

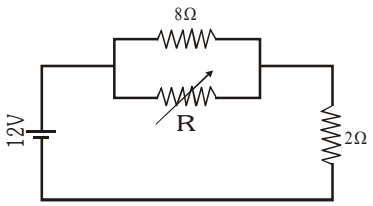
(B) 

(C) 

(D) 

15. Two identical fuses are rated at 10A. If they are joined
(A) in parallel, the combination acts as a fuse of rating 20A
(B) in parallel, the combination acts as a fuse of rating 5A
(C) in series, the combination acts as a fuse of rating 10A
(D) in series, the combination acts as a fuse of rating 20A

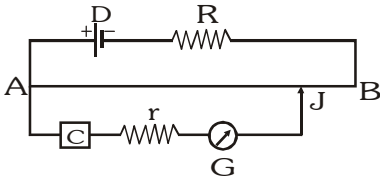
16. The value of the resistance R in figure is adjusted such that power dissipated in the 2Ω resistor is maximum. Under this condition
(A) R=0
(B) R= 8Ω
(C) power dissipated in the 2Ω resistors is 72W
(D) power dissipated in the 2Ω resistor is 8W



17. A microammeter has a resistance of 100Ω and a full scale range of 50 μA. It can be used as a voltmeter or a higher range ammeter provided a resistance is added to it. Pick the correct range and resistance combination(s).
(A) 50V range with 10 kΩ resistance in series.
(B) 10V range with 200 kΩ resistance in series.
(C) 5 mA range with 1 Ω resistance in parallel.
(D) 10 mA range with 1 kΩ resistance in parallel.

18. In a potentiometer wire experiment the emf of a battery in the primary circuit is 20V and its internal resistance is 5Ω. There is a resistance box in series with the battery and the potentiometer wire, whose resistance can be varied from 120Ω to 170Ω. Resistance of the potentiometer wire is 75 Ω. The following potential differences can be measured using this potentiometer.
(A) 5V (B) 6V (C) 7V (D) 8V

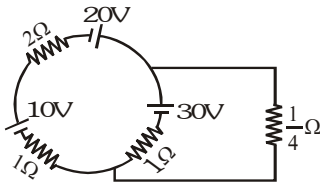
19. In the given potentiometer circuit, the resistance of the potentiometer wire AB is R_0. C is a cell of internal resistance r. The galvanometer G does not give zero deflection for any position of the jockey J. Which of the following cannot be a reason for this?



(A) $r > R_0$ (B) $R >> R_0$

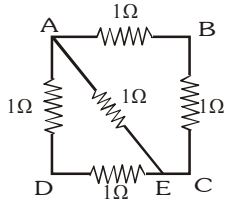
(C) Emf of C> emf of D (D) The negative terminal of C is connected to A

20. In the following circuit diagram, the current flowing through resistor of $1/4\ \Omega$ is



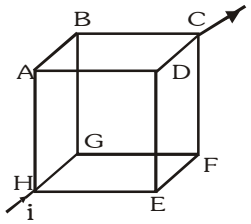
(A) 1 A (B) 60 A (C) 30 A (D) None of these

21. ABCD is a square where each side is a uniform wire of resistance 1Ω. A point E lies on CD such that if a uniform wire of resistance 1Ω is connected across AE and constant potential difference is applied across A and C then B and E are equipotential. Then-



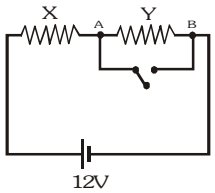
(A) $\frac{CE}{ED}=1$ (B) $\frac{CE}{ED}=2$ (C) $\frac{CE}{ED}=\frac{1}{\sqrt{2}}$ (D) $\frac{CE}{ED}=\sqrt{2}$

22. In the box shown current i enters at H and leaves at C. If $i_{AB}=\frac{i}{6}$, $i_{DC}=\frac{2i}{3}$, $i_{HA}=\frac{i}{2}$, $i_{GF}=\frac{i}{6}$, $i_{HE}=\frac{i}{6}$, Choose the branch in which current is zero



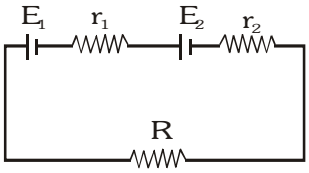
(A) BG (B) FC (C) ED (D) None

23. When an ammeter of negligible internal resistance is inserted in series with circuit it reads 1A. When the voltmeter of very large resistance is connected across X it reads 1V. When the point A and B are shorted by a conducting wire, the voltmeters measures 10V across the battery. The internal resistance of the battery is equal to



(A) zero (B) 0.5Ω (C) 0.2Ω (D) 0.1Ω

24. Under what condition current passing through the resistance R can be increased by short circuiting the battery of emf E_2. The internal resistances of the two batteries are r_1 and r_2 respectively.

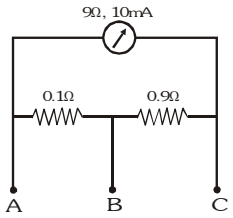


(A) $E_2r_1 > E_1 (R+r_2)$ (B) $E_1r_2 > E_2(R+r_1)$ (C) $E_2r_2 > E_1(R+r_2)$ (D) $E_1r_1 > E_2(R+r_1)$

25. n identical cells are joined in series with its two cells A and B in the loop with reversed polarities. EMF of each cell is E and internal resistance r. Potential difference across cell A or B is (here n >4)

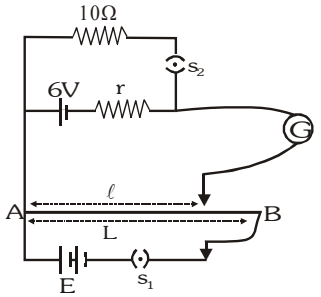
(A) $\frac{2E}{n}$ (B) $2E\left(1-\frac{1}{n}\right)$ (C) $\frac{4E}{n}$ (D) $2E\left(1-\frac{2}{n}\right)$

26. A milliammeter of range 10mA and resistance 9Ω is joined in a circuit as shown. The metre gives full–scale deflection for current I when A and B are used as its terminals, i.e., current enters at A and leaves at B (C is left isolated). The value of I is



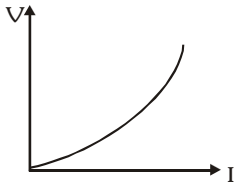
(A) 100 mA (B) 900 mA (C) 1A (D) 1.1 A

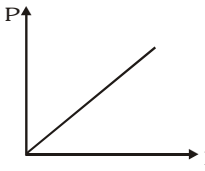
27. In the arrangement shown in figure when the switch S_2 is open, the galvanometer shows no deflection for $\ell = \frac{L}{2}$. When the switch S_2 is closed, the galvanometer shows no deflection for $\ell = \frac{5L}{12}$. The internal resistance (r) of 6V cell, and the emf E of the other battery are respectively

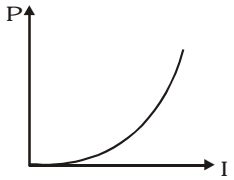


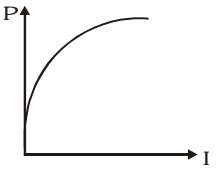
(A) 3Ω, 8V (B) 2Ω, 12V (C) 2Ω, 24V (D) 3Ω, 12V

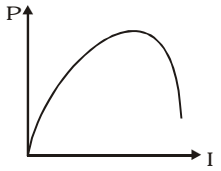
28. The variation of current (I) and voltage (V) is as shown in figure. The variation of power P with current I is best shown by which of the following graph



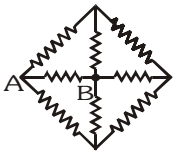
(A) 

(B) 

(C) 

(D) 

29. In the circuit diagram each resistor of resistance 5Ω. The points A and B are connected to the terminals of a cell of electromotive force 9 volt and internal resistance 2/3Ω.



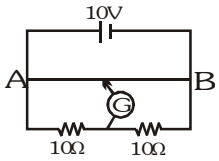
(A) The heat produced in the cell is 6W.

(B) The current in the resistor connected directly between A and B is 1.4A.

(C) The current in the resistor connected directly between A and B is 1.8 A.

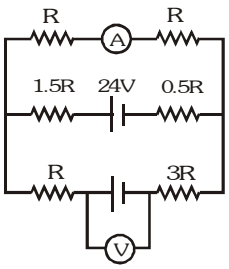
(D) None of the above is correct.

30. The wire AB of a meter bridge changes linearly from radius r to 2r from left end to right end. Length of wire is 1m. Where should the free end of the galvanometer be connected on AB so that the deflection in the galvanometer is zero?



(A) $\frac{2}{3}$m from end B (B) $\frac{1}{3}$m from end A (C) $\frac{1}{4}$m from end A (D) $\frac{3}{4}$m from end B

31. If the reading of ammeter is 2A then the reading of voltmeter



(A) Depends on R

(B) Independent on R

(C) Zero for certain value of R

(D) can't be determined

ANSWER KEY																				LEVEL –2
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	AD	ACD	AC	AC	A	AB	B	D	ACD	D	ABC	A	D	A	AC	AC	BC	ABC	A	C
Que.	21	22	23	24	25	26	27	28	29	30	31									
Ans.	D	B	C	B	D	C	B	B	AB	AB	AC									