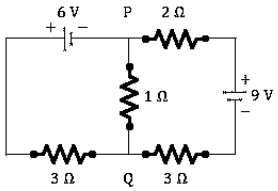
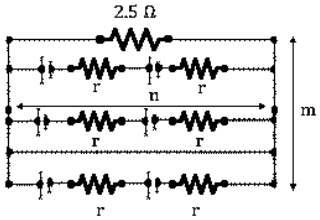
Q.1 In the circuit shown below, the current in the **1 Ω** resistor is

(A)1.3 A, from P to Q **(B)**0 A **(C)**0.13 A, from Q to P **(D)**0.13 A, from P to Q



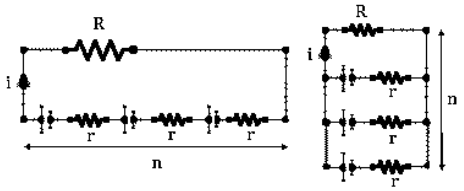
Q.2 To get maximum current through a resistance of **2.5 Ω**, one can use **m** rows of cells, each row having**n** cells. The internal resistance of each cell is **0.5 Ω**. What are the values of **n** and **m** if the total number of cells is **45**?

(A)$m = 3,\ n = 15$ **(B)**$m = 5,\ n = 9$ **(C)**$m = 9,\ n = 5$ **(D)**$m = 15,\ n = 3$



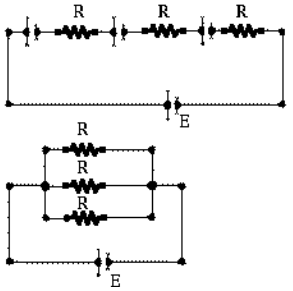
Q.3 A circuit whose resistance **R** is connected to **n** similar cells. If the current in the circuit is the same whether the cells are connected in series or parallel, then the internal resistance **r** of each cell is given by

(A)$r = \frac{R}{n}$ **(B)**$r = nR$ **(C)**$r = R$ **(D)**$r = \frac{1}{R}$



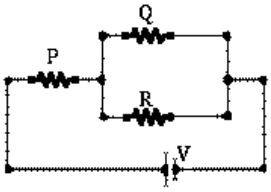
Q.4 Three equal resistors connected in series across a source of emf together dissipate **10 W** of power. What would be the power dissipated if the same resistors are connected in parallel across the same source of emf?

(A)50 W **(B)**70 W **(C)**90 W **(D)**110 W



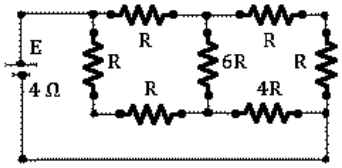
Q.5 Resistors **P**, **Q** and **R** in the circuit have equal resistances. If the battery is supplying a total power of **12 W**, what is the power dissipated as heat in resistor **R** ?

(A)2 W **(B)**6 W **(C)**3 W **(D)**8 W



Q.6 A battery of internal resistance **4 Ω** is connected to the network of resistance as shown in figure. In order that the maximum power can be delivered to the network, the value of **R** (in **Ω**) should be

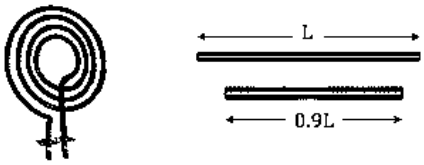
(A) $\frac{4}{9}$ **(B)** 2 **(C)** $\frac{8}{3}$ **(D)** 18



Q.7 If the length of the filament of a heater is reduced by **10**%, the power of the heater will

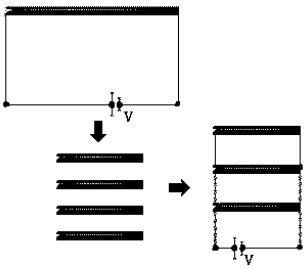
(A) Increase by about 9% **(B)** increase by about 11%

(C) Increase by about 19% **(D)** decrease by about 10%



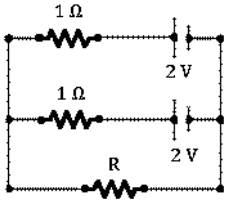
Q.8 Power generated across uniform wire connected across a supply is **H**. If the wire is cut into **n** equal parts and all the parts are connected in parallel across the same supply, the total power generated in the wire is

(A) $\frac{H}{n^2}$ **(B)** n^2H **(C)** Nh **(D)** $\frac{H}{n}$



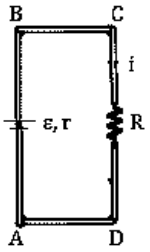
Q.9 Two identical batteries, each of emf **2 V** and internal resistance $\mathbf{r = 1\ \Omega}$ are connected as shown. The maximum power that can be developed across **R** using these batteries is

(A) 3.2 W **(B)** 8.2 W **(C)** 2 W **(D)** 4 W



Q.10 For the given power output, there exists two values of external resistance, the product of these resistances will be equal to

(A) r^2 **(B)** $\frac{r^2}{4}$ **(C)** $2r^2$ **(D)** $\frac{r^2}{3}$

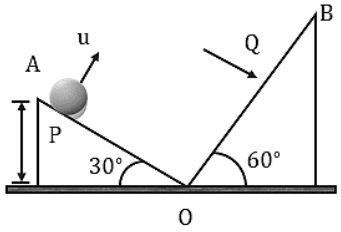


WORKSHEET

Time of Flight with Incline as Frame of Reference

Q.1 Two inclined planes **OA** and **OB** having inclination (with horizontal) **30°** and **60°**, respectively, intersect each other at **O** as shown in figure. A particle is projected from point **P** with velocity $\mathbf{u = 10(\sqrt{3})\ ms^{-1}}$ along a direction perpendicular to the plane **OA**. If the particle strikes the plane **OB** perpendicular at **Q**, calculate the displacement **PQ**

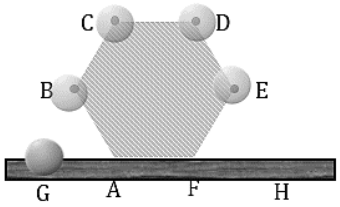
(A) 20 m **(B)** 10 m **(C)** 5 m **(D)** 2.5 m



Projectile Time, Height and Range

Q.2 A particle is projected from point **G** such that it touches the points **B**, **C**, **D** and **E** of a regular hexagon of side **a**. Its horizontal range **GH** is

(A) $\sqrt{3}$a **(B)** $\sqrt{5}$a **(C)** $\sqrt{7}$a **(D)** $\sqrt{6}$a

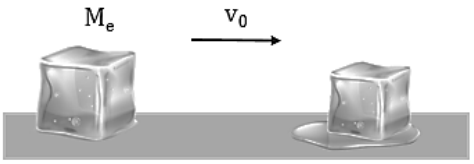


Latent Heat

Q.3 An ice cube of mass $\mathbf{M_0}$ is given a velocity $\mathbf{v_0}$ on a rough horizontal surface with coefficient of friction **μ**. The block is at its melting point and latent heat of fusion of ice is **L**. The block receives heat only due to the friction forces and all work is converted into heat. Find the mass ($\mathbf{M_t}$) of the remaining ice block after time **t**.

(A) $M_t = M_0 e^{-\frac{2\mu g}{L}\left(v_0 t+\frac{1}{2}\mu g t^2\right)}$ **(B)** $M_t = M_0 e^{-\frac{\mu g}{L}\left(v_0 t-\frac{1}{2}\mu g t^2\right)}$

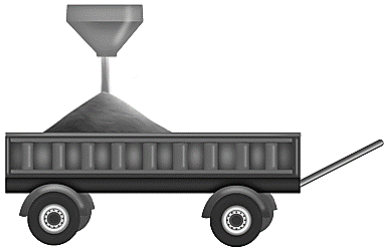
(C) $M_t = M_0 e^{-\frac{3\mu}{L}\left(v_0 t-\frac{1}{2}\mu g t^2\right)}$ **(D)** $M_t = M_0 e^{-\frac{2\mu g}{L}\left(v_0 t-\mu g t^2\right)}$



Newtons Second Law

Q.4 In the figure shown a cart moves on a smooth horizontal surface due to an external constant force of magnitude **F**. The initial mass of the cart is $\mathbf{M_0}$ and velocity is zero. Sand falls on to the cart with negligible velocity at constant rate **μ kg/s** and sticks to the cart. The velocity of the cart at time **t** is:

(A) $\frac{Ft}{M_0+\mu t}$ **(B)** $\frac{Ft}{M_0}e^{\mu t}$ **(C)** $\frac{Ft}{M_0}$ **(D)** $\frac{Ft}{M_0+\mu t}e^{\mu t}$

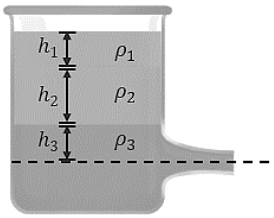


Bernoulli's Principle

Q.5 An open large tank with a nozzle attached contains three immiscible, inviscid fluids as shown. Assuming that the changes in $\mathbf{h_1}$, $\mathbf{h_2}$ and $\mathbf{h_3}$ are negligible, the instantaneous discharge velocity is

(A) $\sqrt{2gh_3\left(1+\frac{\rho_1}{\rho_3}\frac{h_1}{h_3}+\frac{\rho_2}{\rho_3}\frac{h_2}{h_3}\right)}$ **(B)** $\sqrt{2g(h_1+h_2+h_3)}$

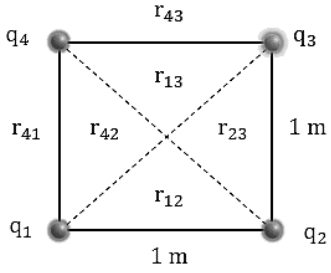
(C) $\sqrt{2g\left(\frac{\rho_1h_1+\rho_2h_2+\rho_3h_3}{\rho_1+\rho_2+\rho_3}\right)}$ **(D)** $\sqrt{2g\left(\frac{\rho_3h_2h_3+\rho_2h_3h_1+\rho_3h_1h_2}{\rho_1h_1+\rho_2h_2+\rho_3h_3}\right)}$



Potential Energy of a System of Multiple Point Charges

Q.6 Four charges $\mathbf{q_1 = 1\ \mu C}$, $\mathbf{q_2 = 2\ \mu C}$, $\mathbf{q_3 = -3\ \mu C}$ and $\mathbf{q_4 = 4\ \mu C}$ are kept on the vertices of a square of side $\mathbf{1\ m}$. Find the electric potential energy of this system of charges

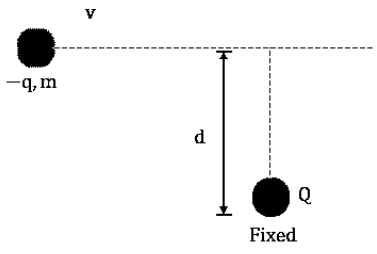
(A) $+7.62\times10^{-2}$ J **(B)** -7.62×10^{-2} J **(C)** 2×10^{-2} J **(D)** -0.1 J



Conservation of Energy in Case of Electrostatics

Q.7 Figure shows a charge $+\mathbf{Q}$ clamped at a point in free space. From a large distance another charge particle of charge $-\mathbf{q}$ and mass of $\mathbf{m}$ is thrown towards $+\mathbf{Q}$ with an impact parameter $\mathbf{d}$ as shown with speed $\mathbf{v}$. How many positions for minimum separation would be obtained for the particle?

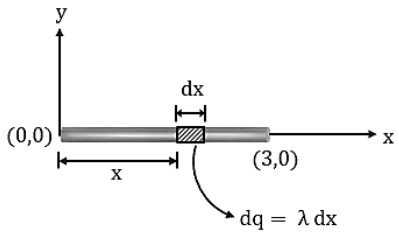
(A) 1 **(B)** 2 **(C)** 3 **(D)** 4



Linear Charge Distribution

Q.7 If the linear charge density of a rod of length **3 m** varies as $\boldsymbol{\lambda = (2 + x)\ C/m}$, where **x** is the distance from one end of the rod, then find the total charge on the rod

(A)21 C **(B)**5.5 C **(C)**10.5 C **(D)**5 C



EMF and EMF Devices

Q.8 A battery has emf **4 V** and internal resistance**r**. When this battery is connected to an external resistance of**2 Ω**, a current of **1 A** flows in the circuit. How much current will flow if the terminals of the battery are connected directly?

(A)1 A **(B)**2 A **(C)**4 A **(D)**Infinite

Series Combination of Cells

Q.9 **n** identical cells, each of e.m.f **ε** and internal resistance **r** are joined in series to form a closed circuit. The potential difference across any one cell is

(A) Zero **(B)**ε **(C)**$\frac{\varepsilon}{n}$ **(D)**$\frac{n-1}{n}\varepsilon$

Kirchhoff's Voltage Law

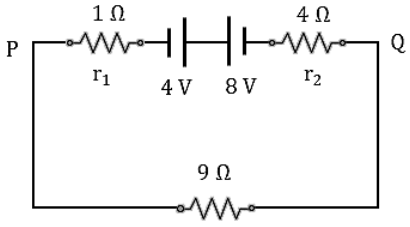
Q.10 In order to determine the emf of a storage battery, it was connected in series with a standard cell in a certain circuit and a current $\mathbf{I_1}$ was obtained. When the battery is connected to the same circuit opposite to the standard cell a current $\mathbf{I_2}$ flows in the external circuit from the positive plate of the storage battery. What is the emf $\mathbf{E_1}$ of the storage battery, if the emf of the standard cell is $\mathbf{E_2}$?

(A)$E_1 = \frac{I_1+I_2}{I_1-I_2}E_2$ **(B)**$E_1 = \frac{I_1+I_2}{I_2-I_1}E_2$ **(C)**$E_1 = \frac{I_1-I_2}{I_1+I_2}E_2$ **(D)**$E_1 = \frac{I_2-I_1}{I_1+I_2}E_2$

Kirchhoff's Voltage Law

Q.11 Two batteries of emf **4 V** and **8 V** with internal resistances **1 Ω** and **2 Ω** are connected in a circuit with a resistance of **9 Ω** as shown in figure. The current and potential difference between the points **P** and **Q** are

(A)$\frac{1}{3}$ A And 3 V **(B)**$\frac{1}{6}$ A and 4 V **(C)**$\frac{1}{9}$ A and 9 V **(D)**$\frac{1}{2}$ A and 12 V



Mixed Combination of Cells

Q.12 **N** identical cells are connected to form a battery. When the terminals of the battery are joined directly (short-circuited), current **I** flows in the circuit. To obtain the maximum value of **I**

(A) All the cells should be joined in series

(B) All the cells should be joined in parallel

(C) Two rows of N/S cells each should be joined in parallel

(D) $\sqrt{N}$ Rows of $\sqrt{N}$ cells each should be joined in parallel

Mixed Combination of Cells

Q.13 **N** identical cells are connected to form a battery. When the terminals of the battery are joined directly (short-circuited), current **I** flows in the circuit. To obtain the maximum value of **I**

(A) All the cells should be joined in series

(B) All the cells should be joined in parallel

(C) Two rows of N/S cells each should be joined in parallel

(D) $\sqrt{N}$ Rows of $\sqrt{N}$ cells each should be joined in parallel

Power in Electric Circuits

Q.14 Power generated across uniform wire connected across a supply is**H**. If the wire is cut into **n** equal parts and all the parts are connected in parallel across the same supply, the total power generated in the wire is

(A) $\frac{H}{n^2}$ **(B)** n^2H **(C)** nH **(D)** $\frac{H}{n}$

Power in Electric Circuits

Q.15 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%

Centripetal Acceleration

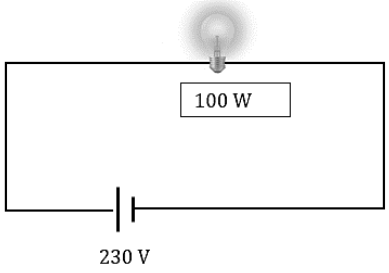
Q.16 An electric kettle has two heating filaments. One brings it to boil in **10 min** and the other in **15 min** when they are connected across the same potential difference. If the two heating filaments are connected in parallel, then water in kettle will boil in

(A) 6 min **(B)** 8 min **(C)** 25 min **(D)** 5 min

Power Delivered and Heat Dissipated in a Circuit

Q.17 A 100 W bulb is designed to operate at a potential difference of 230 V. Find the current drawn by the bulb if it is operated at a potential difference for which it is designed.

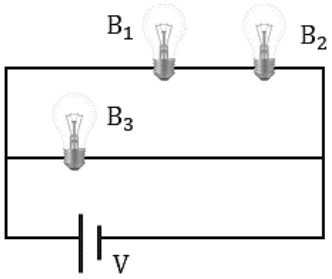
(A) $\frac{2}{23}$ A **(B)** $\frac{5}{23}$ A **(C)** $\frac{7}{23}$ A **(D)** $\frac{10}{23}$ A



Electric Bulbs

Q.18 The above configuration shows three identical bulbs, grade them in order of their brightness

(A) $B_3 > B_2 = B_1$ **(B)** $B_1 = B_2 > B_3$ **(C)** $B_3 > B_1 > B_2$ **(D)** $B_2 > B_1 > B_3$

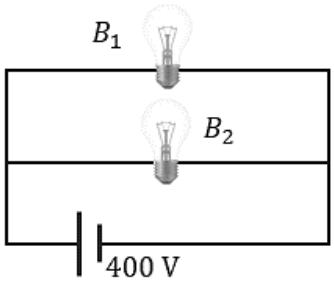


Electric Bulbs

Q.19 Bulb **1** and Bulb **2** are rated (**30 W − 200 V**) and (**60 W − 200 V**) respectively. They are connected with a **400 V** power supply. Find which bulb will get fused if they are connected in parallel

(A) Bulb 1 will get fused **(B)**Bulb 2 will get fused

(C) Both will get fused **(D)**No bulb will get fused



Electric Bulbs

Q.20 A factory is served by a **220 V** supply line. In a circuit protected by a fuse marked**10 A**, the maximum number of **100 W** lamps in parallel that can be turned on is

(A)11 **(B)**22 **(C)**33 **(D)**66

ANSWER KEY

Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(C)	(A)	(C)	(C)	(A)	(B)	(B)	(B)	(C)	(A)

WORK SHEET										
Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(A)	(C)	(B)	(B)	(A)	(B)	(A)	(C)	(B)	(A)
Q.	11	12	13	14	15	16	17	18	19	20
Sol.	(A)	(A)	(B)	(B)	(B)	(A)	(D)	(A)	(C)	(B)