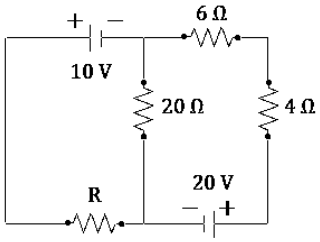
Q.1 In the circuit shown in figure, for what value of ***R*** will the power consumed by this resistance will be maximum

(A) $40\ \Omega$ **(B)** $\frac{20}{3}\ \Omega$ **(C)** $\frac{10}{7}\ \Omega$ **(D)** $30\ \Omega$

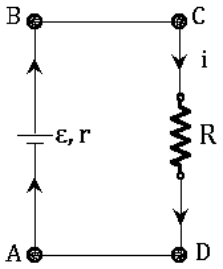


Q.2 A cell of internal resistances **r** is connected to a load of resistance**R**. Energy is dissipated in the load, but some thermal energy is also wasted in the cell. The efficiency of such arrangement is found from the expression $\frac{\textbf{Energy dissipated in the load}}{\textbf{Energy dissipated in the complete circuit}}$ .which of the following gives the efficiency in this case?

(A) $\frac{r}{R}$ **(B)** $\frac{R}{r}$ **(C)** $\frac{r}{R+r}$ **(D)** $\frac{R}{R+r}$

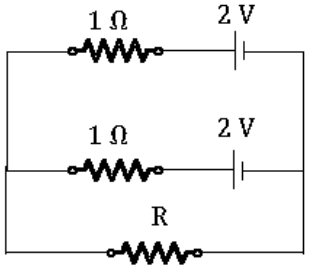
Q.3 For a given power output, there exists two values of external resistance, the product of these resistances will be equal to

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



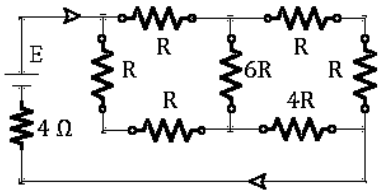
Q.4 Two identical batteries, each of emf **2 V** and internal resistance $\mathbf{r = 1\ \Omega}$ are connected as shown. The maximum power that can be developed across **R** using these batteries is

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



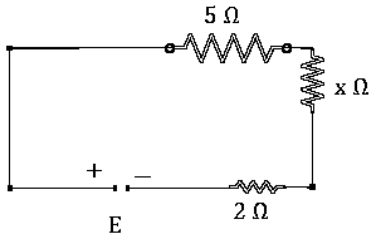
Q.5 A battery of internal resistance $\mathbf{4\ \Omega}$ is connected to the network of resistance as shown in figure. In order that the maximum power can be delivered to the network, the value of **R** (in $\mathbf{\Omega}$) should be

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



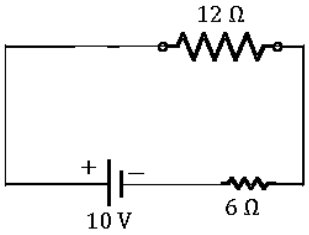
Q.6 In the given circuit the power generated in **5 Ω** resistance will be maximum for **x** equal to

(A)1 Ω **(B)** 7 Ω **(C)**$\frac{2}{3}$ Ω **(D)**0 Ω



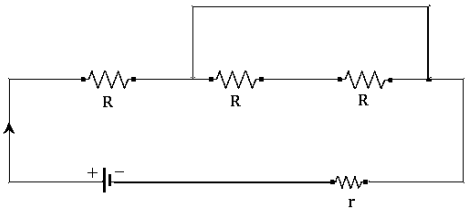
Q.7 Find the efficiency of the below given battery having internal resistance**6 Ω.**

(A)75 % **(B)**37.5 % **(C)**50 % **(D)**67 %



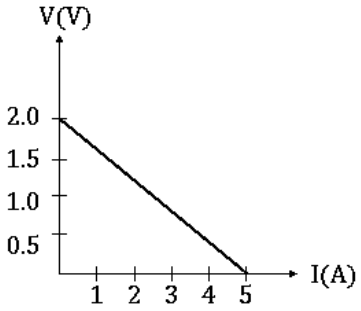
Q.8 Find the value of **r** in terms of **R**, so that power in external circuit is maximum.

(A)$r = 3R$ **(B)**$r = 3R$ **(C)**$r = \frac{R}{3}$ **(D)**$r = \frac{R}{2}$



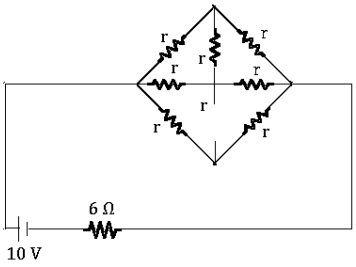
Q.9 A battery of emf **E** and internal resistance **r** is connected across a resistance**R**. Resistance **R** can be adjusted to any value greater than or equal to zero. A graph is plotted between the current passing through the resistance (**I**) and potential difference across the terminals of the battery(**V**). Maximum power developed across the resistance **R** is

(A)5 W **(B)**15 W **(C)**25 W **(D)**10 W



Q.10 In the given circuit diagram, battery has internal resistance of **6 Ω**. For what value of **r**, external circuit will consume maximum power?

(A)5 Ω **(B)**6 Ω **(C)**9 Ω **(D)**3 Ω



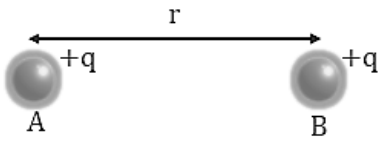
WORKSHEET

Principle of Superposition

Q.1 Two equally charged identical metallic spheres **A** and **B** repel each other with a force $\mathbf{2 \times 10^{-5}\ N}$, when placed in air (neglect the dimension of sphere as they are very small). Another identical uncharged sphere **C** is touched to **B** and then placed at the midpoint of line joining **A**and**B**. What is the net electrostatic force on **C** ?

(A) 1×10^{-5} N, toward BA **(B)** 2×10^{-5} N, towards AB

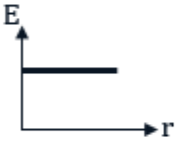
(C) 4×10^{-5} N, towards BA **(D)** 0.5×10^{-5} N, towards AB



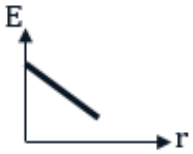
Electric Field Due to a Line of Charge Not on Its Axis

Q.2 Which of the following graph shows the curve between electric field (**E**) versus distance (**r**) from infinite line charge having constant positive charge density

(A)

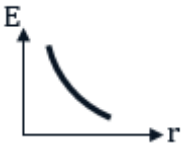


(B)



(C)

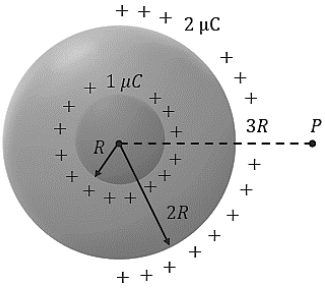
(D)



Electric Potential Due to Shell

Q.3 Two concentric spheres of radii **R** and **2R** are charged. The inner sphere has a charge of **1 μC** and the outer sphere has a charge of **2 μC** of the same sign. The potential is **9000 V** at a distance **3R** from the common center. The value of **R** is

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

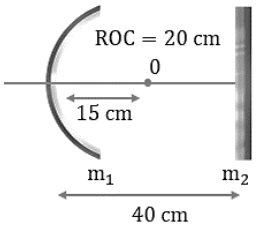


Mirror Formula

Q.4 Find the position of the final image of the object **O** after three successive reflections taking the first reflection on $\mathbf{m_1}$

(A) 12.5 cm in front of the mirror m_1 **(B)** 10 cm In front of the mirror m_1

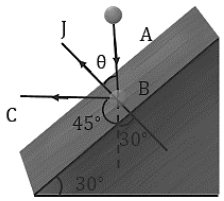
(C) 12.5 cm In front of the mirror m_2 **(D)** 10 cm In front of the mirror m_2



COM in Oblique Collision

Q.5 The point B lies on a smooth plane inclined at **30°** to the horizontal. A particle of mass $\frac{1}{7}$ **kg** is dropped from a point A which lies **10 m** vertically above**B**.The particle rebounds from the plane in the direction **BC** with speed **v m/s** at an angle of **45°** to the plane. Find the impulse exerted by the plane on the particle (in**Ns**)

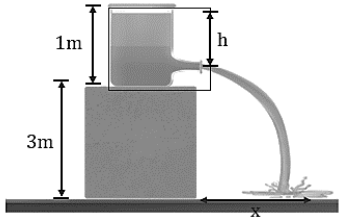
(A) $1+\sqrt{3}$ **(B)** $1-\sqrt{3}$ **(C)** $2+\sqrt{3}$ **(D)** $2-2\sqrt{3}$



Speed of Efflux

Q.6 A water tank stands on the roof of a building as shown in the figure. The value of height of water above the hole (**h**) for which the horizontal distance covered by the water (**x**) is maximum

(A) 0.5 m **(B)** 0.8 m **(C)** 1 m **(D)** 0.2 m



Heat Engines

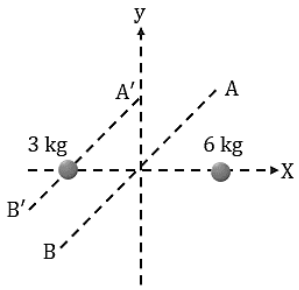
Q.7 For which combination of temperatures the efficiency of Carnot's engine is highest?

(A) 80 K, 60 K **(B)** 100 K, 80 K **(C)** 60 K, 40 K **(D)** 40 K, 20 K

Moment of Inertia of Solid Bodies

Q.8 Two particles having masses **3 kg** and **6 kg** are situated in a plane perpendicular to line **AB** at a perpendicular distance of **2 m** and **4 m** respectively as shown in figure. Find the moment of inertia about an axis **A′B′** parallel to **AB**

(A) $216\ \text{kg}-\text{m}^2$ **(B)** $108\ \text{kg}-\text{m}^2$ **(C)** $300\ \text{kg}-\text{m}^2$ **(D)** $200\ \text{kg}-\text{m}^2$



Relative Motion: Rain Example

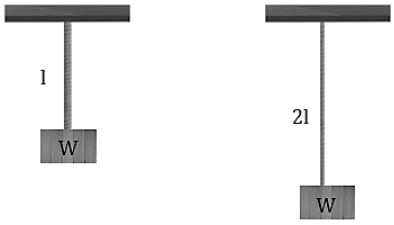
Q.9 Rain is falling vertically with a velocity of $\mathbf{15\ ms^{-1}}$. A person rides a bicycle with a speed of $\mathbf{15\ ms^{-1}}$ in the west to east direction. What is the direction (angle with vertical) in which he should hold his umbrella to save himself from the rain?

(A)45° **(B)**90° **(C)**30° **(D)**15°

Longitudinal Strain

Q.10 A steel wire of length **1 m** and cross sectional area **A** is stretched by **1 cm** under a given load. When the same load is applied to another steel wire of double length and half the cross-sectional area of the first one, the amount of stretching (extension) is

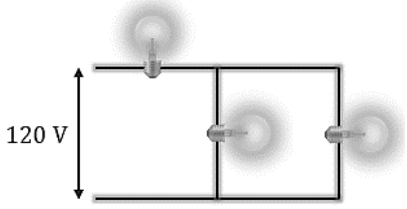
(A)0.5 m **(B)**2 m **(C)**4 m **(D)**1.5 m



Electric Bulbs

Q.11 Three light bulbs (**60 W**, **120 V**) are connected across a **120 V** power source. If the resistance of each bulb does not change with current, then find out total power delivered to the three bulbs

(A)80 W **(B)**60 W **(C)**40 W **(D)**20 W



Electric Bulbs

Q.12 When electric bulbs of same power, but different marked voltage are connected in series across the power line, their brightness will be

(A) Proportional to their marked voltage

(B) Inversely proportional to their marked voltage

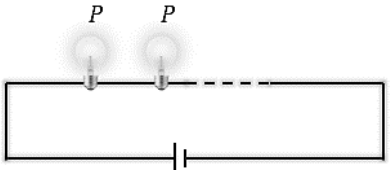
(C) Proportional to the square of their marked voltage

(D) Inversely proportional to the square of their marked voltage

Power in Electric Circuits

Q.13 **n** identical light bulbs, each designed to draw **P** power from a certain voltage supply, are joined in series across that supply. The total power which they will draw is

(A) nP **(B)** P **(C)** P/n **(D)** P/n^2



Power in Electric Circuits

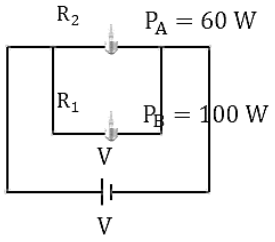
Q.14 Two electric bulbs **A** and **B** are rated **60 W** and **100 W** respectively. If they are connected in parallel to the same source, then (assume the bulb **A** and **B** have the same voltage rating.)

(A) Both the bulbs draw the same current

(B) Bulb A draws more current than bulb B

(C) Bulb B draws more current than bulb A

(D) Current drawn in the bulbs are in the ratio of their resistances



Electric Bulbs

Q.15 Three similar light bulbs are connected to a constant voltage D.C. supply as shown in the figure. Each bulb operates at normal brightness and the ammeter (of negligible resistance) registers a steady current.

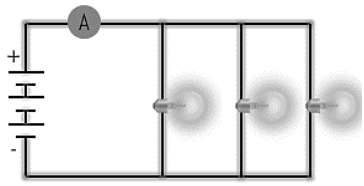
The filament of one of the bulbs breaks. What happens to the ammeter reading and to the brightness of the remaining bulbs?

(A) Both ammeter reading and bulb brightness increases

(B) Ammeter reading increases and bulb brightness remains unchanged

(C) Both ammeter reading and bulb brightness remains unchanged

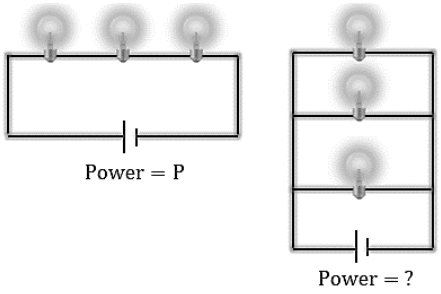
(D) Ammeter reading decreases and bulb brightness remains unchanged



Power in Electric Circuits

Q.16 Three identical bulbs are connected in series and these together dissipate a power **P**. If now these bulbs are connected in parallel, then the power dissipated will be

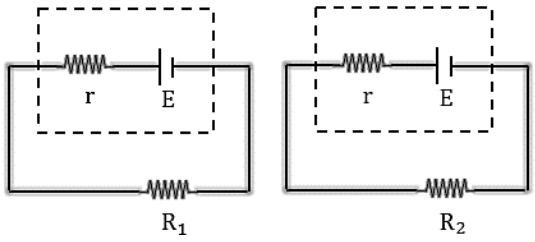
(A) $\frac{P}{3}$ **(B)** 3 P **(C)** 9 P **(D)** $\frac{P}{9}$



Power in Electric Circuits

Q.17 A cell of constant emf is first connected to a resistance $\mathbf{R_1}$ and then connected to a resistance $\mathbf{R_2}$. If power delivered in both cases is same, then the internal resistance of the cell is

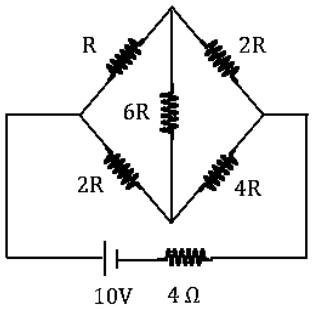
(A) $\sqrt{R_1R_2}$ **(B)** $\sqrt{\frac{R_1}{R_2}}$ **(C)** $\frac{R_1-R_2}{2}$ **(D)** $\frac{R_1+R_2}{2}$



Power Delivered and Heat Dissipated in a Circuit

Q.18 A battery if internal resistance **4 Ω** is connected to the network of resistances as shown. What must be the value of **R** so that maximum power is delivered to the network?

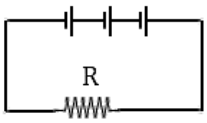
(A) 4 Ω **(B)** 2 Ω **(C)** 1 Ω **(D)** 0.5 Ω



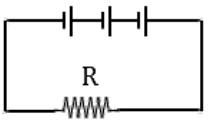
Power in Electric Circuits

Q.19 Three identical cells, each having an e.m.f. of $\mathbf{1.5\ V}$ and a constant internal resistance of $\mathbf{2.0\ \Omega}$, are connected in series with a $\mathbf{4.0\ \Omega}$ resistor **R**, first as in circuit (**i**) and secondly as in circuit (**ii**). What is the ratio of $\frac{\textbf{Power across R in circuit(i)}}{\textbf{Power across R in circuit(ii)}}$?

(A) 9.0 **(B)** 7.2 **(C)** 1.8 **(D)** 3.0



Circuit (i)

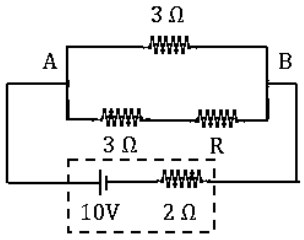


Circuit (ii)

Power Delivered and Heat Dissipated in a Circuit

Q.20 A battery having emf 10 V and internal resistance $\mathbf{2\ \Omega}$ is connected to an external circuit as shown in the diagram. Find the value of R for which maximum power will be transferred to the external circuit. Also find the efficiency of the battery.

(A) 2 Ω, 50 **(B)** 4 Ω, 50 **(C)** 2 Ω, 67 **(D)** 4 Ω, 67



ANSWER KEY

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