Gazette's Educational Supplement

PHYSICS 3rd Sec.

Physics Teacher

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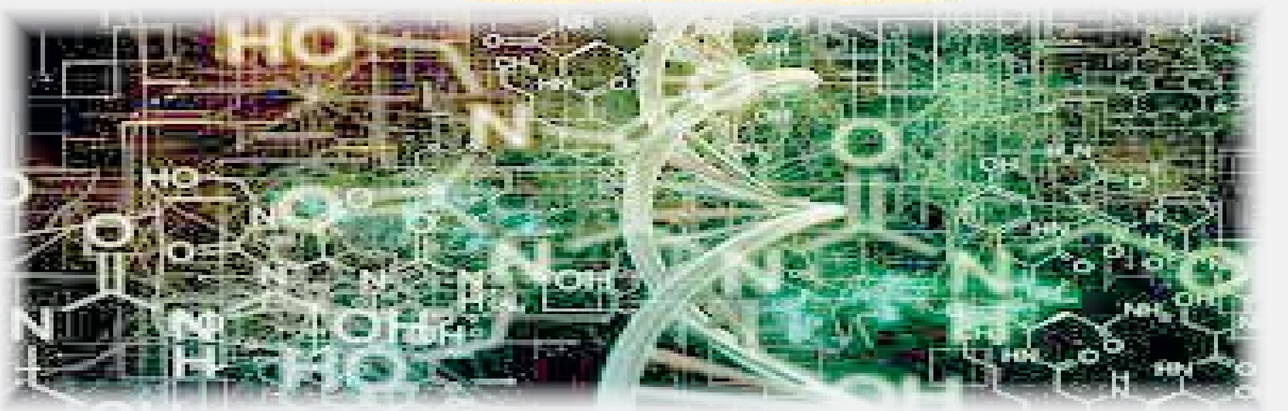
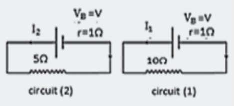
Educational Consultant

Awatef Ahmed



Final revision on ch 8 ,1

(1) In the figure, the ratio, $\frac{I_1}{I_2}=\dots$



a) $\frac{6}{11}$ b) $\frac{11}{6}$

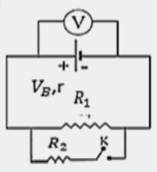
c) $\frac{1}{2}$ d) $\frac{2}{1}$

The correct answer is a) $\frac{6}{11}$

Because, from ohm's law for closed circuit $I=\frac{V_B}{R+r}$

$I_1=\frac{V}{10+1}=\frac{V}{11}$, $I_2=\frac{V}{5+1}=\frac{V}{6}\rightarrow\frac{I_1}{I_2}=\frac{6}{11}$

(2) In the circuit shown in the figure what happens to the voltmeter reading when the (K) is closed



a) Increase b) decrease

c) Remains constant d) decrease to half

The correct answer is: decrease

Because $V=V_B-Ir$(when key of external circuit is closed the electric current intensity increased and that is inversely proportion with potential difference from ohm's law of closed circuit)

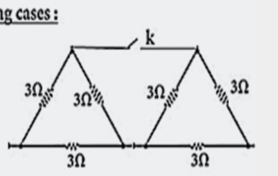
(3)**The equivalentresistance in the following cases:**

a)When(k) is open is ....

a)2 b)4 c)6 d)8

b)When(k) is closed is ....

a)2 b)4 c)6 d)8



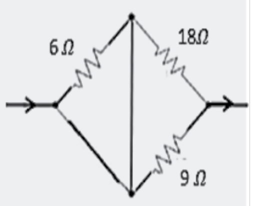
The correct answer is: a) open 4Ω b) closed 3Ω

Because, in case of open circuit 6Ω//3Ωseries 6Ω//3Ω $R_{eq}=2+2=4\Omega$

But, in case of closed circuit 6Ω//6Ω, $R_{eq}=3\Omega$

(4)From the opposite diagram

$R_{eq}=$................



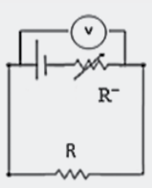
a) $\frac{72}{11}\Omega$ b) 6Ω

c) $\frac{54}{11}\Omega$ d) zero Ω

The correct answer is 6Ω

Because, 18Ω//9Ω (6Ω is cancelled) $R_{eq}=\frac{18\times9}{18+9}=6\Omega$

(5)By increasing (R⁻) in the shown circuit, the reading of voltmeter...............



a) Increase b) doubled

c) Decrease d) remains same

The correct answer is : decreases

Because; if the battery has an internal resistance r Ω
The reading of voltmeter $V=V_B-I(R'+r)$

(6)If the length of a metal conductor is doubled, and its radius decrease to half, so the specific resistance is...................

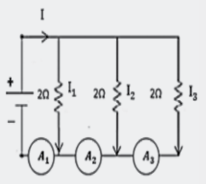
a) Increased 8 times b) increased 4 times

c) Increased 2 times d) unchanged

The correct answer is (d) unchanged

Because, the specific resistance (resistivity) depends only on kind of material and temperature.

(7)In the shown electric circuit, if the reading of Ammeter (A_1) is 1.2A then the reading of Ammeter (A_2) is.............



(a) 0.2 A (b) 0.4A

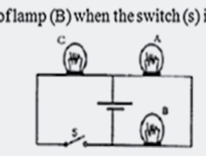
(c) 0.6A (d) 0.8A

The correct answer is :(d) 0.8A

Because, I=1.2A,$I_1=I_2=I_3=\frac{1.2}{3}=0.4A$

$A_2=I_2+I_3=0.4+0.4=0.8A$

(8)In the opposite figure three identical lamps connected with a battery of negligible internal resistance, what will happen to the brightness of lamp (B) when the switch (s) is closed?



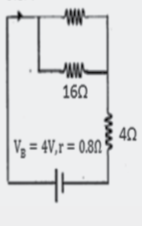
a) increased b) increased 2 times c) decreased d) remains constant

The correct answer is remains constant

Because, the current intensity through lamp is unchanged

(9)In the circuit shown, the value of resistance (R) equals ....

a)2Ω b) 4Ω b)6Ω d)8Ω

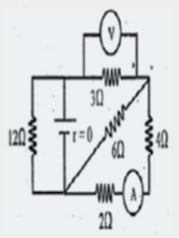


The correct answer is: 4Ω

Because, $I=\frac{V_B}{R+r}\rightarrow0.5=\frac{4}{\frac{16R}{16+R}+4+0.8}\rightarrow\frac{16R}{16+R}+4.8=8$

$3.2=\frac{16R}{16+R}\rightarrow R=4\Omega$

(10)In the opposite figure, if the current intensity passing through resistance 2Ω equals 1A, so the current through resistance 12Ω equals ....

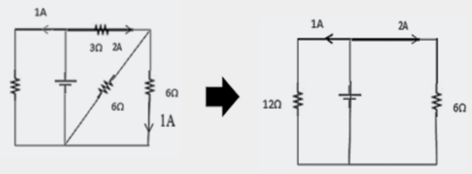


(a)1A (b)2A

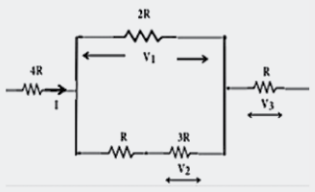
(C) 3A (d)4A

The correct answer is 1A

Because, 6//6 →3Ωseries with3



(11)From the opposite figure electric circuit, which of the following is the correct answer:

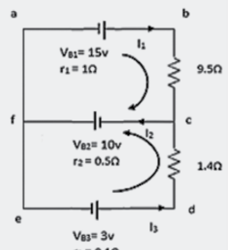


a) $V_1>V_2>V_3$ b)$V_2>V_1>V_3$ c) $V_1>V_2=V_3$ d) $V_3>V_1>V_2$

The correct answer is c) $V_1>V_2=V_3$

Because, $V_1=\frac{2}{3}I\times2R=\frac{4}{3}IR$ but, $V_2=\frac{1}{3}I\times3R=IR$ also, $V_3=IR$

(12)In the given circuit find the current intensities: I_1, I_2 and I_3



a) 2,4,6 b) 2,8,6

c) 1,2,3 d) 1,3,5

The correct answer is 2,8,6

Because,

Applying Kirchhoff's first law at point (c):

$I_1+I_3=I_2$ ⟶ (1).

Applying Kirchhoff's second law to the closed path (loop) (a b c f a)

$\sum V_B=\sum IR.$

$15+10=(1+9.5)\ I_1+0.5\ I_2$

multiplying x 2

$50=21\ I_1+1\ I_2$ ⟶ (2).

Applying Kirchhoff's second law to the closed path (loop) (f c d e f)

$\sum V_B=\sum IR.$

$3+10=0.5\ I_2+(0.1+1.4)\ I_3$

multiplying x 2

$26=I_2+3\ I_3$ ⟶ (3).

From equations (1) and (2),

$50=20\ (I_2-I_3)+I_2=22\ I_2-21\ I_3$ ⟶ (4).

Multiplying equation (3) x 7 and adding it to equation (4)

$182=7\ I_2+21\ I_3$

$50=22\ I_2+21\ I_3$ ⟶ (4).

By addition: $232=29\ I_2$ $I_2=8A.$

Substituting in equation (2)

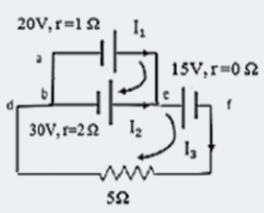
$50=21\ I_1+8$

$I_1=2A$

Substituting in equation (1), we find that $I_3=6A$

N.B. All the assigned directions are correct since all current intensities are positive

(13) <u>From the opposite electric circuit shown in figure, answer The following quest:</u>



(a) The intensity of current through each battery are..........

(1) -2.35,-3.82, 1.46 (2) -5.66,-1.52, 5.33

(3) -3.23,-6.69, 4.34 (4) -4.69, -8.45, 4.12

(b) The terminal voltage of the battery 30V is................volts.

(1)12 (2)13 (3)14 (4)15

(c)The potential difference across the resistor 5 Ω is ....volts.

(1) 5.2 (2)2.7 (3)7.2 (4)2.5

The correct answer

(a) (1) -2.35,-3.82, 1.46 (b) (4)15v (C) 7.5v

Because,

Assume directions of current as shown in figure.

Applying Kirchhoff's first law at point (e):

$I_1+I_2=I_3$ ⟶ (1).

Applying Kirchhoff's second law to the closed path (loop) (a e c b a)

$\sum V_B=\sum IR.$

$20-30=1\times I_1-2\times I_2$

$-10=I_1-2\ I_2$ ⟶ (2).

Applying Kirchhoff's second law to the closed path (loop) (a e f d b a)

$20-15=1\times I_1+5\times I_3$

$5=I_1+5(I_1+I_2)$

$5=6\ I_1+5\ I_2$ ⟶ (3).

Solving equations (2) and (3), by multiplying equation (2) x 5 and equation (3) x 2

$-50=5\ I_1-10\ I_2$

$10=12\ I_1+10\ I_2$

Adding the two equations:

$-40=17\ I_1$

$I_1=-2.35A$

The direction of the current I_1 is opposite to the assumed direction. i.e. The battery 20V is in a state of charging.

Substituting in (2), we find that: $I_2=-3.82$ A i.e. the battery 30 V is in a state of discharge.

And the current $I_3=1.46A$

Terminal voltage of the battery 30 V:

$V_2=V_B-Ir=30-(3.82\times2)=22.36$ V

$V_3=15$ V

$V_R=5\times1.46=7.3$ V

(14) In a pure Si crystal the concentration of each free electrons or holes is $1.5\times10^{10}cm^{-3}$ if it is doped with <u>5-valency Arsenic</u> by the concentration 10^{13} cm^{-3} atoms/cm^{-3},then the concentration of both free electrons and holes in the doped crystals are................cm^{-3} and ....cm^{-3} Respectively.

(a) $10^{13}, 2.25\times10^{7}$ (b) $10^{10}, 2.55\times10^{12}$

(c) $10^{12}, 1.5\times10^{10}$ (d) $10^{3}, 2.25\times10^{10}$

The correct answer is (a) $10^{13}, 2.25\times10^{7}$

Because,

$n=N_D^{+}=10^{13}cm^{-3}$

$p=\frac{n_i^2}{N_D^{+}}=\frac{(1.5\times10^{10})^2}{10^{13}}=2.25\times10^{7}cm^{-3}$

(15)If you know that the concentration of free electrons or holes in a pure Ge crystal is $10^{15}cm^{-3}$. Antimony is added with concentration $6\times10^{17}cm^{-3}$ and also boron is added with concentration of 10^{17} cm^{-3},

(Answer the following questions)

(a)The type of this semiconductor is............

(1) Positive (2) negative (3) neutral (4) -2

(b) The concentration of free electrons and holes are ....

(1)$5\times10^{17}cm^{-3}, 2\times10^{12}cm^{-3}$ (2) $5\times10^{15}cm^{-3}, 2\times10^{110}cm^{-3}$

(3) $9\times10^{15}cm^{-3}, 3\times10^{12}cm^{-3}$ (4) $4\times10^{17}cm^{-3}, 3\times10^{12}cm^{-3}$

(c) The type and concentration of impurities that must be added to make the semiconductor behave as pure semiconductor is................

(1) 5-valency with concentration $5\times10^{17}cm^{-3}$

(2) 3-valency with concentration $5\times10^{17}cm^{-3}$

(3) 5-valency with concentration $2\times10^{12}cm^{-3}$

(4) 3-valency with concentration $3\times10^{17}cm^{-3}$

The correct answer is **(a) (2) negative**

(b) (1)$5\times10^{17}cm^{-3}, 2\times10^{12}cm^{-3}$

(c) (2) 3-valency with concentration $5\times10^{17}cm^{-3}$

Because,

(a) Since $N_D>N_A$, n-type the semiconductor.
(b) $n=N_D-N_A=6\times10^{17}-10^{17}=5\times10^{17}cm^{-3}$
$p=\frac{n_i^2}{(N_D-N_A)}=\frac{(10^{15})^2}{5\times10^{17}}=2\times10^{12}cm^{-3}$
(c) we must add 3-valency impurities as boron or aluminum with concentration $=N_D-N_A=6\times10^{17}-10^{17}=5\times10^{17}cm^{-3}$.

(16)The concentration of free electrons or holes in pure silicon is $2.4\times10^{13}cm^{-3}$ If concentration of Si atoms is 4.42×10^{22}atoms /$cm^3$and silicon is doped with phosphorus in concentration of one phosphorus atom in one million Si atoms the concentration of free electrons and holes are ....and ....

(a) $3.2\times10^{11}cm^{-3}, 5.3\times10^{10}$ (b) $2.6\times10^{15}cm^{-3}, 3\times10^{10}$

(c) $4.42\times10^{16}cm^{-3}, 1.303\times10^{10}$ (d) $4.42\times10^{16}cm^{-3}, 7\times10^{10}$

The correct answer is $4.42\times10^{16}cm^{-3}$, $1.303\times10^{10}cm^{-3}$

Because, $N_D=\frac{4.42\times10^{22}}{10^6}=4.42\times10^{16}cm^{-3}$

$\therefore n=N_D^{+}=4.42\times10^{16}cm^{-3}$

$p=\frac{n_i^2}{n}=\frac{(2.4\times10^{13})^2}{4.42\times10^{16}}=1.303\times10^{10}cm^{-3}$

(17) A diode has a resistance 200Ω in forward bias connection.

(a)The current passing in it if a forward bias of +4v is applied on it is......

(1) 0.1A (2) 0.01A (3) 0.2A (d) 0.02A

(b) The current passing in it if a reverse bias of -4v is applied on it is..... A

(1) -0.02 (2) -0.01 (3) 0.02 (4) Zero

The correct answer is 0.002A, Zero

Because, (a) for forward bias: $I=\frac{V}{R}=\frac{4}{200}=0.02A$
(b) for reverse bias the resistance of the diode is very high ∞, so current I = 0.

(18)In a transistor the ratio between the collector current and emitter current is $\alpha_e=0.99$ and the base current has intensity 50 μA ,then

(a) TheCurrent amplification $\beta_e=$

(1) 100 (2) 99 (3) 98 (4) 97

(b) Collector current $I_C=$ μA

(1) 5050 (2) 5049 (3) 4950 (4) 1210

The correct answer is 99 , 4950μA

Because, (a) $\beta_e=\frac{\alpha_e}{1-\alpha_e}=\frac{0.99}{1-0.99}=\frac{0.99}{0.01}=99$

(b) $\beta_e=\frac{I_C}{I_B}\Rightarrow I_C=\beta_e I_B=99\times50=4950\ \mu A$

(19)An npn transistor works as a switch with $V_{cc}=10$ V and$R_c=1000\ \Omega$. the current of collector (I_c),in the following cases

a) a +ve potential is applied on its base sufficient to make the transistor "on".

(1) 0.001A (2) 0.01 (3) 0.1 (4) Zero

b) a -ve potential is applied on its base sufficient to make the transistor "off".

(1) Zero (2) 1 (3) 2 (4) 3

The correct answer is 0.01, Zero

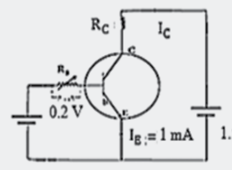
$V_{CC}=V_{CE}+I_cR_c$

a) When transistor is on V_{CE} is nearly = 0

$\therefore V_{CC}=I_cR_c\rightarrow I_c=\frac{V_{CC}}{R_c}=\frac{10}{1000}=0.01$ A

b) If transistor is off $I_c=0$

(20) The circuit represents a transistor as invertor gate, if the output Potential $(V_{CE})=0.8V$ when the resistance of the base circuit $(R_B=4000\Omega)$, so the value of the collector circuit resistance $(R_C)=\cdots$ approximately.



(a) $7.36\times10^{2}\Omega$ (b) $73.6\times10^{2}\Omega$

(c) $0.736\times10^{2}\Omega$ (d) $7360\times10^{2}\Omega$

The correct answer is (a) $7.36\times10^{2}\Omega$

Because,

$V_B=0.2V$, $V_{CE}=0.8V$, $R_B=4000\Omega$

$I_B=\frac{V_B}{R_B}=\frac{0.2}{4000}=5\times10^{-5}A$

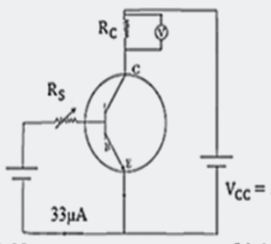
$I_E=I_B+I_C$ → $I_C=I_E-I_B$

$I_C=1\times10^{-3}-(5\times10^{-5})=9.5\times10^{-4}$

$V_{CC}=V_{CE}+I_CR_C\rightarrow1.5=0.8+9.5\times10^{-4}R_C$

$R_C=7.36\times10^{2}\Omega$

(21) The circuit represents a transistor as an amplifier, if the voltmeter reads 4.8V, and the value of $R_C=4.5K\ \Omega$ So, the values of β_e and α_e respectively are ....



(a) 0.97, 32.32 (b) 0.95, 33.67

(c) 0.99, 99 (d) 0.75, 3

The correct answer is (a) 0.97, 32.32

Because, $V_{CC}=5V$, $R_C=4500\ \Omega$, $I_C=\frac{4.8}{4500}=1.067\times10^{-3}A$

$I_B=3.3\times10^{-6}A$ → $\beta_e=\frac{I_C}{I_B}=\frac{1.067\times10^{-3}A}{3.3\times10^{-6}}=32.32$

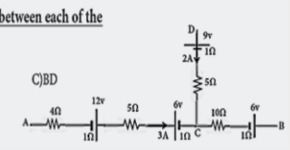
$\beta_e=\frac{\alpha_e}{1-\alpha_e}=32.32$ → $1-\alpha_e=\frac{\alpha_e}{32.32}$

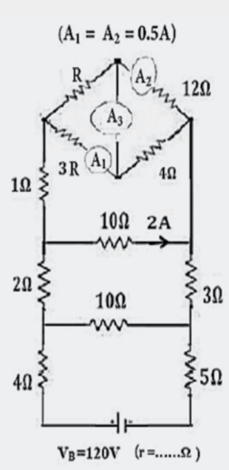
$32.32-32.32\alpha_e=\alpha_e$ → $33.32\alpha_e=32.32$ → $\alpha_e=97$

Competition

(1) <u>Calculate the potential difference between each of the following two points:</u>

a) AB b)AD C)BD





(2) <u>From the opposite figure calculate,</u>

a) The reading of A_3=..............
b) The value of the unknown resistance (R)
c) The equivalent resistance in electric circuit
d) The internal resistance of the battery

<u>Answer</u>

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