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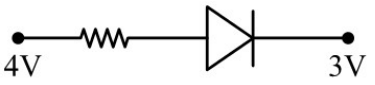
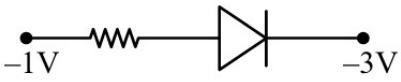
# Ultimate KCET Crash Course 2026

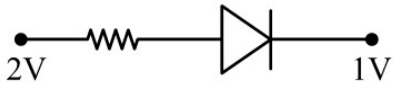
## PHYSICS

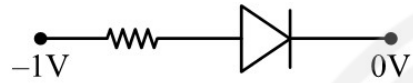
## Semiconductor Electronics DPP : 01

**Q1** Which among the following diodes is reverse biased?

(A) 


(B) 


(C) 


(D) 


**Q2** In an unbiased p-n junction, holes diffuse from the p-region to the n-region because:

(A) free electrons in the n-region attract them.

(B) they move across the junction due to potential difference.

(C) hole concentration in p-region is more as compared to n-region.

(D) all the above.

**Q3** In forward biasing of the $p-n$ junction:

(A) The positive terminal of the battery is connected to $p$-side and the depletion region becomes thin

(B) The positive terminal of the battery is connected to $p$-side and the depletion region becomes thick

(C) The positive terminal of the battery is connected to $n$-side and the depletion region becomes thin

(D) The positive terminal of the battery is connected $n$-side and the becomes thick

**Q4** A solid having upper most energy band partially filled with electrons is called:

(A) Insulator. (B) Semiconductor.

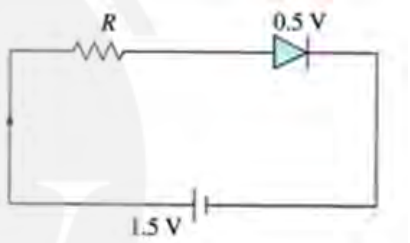
(C) Conductor. (D) None of these

**Q5** In a semiconductor, the concentration of electrons is $8 \times 10^{14}/\text{cm}^3$ and that of the holes is $5 \times 10^{10}\ \text{cm}^3$. The semiconductor is:

(A) *P*-type (B) *N*-type

(C) Intrinsic (D) *PN* junction

**Q6** The diode used in the circuit shown in the figure has a constant voltage drop of $0.5\ \text{V}$ at all currents and a maximum power rating of 100 milliwatts. What should be the value of the resistor $R$ connected in series with the diode for obtaining maximum current?



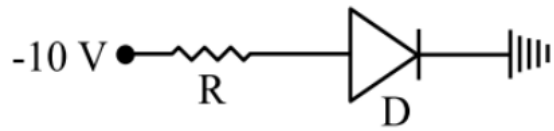

(A) $1.5\Omega$

(B) $5\Omega$

(C) $6.67\Omega$

(D) $200\Omega$

**Q7** In the figure given below, is the diode $\text{D}$ forward or reverse biased?




(A) Forward biased

(B) Reverse biased

(C) Both (A) and (B)

(D) None of these

**Q8** In a $p$ type semiconductor, the majority carriers of current are

(A) protons (B) electrons

(C) holes (D) neutrons

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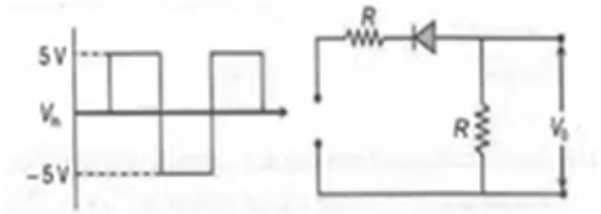
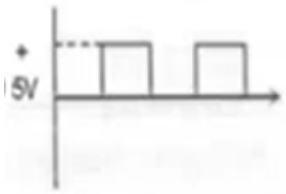
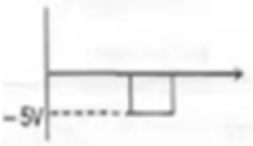
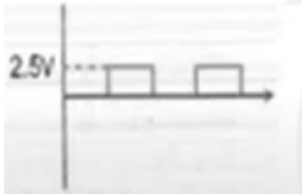
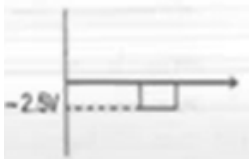
**Q9** A waveform shown when applied to the following circuit will produce which of the following output waveform? [Assume ideal diode configuration]



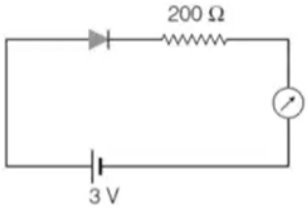

(A)



(B)



(C)


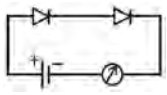

(D)


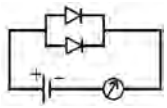

**Q10** The reading of the ammeter for a silicon diode in the given circuit is

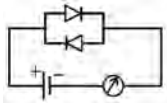


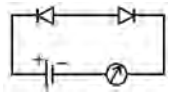

(A) $13.5\ \text{mA}$
(B) 0
(C) $15\ \text{mA}$
(D) $11.5\ \text{mA}$

**Q11** Which circuit will not show current in ammeter?

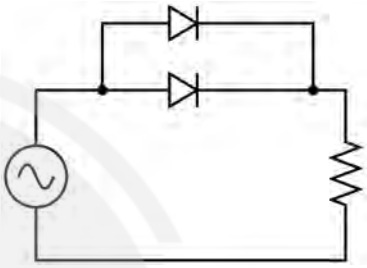
(A)


(B)


(C)


(D)


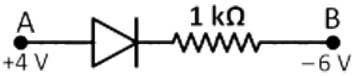
**Q12** Given the following diode circuit, is it a full wave rectifier/half wave rectifier?



(A) Full wave rectifier
(B) No full wave rectifier
(C) Data is insufficient
(D) None of the above

**Q13** A pure semiconductor behaves as a good conductor at:-
(A) Room temperature
(B) Low temperature
(C) High temperature
(D) Both (B) and (C)

**Q14** Consider the junction diode as ideal. The value of current flowing through AB is




(A) $10^{-1}$ A
(B) $10^{-3}$ A
(C) 0 A
(D) $10^{-2}$ A

**Q15** In a pure silicon $\left(n_i = 10^{16}/\text{m}^3\right)$ crystal at $300\ \text{K}$, $10^{21}$ atoms of phosphorus (pentavalent) are added per cubic metre. The new hole concentration will be:
(A) $10^{21}$ per $\text{m}^3$

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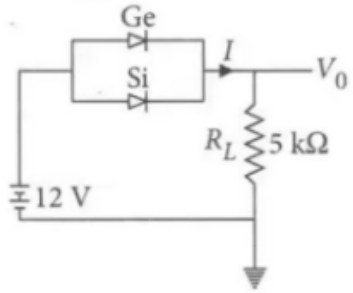
(B) $10^{19}$ per $m^3$
(C) $10^{11}$ per $m^3$
(D) $10^{5}$ per $m^3$

**Q16** In the circuit shown in figure, the silicon and germanium diodes start conducting at $0.7$ V and $0.3$ V respectively. What are the values of $V_0$ and $I$ ?

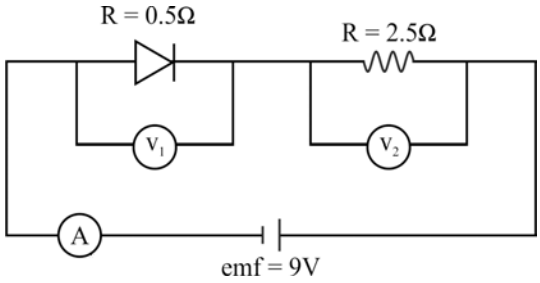



(A) $12$ V, $2.4$ mA
(B) $11.7$ V, $2.34$ mA
(C) $11.3$ V, $2.26$ mA
(D) $11$ V, $2.2$ mA

**Q17** A Ge specimen is doped with Al. The concentration of acceptor atom is $\sim 10^{21}$ atoms per $m^3$. Given that the intrinsic concentration of electron hole pairs is $\sim 10^{19}$ per $m^3$, the concentration of electrons in the specimen is:-
(A) $10^{17}$ per m $^3$
(B) $10^{15}$ per m $^3$
(C) $10^{4}$ per $^3$
(D) $10^{2}$ per $m^3$

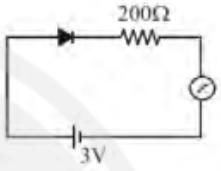
**Q18** Among the following classes of materials, which one possesses the maximum energy band gap between the valence band and the conduction band?
(A) Metals (B) Semi-metals
(C) Semiconductors (D) Insulators

**Q19** In the following circuit find the reading of both voltmeters and current flowing through the circuit.



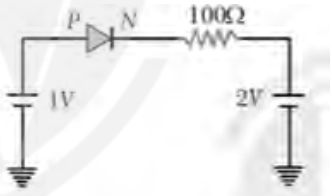

(A) $V_1 = 1$ V, $V_2 = 3$ V and I = 0
(B) $V_1 = 1.5$ V, $V_2 = 7.5$ V and I = 0
(C) $V_1 = 9$ V, $V_2 = 0$ and I = 0
(D) $V_1 = 0, V_2 = 9$ V and I = 0

**Q20** The reading of the ammeter for a silicon diode in the given circuit is :



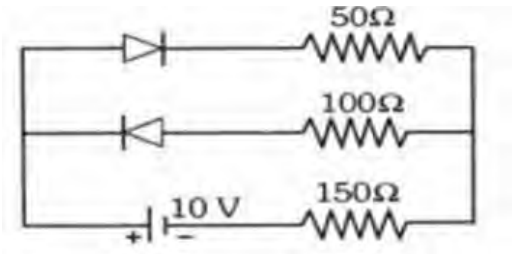

(A) 15 mA (B) 11.5 mA
(C) 13.5 mA (D) 0

**Q21** The current through an ideal $PN$-junction shown in the following circuit diagram will be




(A) Zero
(B) $1$ mA
(C) $10$ mA
(D) $30$ mA

**Q22** Assume that each diode shown in the figure has a forward bias resistance of $50\Omega$ and an infinite reverse bias resistance. The current through the resistance $150\Omega$ is



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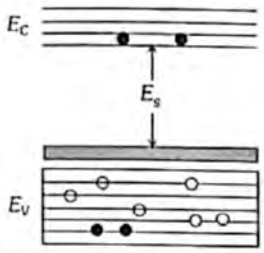
(A) $0.66\ \text{A}$
(B) $0.05\ \text{A}$
(C) Zero
(D) $0.04\ \text{A}$

**Q23** When an impurity is doped into an intrinsic semiconductor, the conductivity of the semiconductor
(A) Increases
(B) Decreases
(C) Remains the same
(D) Becomes zero.

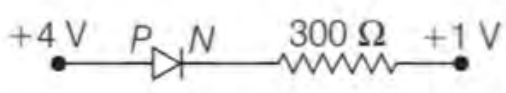
**Q24** In the energy band diagram of a material shown below, the empty circles and filled circles represent "hole" and electron respectively. Then the material is:




(A) p-type semiconductor
(B) an insulator
(C) a metal
(D) n-type semiconductor

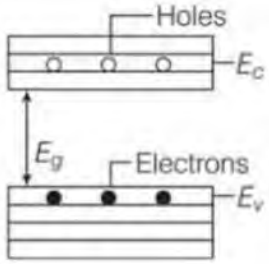
**Q25** For an insulator, the forbidden energy gap is
(A) Zero (B) 1 eV
(C) 2 eV (D) 5 eV

**Q26** In the circuit given below, the value of the current is

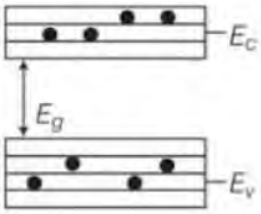



(A) $0\ \text{A}$
(B) $10^{-2}\ \text{A}$
(C) $10^{2}\ \text{A}$
(D) $10^{-3}\ \text{A}$

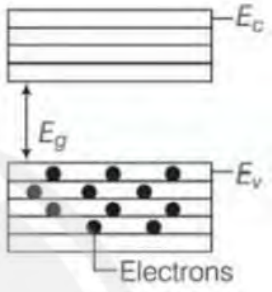
**Q27** Energy band gap diagram for an intrinsic semiconductor at temperature $T > 0\ \text{K}$ is:
(A)



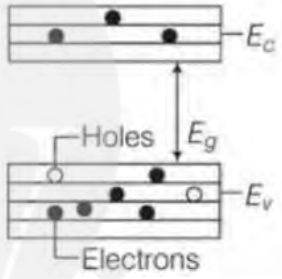

(B)




(C)




(D)




**Q28** Pure Si at 300 K has equal electron $n_e$ and hole $n_h$ concentration of $1.5\times10^{16}/\text{m}^3$. Doping by indium increases $n_h$ to $4.5 \times 10^{22}/\text{m}^3$. Calculate $n_e$, in doped silicon.
(A) $5 \times 10^{9}/\text{m}^3$
(B) $2 \times 10^{7}/\text{m}^3$
(C) $3 \times 10^{5}/\text{m}^3$
(D) $4 \times 10^{4}/\text{m}^3$

**Q29** In a reverse biased diode when the applied voltage changes by 1 V, the current is found to change by $0.5\ \mu\text{A}$. The reverse bias resistance of the diode is:
(A) $2 \times 10^{5}\ \Omega$
(B) $2 \times 10^{6}\ \Omega$
(C) $200\ \Omega$
(D) $2\ \Omega$

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**Q30** The electron concentration in an *n*-type semiconductor is the same as hole concentration in a *p*-type semiconductor. An external field (electric) is applied across each of them. Compare the current in them.

(A) current in *n*-type = current in *p*-type
(B) current in *p*-type > current in *n*-type
(C) current in *n*-type > current in *p*-type
(D) No current will flow in *p*-type, current will only flow in *n*-type

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# Answer Key

| | |
|---|---|
| Q1 | (D) |
| Q2 | (C) |
| Q3 | (A) |
| Q4 | (C) |
| Q5 | (B) |
| Q6 | (B) |
| Q7 | (B) |
| Q8 | (C) |
| Q9 | (D) |
| Q10 | (B) |
| Q11 | (D) |
| Q12 | (B) |
| Q13 | (C) |
| Q14 | (D) |
| Q15 | (C) |
| Q16 | (B) |
| Q17 | (A) |
| Q18 | (D) |
| Q19 | (C) |
| Q20 | (B) |
| Q21 | (A) |
| Q22 | (D) |
| Q23 | (A) |
| Q24 | (A) |
| Q25 | (D) |
| Q26 | (B) |
| Q27 | (D) |
| Q28 | (A) |
| Q29 | (B) |
| Q30 | (C) |

# Hints & Solutions

Note: scan the QR code to watch video solution

**Q1 Text Solution:**

If *p* side is at lower potential than *n* side of *p* – *n* junction diode, then diode is in reverse biased condition.

**Video Solution:**

**Q2 Text Solution:**

**(3)**

- Hole concentration in p-region is more as compared to n-region.
- In an unbiased diode, the electric field is set across the depletion layer which is between the n-type and p-type regions.
- This is because of the imbalance caused by the free electrons because of doping.
- Holes are the majority carriers in the p-region and electrons are the minority carriers.
- Electrons are the majority carriers in the n-region and holes are the minority carriers.
- Diffusion of charge carriers takes place between the junction of these two regions which happens from the region from higher concentration to the region of lower concentration
- So, holes diffuse from the p-region to the n-region.
- Electrons from the N-region do attract the holes.
- But, the movement of holes from the p-region to the n-region is because of the charge diffusion and the difference between the concentration of holes in both the regions.
- The potential difference across the junction helps the minority carriers to move across.
- But holes are the majority carriers in the P-region.
- Options (1) and (2) are not suitable for this question.
- So. "All of the above" can not be there.

Therefore, In an unbiased p-n junction, holes diffuse from the p-region to the n-region because hole concentration in p-region is more as compared to n-region.

**Video Solution:**

**Q3 Text Solution:**

Fact.

**Video Solution:**

**Q4 Text Solution:**

In a conductor, uppermost band is occupied by conduction electrons. Uppermost band is conduction band.

**Video Solution:**

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**Q5 Text Solution:**

Since $n_e > n_h$; the semiconductor is *N*-type.

**Video Solution:**

**Q6 Video Solution:**

**Q7 Video Solution:**

**Q8 Video Solution:**

**Q9 Video Solution:**

**Q10 Video Solution:**

**Q11 Video Solution:**

**Q12 Video Solution:**

**Q13 Video Solution:**

**Q14 Text Solution:**

Here, the p-n junction diode is forward biased, hence it offers zero resistance.

so $I_{AB} = \frac{4-(-6)}{1\times10^3} = 10^{-2}\ A$

**Video Solution:**

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**Q15 Video Solution:**

**Q16 Video Solution:**

**Q17 Video Solution:**

**Q18 Text Solution:**

Energy band gap is the separation between the valence band and the conduction band.
In metals, the band gap is zero or bands overlapping.
Semiconductors have a small band gap (<3 eV).
Insulators have a very large band gap (> 3 eV), hence the largest.

**Video Solution:**

**Q19 Video Solution:**

**Q20 Video Solution:**

**Q21 Video Solution:**

**Q22 Video Solution:**

**Q23 Text Solution:**

If impurity is doped in intrinsic semiconductor, the conductivity of the semiconductor increases because more number of electron-hole pair is generated hence number of charge carriers increases.

**Video Solution:**

**Q24 Video Solution:**

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**Q25 Text Solution:**

The forbidden energy gap (band gap) is the energy difference between the valence band and the conduction band in a material.

- Conductors: Have a zero or very small energy gap (~0 eV).
- Semiconductors: Have a moderate energy gap (~1 eV to 2 eV).
- Insulators: Have a large energy gap (~greater than 3 eV).

For an insulator, the forbidden energy gap is typically greater than 3 eV and can range up to 5 eV or more.

**Video Solution:**

**Q26 Video Solution:**

**Q27 Video Solution:**

**Q28 Text Solution:**

**(1)**

By mass-action law-

$n_i^2 = n_e \times n_n$

Given

$n_i = 1.5 \times 10^{16}/m^3 \quad n_h = 4.5 \times 10^{22}/m^3$

$n_e = \frac{n_i^2}{n_h} = \frac{(1.5\times10^{16})^2}{4.5\times10^{22}} = 5 \times 10^9/m^3$

**Video Solution:**

**Q29 Text Solution:**

**(2)**

Reverse resistance

$= \frac{\Delta V}{\Delta I} = \frac{1}{0.5\times10^{-6}} = 2 \times 10^6\ \Omega$

**Video Solution:**

**Q30 Text Solution:**

In *N* type semiconductor majority charge carries are $e^-$ and in *P* type semiconductor majority charge carries are holes.

$I = neAV_d = neA(\mu E)$

$\mu_e > \mu_h$

$\Rightarrow I_e > I_h$

**Video Solution:**