



SOLID STATE ELECTRONICS

DIGITAL ELECTRONICS

SOFT CONDENSED MATTER PHYSICS



PHYSICS

The energy band occupied by the valence electrons is called valence band and is the highest filled band.

Band occupied by the electrons coming from the valence band is called conduction band. It is either empty or partially filled and lies above the valence band.

The minimum energy required by an electron to jump from valence band to conduction band is equal to the forbidden energy gap.



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- Conductors: In conductors the valence and conduction band overlap on each other such that forbidden energy gap is not there. The electrons in the overlapping region are called conduction electrons.
- Insulator: In insulators the valence band is completely filled and conduction band is empty and both bands are separated by a forbidden energy gap of 7eV .



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- Semiconductor: semiconductors are the materials in which the forbidden energy gap between valence and conduction band is very small.
- Examples are germanium($E_g=0.72\text{eV}$) and silicon($E_g=1\text{eV}$).
- The pure semiconductors are called intrinsic semiconductor where as those having some specific impurity are called extrinsic semiconductor.
- the process of adding impurities to semiconductors is called doping.



PHYSICS

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PHYSICS

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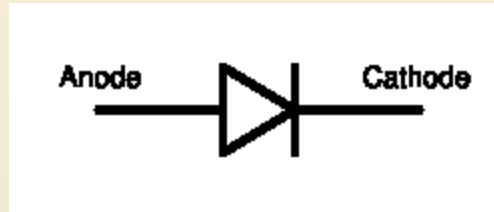
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- n type semiconductor: when pentavalent impurity is added to pure germanium or silicon crystal we get an extrinsic semiconductor known as n type semiconductor.
- p type semiconductor: when trivalent impurity is added to pure germanium or silicon we get p type semiconductor
The boundary dividing the two halves of such a semiconductor is called a junction and the arrangement is known as p n junction diode.

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- The region around the junction containing immobile +ve and -ve charges is known as depletion region.

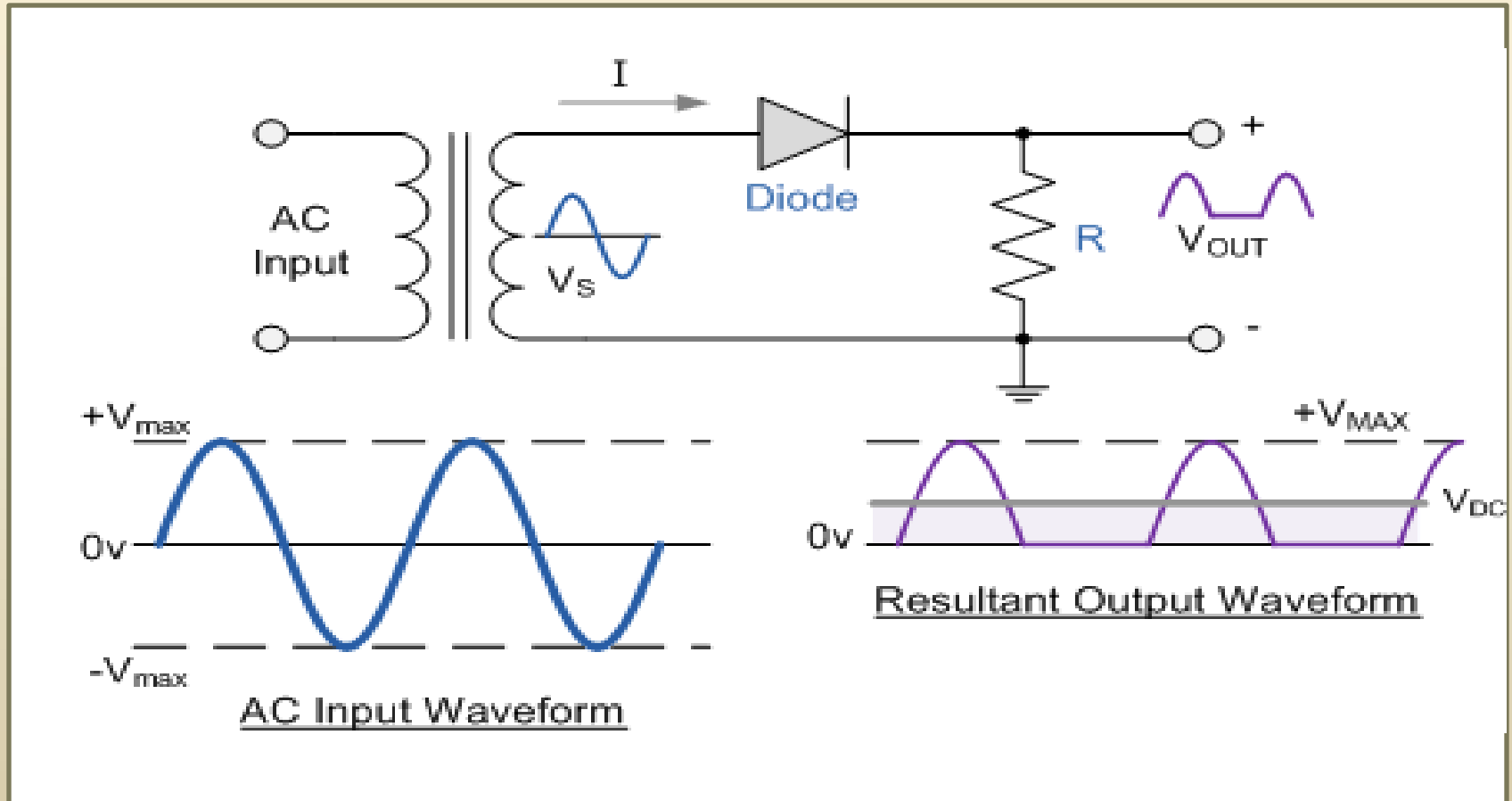
- Symbol of diode:



- When a battery or emf greater than the barrier potential is connected in such a way that +ve terminal is connected to p side and -ve terminal of battery is connected to n side the diode is said to be in forward bias condition.

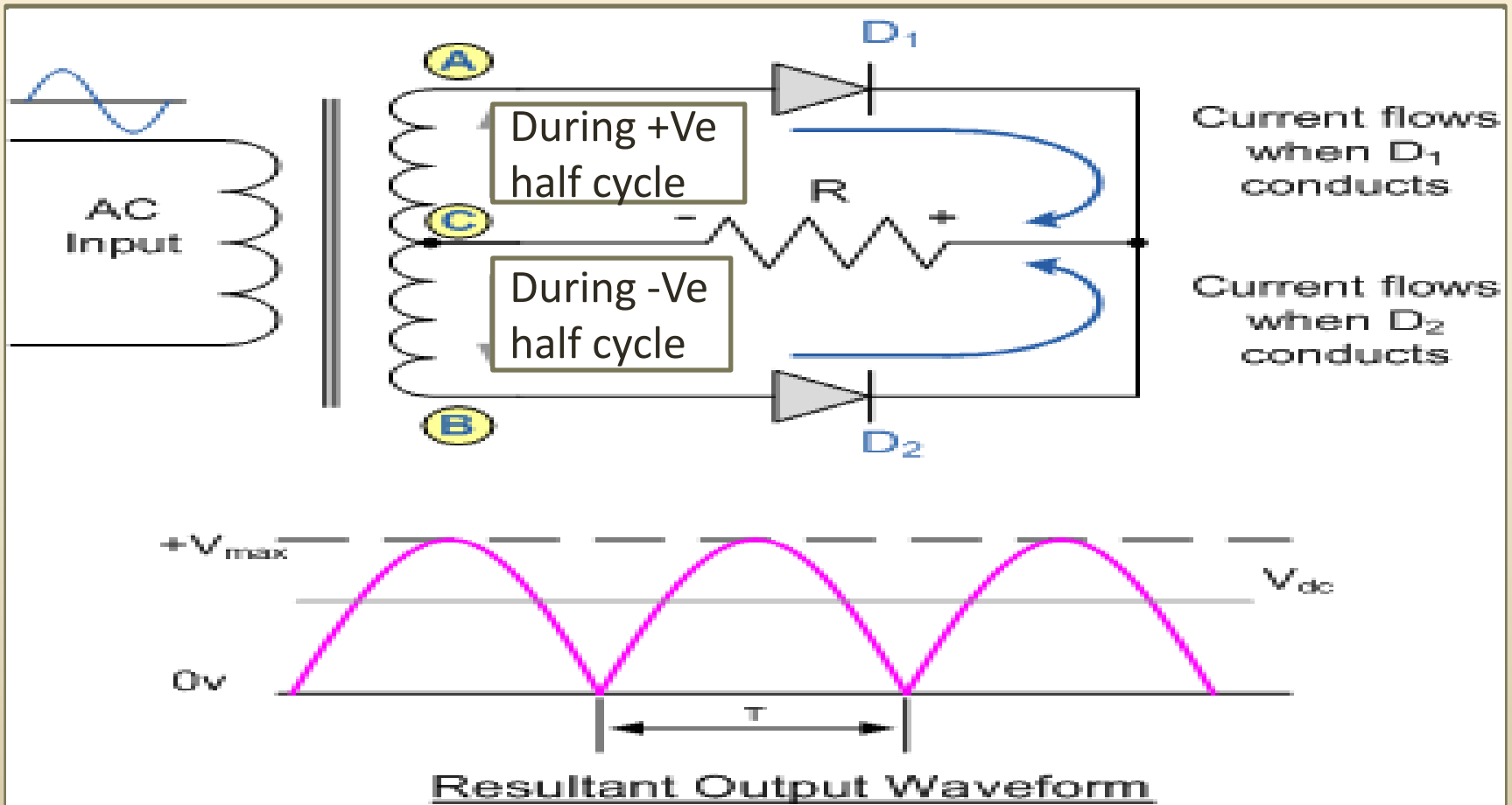
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Diode as half wave rectifier:



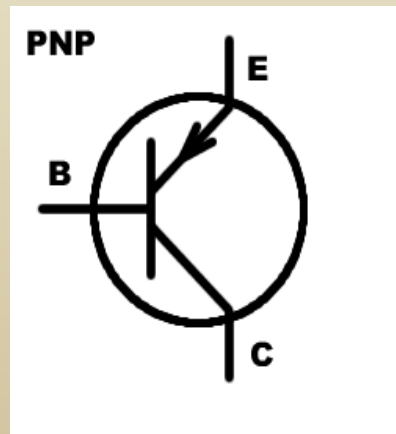
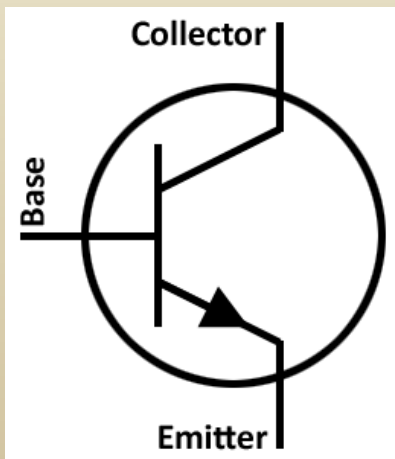
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- Diode as full wave rectifier:



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- Junction transistor is a 3 terminal Semiconductor. It is formed when a thin layer of one type of extrinsic semiconductor is sandwiched between 2 thick layers of other type of extrinsic semiconductor.
- 2 Types namely npn and pnp whose symbols are as shown...





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- An intermediate state structure called liquid crystal appears b/w the crystalline solid state at low temperature and the ordinary liquid state at high temperature.
- gel: dispersion medium is solid, dispersed phase is liquid.
- An emulsion is a colloidal dispersion in which 2 immisible liquids are used as dispersed phase and dispersed medium



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- Boolean algebra: this algebra allows only 2 states for a variable. these states are represented as high (1) or low(0).
- The OR operation is represented as $y = a + b$
 $= a \text{ OR } b$
- The AND operation is represented as $y = a \text{ AND } b$
 $= a \cdot b$
- The NOT operation is $y = \text{NOT } a$



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- NAND, NOR gate are called universal logic gates. which are complementary operation of AND and OR respectively.
- Half adder is logic circuit which adds 2 bits at a time.
- Full adder is a circuit which adds 3 bits at a time.



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1 The bands in which an electron cannot lie in a crystal

1. Valence band
2. Forbidden band
3. Conduction band
4. In all energy bands



PHYSICS

Answer (2)



PHYSICS

2 The conduction electrons have greater mobility than that of holes because

- 1) They are lighter
- 2) They carry –ve charge
- 3) Need less energy for movement
- 4) Experience less collision



PHYSICS

Answer (3)

PHYSICS

3 A piece of copper and germanium are cooled from room temperature to 100K. What happens to their resistivity?

- 1) Decreases in both
- 2) Increases in both
- 3) Increases in copper & decreases in germanium
- 4) Decreases in copper & increases in germanium



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Answer (4)

Temperature coefficient for copper is positive and that for germanium is negative.

PHYSICS

4 In the depletion region of p-n junction there is a shortage of.....

- 1) Acceptor ions
- 2) Donor ions
- 3) Holes and electrons
- 4) None of the above



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Answer (3)



PHYSICS

- 5 At room temperature an intrinsic semiconductor has...
1. Many free electrons only
 2. A few free electrons and holes
 3. No free electrons and holes
 4. Many holes only



PHYSICS

Answer (2)



PHYSICS

6 For a transistor the α and β values are as follows....

1) $\alpha\beta=1$

2) $\alpha<1$ and $\beta>1$

3) $\alpha>1$ and $\beta<1$

4) None of the above



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Answer (2)



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p-n junction diode acts as insulator. if connected.....

- 1) In reverse bias
- 2) To ac source
- 3) In forward bias
- 4) Either to ac source or in reverse bias



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Answer (1)

In reverse bias condition depletion region increases resulting in the increase of resistance.

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8 Which type of liquid crystals used to prepare holograms ?

1. Cholesteric
2. Smectic A
3. Smectic C
4. Nematic



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Answer (1)



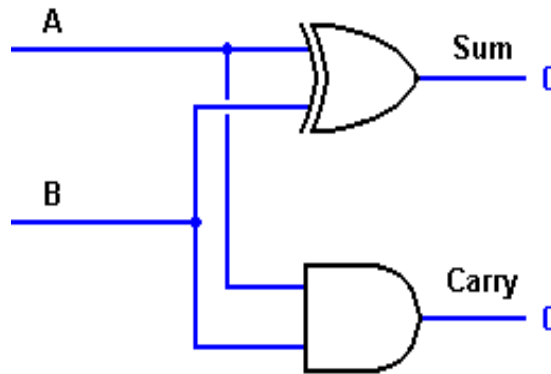
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9) Half adder is the combination of the following

- 1) AND and XOR gates
- 2) AND and OR gates
- 3) XOR and NOT gates
- 4) XOR and OR gates

Answer (1)

Half adder is given as:





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10 Which of the following is not the function of NOT gate

- 1) Complement signal
- 2) Stop a signal
- 3) Invert an input signal
- 4) Change the logic level of the digital circuit

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Answer (2)

The output of NOT gate is '1' when input is '0', when input is '0' output is '1'. Hence except (2) all answers are correct.



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11

In a transistor the base is...

- 1) An insulator
- 2) An extrinsic semiconductor
- 3) A conductor of high resistance
- 4) A conductor of low resistance



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Answer (2)



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12 The energy band gap between conduction band and the valence band in a material is 0.7eV . It is....

- 1) A metal
- 2) An insulator
- 3) An alloy
- 4) A semiconductor



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Answer (4)

Energy gap of semiconductor is approximately 1eV.



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13 A colloidal state in which a gas is dispersed in a liquid or a solid is....

- 1) gel
- 2) Liquid crystal
- 3) foam
- 4) emulsion



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Answer (3)

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14 The main distinction between conductors, semiconductors and insulator is ...

- 1) Binding energy of electrons
- 2) Work function
- 3) Width of forbidden band
- 4) Temperature coefficient of resistance

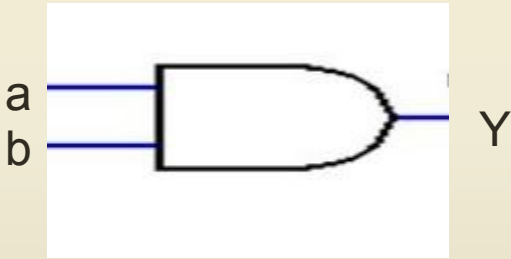


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Answer (3)

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15 The Boolean equation for the given logic circuit is



- 1) $Y = a \text{ AND } b$
- 2) $Y = a \text{ OR } b$
- 3) $Y = a \text{ XOR } b$
- 4) $Y = a \text{ NAND } b$

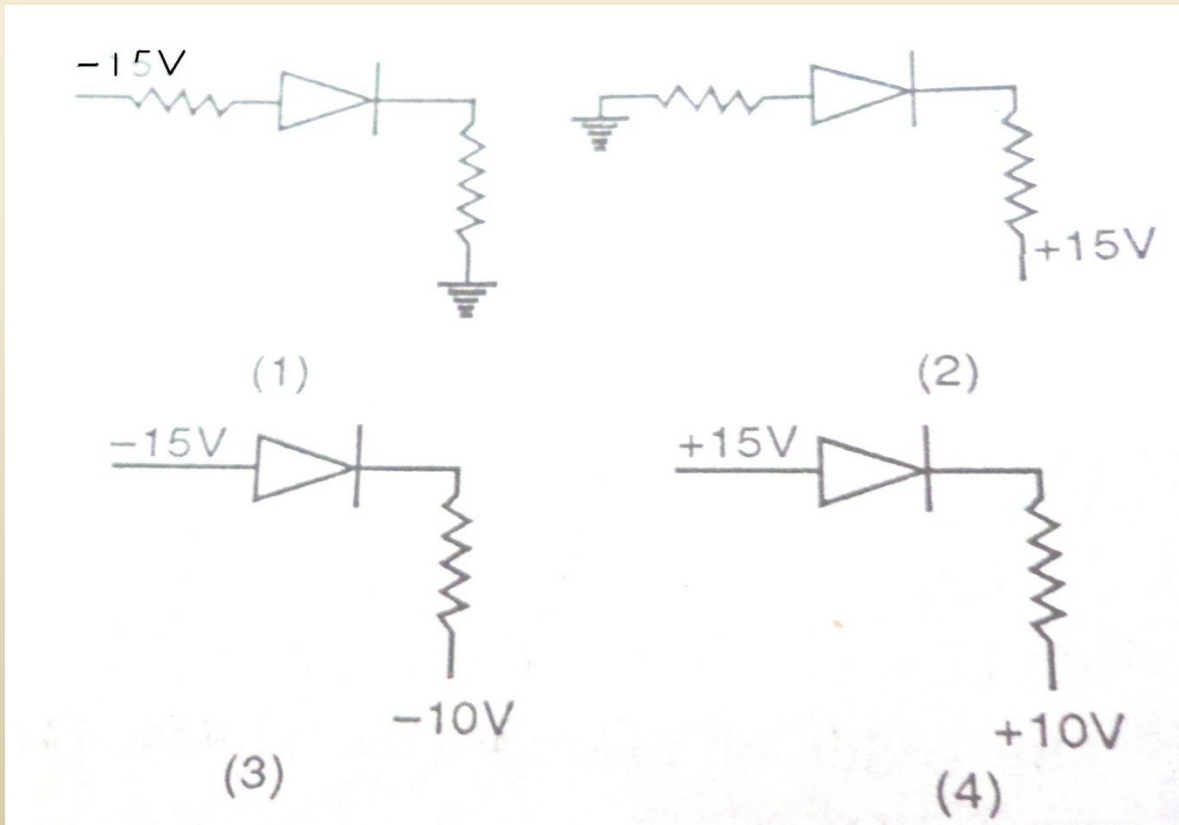


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Answer (1)

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16 In which of the following cases the diode is forward biased...





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Answer (4)

PHYSICS

17 Minority carriers present in a p- type semi conductor are due to

1. Bias voltage
2. Thermal agitation
3. Addition of impurities
4. Ionisation of impurities



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Answer(2)



PHYSICS

18 A Nematic liquid crystalline phase has..

- 1) Position order only
- 2) Orientational order only
- 3) Both Orientational and positional order
- 4) All the above



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Answer (2)



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19 The reverse biasing in a junction diode...

- 1) Decreases the potential barrier
- 2) Increases the potential barrier
- 3) Increases the number of minority charge carriers
- 4) Increases the number of majority charge carriers



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Answer (2)



PHYSICS

20 Phase angle between input and output signals in a CE amplifier in degrees is...

1. 180
2. 45
3. 90
4. 0



PHYSICS

Answer (1)

In CE amplifier we take output across the emitter. Hence output and input signals differ by a value of 180 degrees

PHYSICS

21 In which of the following states of matter the majority of crystalline substances generally exist?

- 1) liquid
- 2) solid
- 3) foam
- 4) plasma



PHYSICS

Answer (2)

PHYSICS

22 When the conductivity of a semiconductor is only due to the breaking of covalent bond ,then the semiconductor is...

1. Extrinsic
2. Donor
3. intrinsic
4. acceptor



PHYSICS

Answer (3)

PHYSICS

23 To a germanium crystal equal number of aluminium and arsenic atoms are added. Then.....

- 1) It becomes an insulator
- 2) It remains as intrinsic semiconductor
- 3) It becomes a superconductor
- 4) All the above



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Answer (2)



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24 Which of the following is called universal gate....

- 1) AND
- 2) OR
- 3) XOR
- 4) NAND



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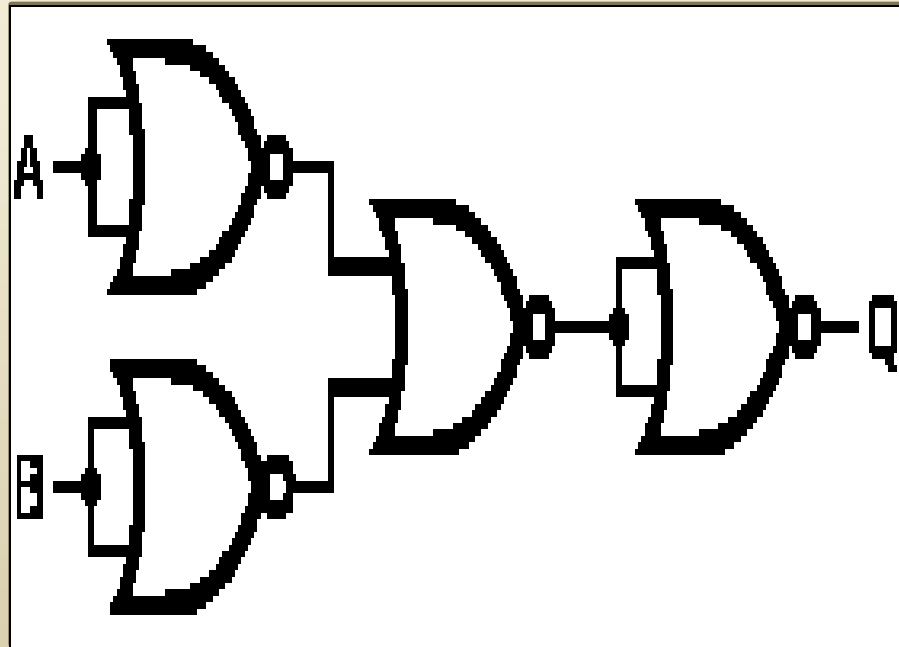
Answer (4)

NAND, gate is called universal gate because any basic gate can be constructed using above gate.

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25 Identify the logic operation performed by the circuit shown.

- 1) OR
- 2) AND
- 3) NAND
- 4) NOT



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Answer (3)

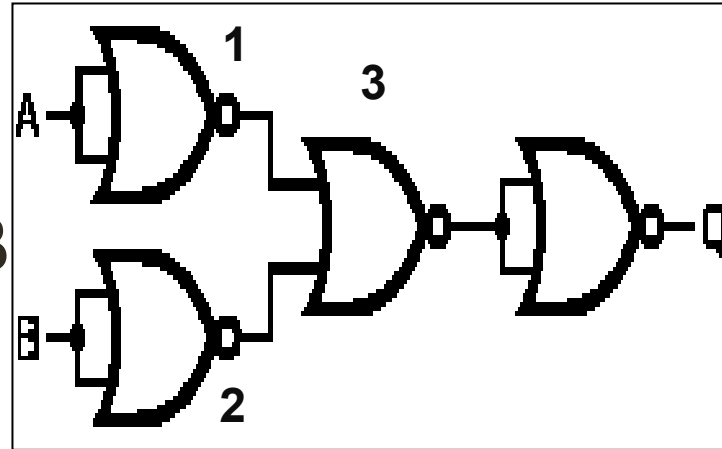
put 1, 1 for A and B

Gate 1 gives 0

Gate 2 gives 0

Gate 3 gives 1

Thus 1 is given to last NOR gate to get $Q=0$. Thus the given system behaves as NAND gate.





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26 Milk is emulsion in which...

- 1) Fat is dispersed medium, water is dispersion medium
- 2) Both fat and water are dispersed medium
- 3) Water is dispersed medium, fat is dispersion medium
- 4) None of the above



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Answer (1)



PHYSICS

27 Hole in a p-type semiconductor is
.....

- 1) An excess electron
- 2) A missing atom
- 3) A missing electron
- 4) A donor level



PHYSICS

Answer (3)

PHYSICS

28 Which of the following is the operation of NOR gate.....

- 1) $1 \text{ NOR } 1 = 0$
- 2) $1 \text{ NOR } 0 = 1$
- 3) $0 \text{ NOR } 0 = 0$
- 4) None of the above



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Answer (1)



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29 True statement for AND gate is

- 1) It has no equivalent to switching circuit
- 2) It is equivalent to series switching circuit
- 3) It is equivalent to parallel switching circuit
- 4) None of the above



PHYSICS

Answer(2)



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30 The forbidden energy band gap in conductors, semiconductors and insulators are E_1, E_2, E_3 respectively..then which relation is true...

- 1) $E_1 = E_2 = E_3$
- 2) $E_1 < E_2 < E_3$
- 3) $E_1 > E_2 > E_3$
- 4) $E_1 < E_2 > E_3$



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Answer (2)



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31 A half wave rectifier is being used to rectify an ac voltage of frequency 50Hz. The number of pulses of rectified current obtained in 1 second is....

- 1) 50
- 2) 100
- 3) 25
- 4) 150



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Answer (1)



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32 A transistor has $\alpha = 0.99$. then β is.....

- 1) 0.95
- 2) 1.5
- 3) 19
- 4) 25



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Answer (3)

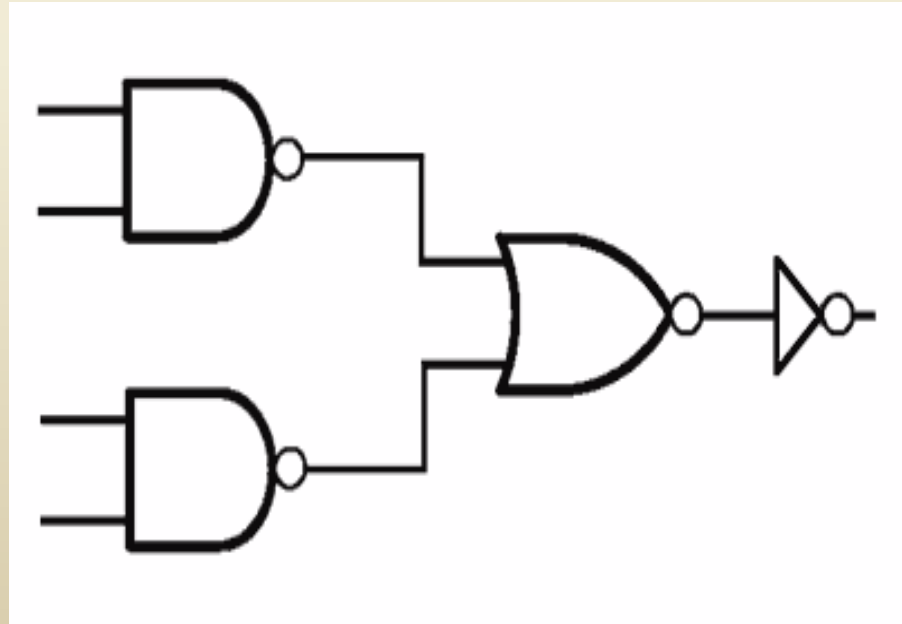
We have the relation $\beta = \alpha / (1 - \alpha)$
for the given question

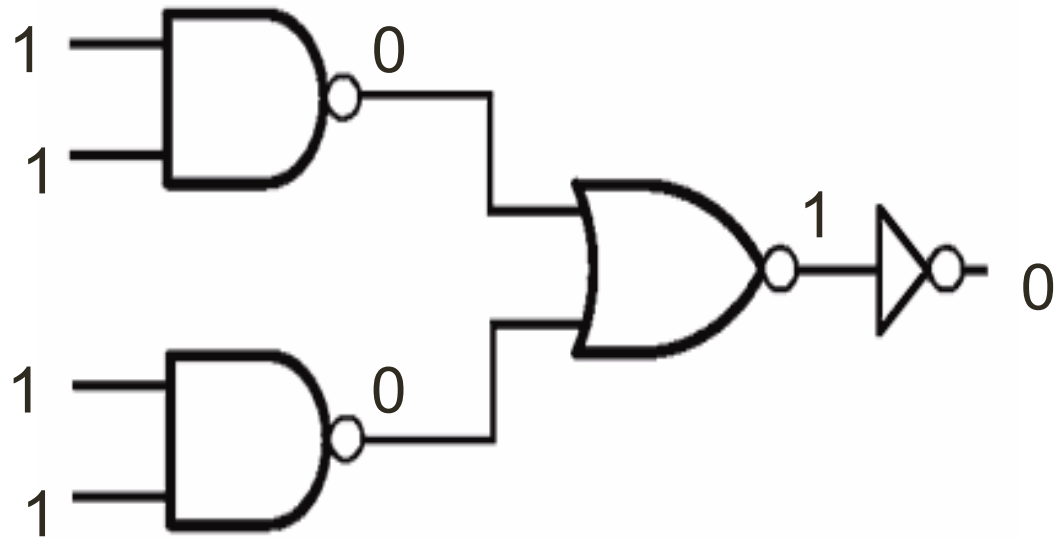
$$0.95 / (1 - 0.95) = 19$$

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33 What is the final output of given logic circuit, if the input for first 2 NAND gates is '1'....

1. '1'
2. '0'
3. '0' or '1'
4. Not possible to say



Answer (2)



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34 The truth table shown here belongs to which of the following logic gates...

- 1) NOR
- 2) OR
- 3) AND
- 4) XOR

Inputs		Output
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0



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Answer (4)

Since the output is '0' for same combination of input and is '1' for different combination, it is the truth table of XOR gate.



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35 At 0K ,intrinsic semiconductor behaves as...

- 1) A perfect conductor
- 2) A perfect insulator
- 3) A semiconductor
- 4) A super conductor



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Answer (2)

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36

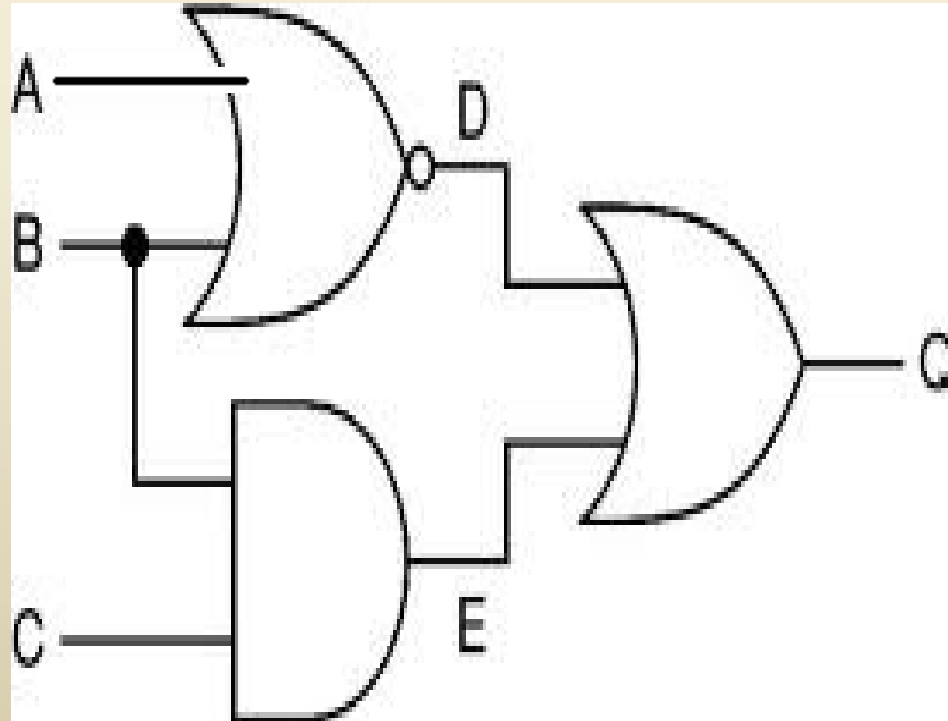
What is the output expression for given logic circuit.....

1) $\overline{(A+B)} + BC$

2) $\overline{(B+C)} A$

3) $AC + BC$

4) $AC \overline{(B+A)}$





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Answer (1)



PHYSICS

37 Which of the following when added as a impurity to the silicon produces the n type semiconductor...?

1)P

2)Al

3)Mg

4)B



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Answer (1)

PHYSICS

38 One serious drawback of semiconductor devices is...

1. They do not last for long time
2. They pollute the environment
3. They are costly
4. They can't be used with high voltages



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Answer (4)

PHYSICS

39 The electrical circuits used to get smooth DC from rectifier circuit is...

1. Full wave rectifier
2. Amplifier
3. Oscillator
4. filter



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Answer(4)

PHYSICS

40 If l_1 , l_2 and l_3 are the lengths of the emitter, base and collector of a transistor then

1. $l_3 < l_2 > l_1$
2. $l_3 = l_2 = l_1$
3. $l_3 > l_1 > l_2$
4. $l_3 < l_1 < l_2$



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Answer(3)



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THANK YOU