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Diode:

→ small electronic component that allows electricity to flow through it in only one direction. (ex) (like a one-way street for electric current)

→ TWO terminals: 1) Anode (+ve)
2) cathode (-ve)

→ current flow:

When the anode is more positive than cathode, the diode allows current to pass (forward bias)

When anode is less than cathode, it blocks current (Reverse bias)

(ex) Plumbing the water flows only in one direction, other way it stops (Diode stops electricity when it is in wrong direction)

symbol. → | (Arrow pointing towards diode)

arrow indicates the direction of flow of current (Anode to cathode)

Practical use: 1) Rectification (AC to DC conversion)

→ This is commonly found in adapters and power supplies to convert the AC voltage from wall socket into DC voltage suitable for electronic devices.

2) LED → Indicator lights, displays and lighting

3) voltage Regulation (zener diode)

→ zener diode are used in voltage regulation circuits to maintain a constant voltage across a load, even when the input voltage fluctuates. They operate in Reverse bias mode.

1) signal Demodulation: (Diode Detector)

→ It is used in Radio receivers to extract the audio signal from the modulated carrier wave. this process is called demodulation. (Diode in a crystal radio set detects the audio signal from radio waves, enabling you to listen to radio stations.

5) Reverse voltage protection:

→ Diodes are placed in series with the power supply to prevent damage when a battery or power source is connected backward. The diode blocks if the polarity is reverse biased

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6) Clamping circuits → Diodes are used for voltage limiting
7) switching Applications (Digital logic circuits)
8) voltage multiplication (high voltage circuits)
(to generate high DC voltage from low AC input

PN Junction : Diode

It is created when p-type semiconductor devices is joined with an n-type semiconductor.

n-diffuse into p-side and combine with the holes, creating a depletion region.

potential barrier (V_0) → 0.7 V for silicon
0.3 V for germanium

i) Operation of PN Junction

a) No bias condition
(without an external voltage)

Minority carriers on either side are attracted to the junction, balancing drift and diffusion current

b) forward bias condition

P side is connected to a +ve terminal and the n-side to a negative terminal → potential barrier decreases

shockley diode $I = I_s \left(e^{\frac{V}{nV_T}} - 1\right)$

I = Diode current

I_s → reverse saturation current

V - Applied voltage

n - Ideality factor (typically 1 for silicon diodes)

V_t - Thermal voltage

→ Diodes shows low resistance in the forward bias

() Reverse bias :

p is connected to a negative terminal and the n-side to a +ve terminal, the potential barrier increases

The diode shows high resistance and blocks the current flow -

Diode current equation $I = I_S \left(e^{V/\eta V_T} - 1 \right) \rightarrow ①$

Depletion width (W)

$$W = \sqrt{\frac{2\varepsilon(V_0 + V)}{q} \left(\frac{1}{N_A} + \frac{1}{N_D} \right)} \rightarrow ②$$

ε - Permitivity of semiconductor

q - electronic charge

V_0 - built in potential

N_A, N_D - doping concentrations of p and n regions

small signal resistance $r_d = \frac{\eta V_T}{I_D}$

$I_D \rightarrow$ DC bias current

Quantitative Aptitude:

Fractions & Decimals

1) What will be fraction form of $0.\overline{3523}$?

↳ no. is repeating

$0.352323\ldots$

$0.\overline{3523} \rightarrow$ fraction

N 3523 − 35 = 3488

D 9900 = 9900

↓ Bar ↘ No bar

$0.\overline{25} \Rightarrow \frac{25}{99}$

$0.5\overline{25} \rightarrow \frac{525}{1000}$

$0.\overline{46} \Rightarrow 0.46666$

$\frac{N}{D} = \frac{46-4}{90} = \frac{42}{90}$

2) What is value of $5.55 + 5 + 5.5 + 5.555 + 5.05 + 5.00$?

↑ ③ max decimal point.

5.550 → max decimal point zeros is added

5.000

5.500

5.555

5.050

5.000

31.655

3) What will be value of $\frac{2.4 \times 0.72 \times 4.5}{0.18 \times 0.06 \times 0.9} \times 3$

$\frac{24/10 \times 72/100 \times 45/10}{18/10 \times 6/10 \times 9/10} \times 3 \Rightarrow \frac{24 \times 5}{12 \times 3} = \frac{120}{36}$

$\frac{16 \times 5}{8 \times 3} = \frac{80}{24} \times 10 = 240$ Ans

4) What will be $(0.\overline{15268} \div 0.\overline{45804})$? → Recurring numbers (bar)

↓ fraction

$0.\overline{15268} \Rightarrow \frac{15268}{99999} \div \frac{45804}{99999}$

$\frac{15268}{99999} \div \frac{45804}{99999} = \frac{15268}{45804}$

$\Rightarrow 1/3 = 0.3333 = 0.\overline{3}$ ← Answer.

N = 15

N = 45

$\frac{15268 \times 3}{45804}$

③ → ① N or D

N = 2D ?

= 3D ?

D = 4N

② ⇒ N and D get divided by some common factor

3) Actually have to divide (rare)

5) How much would be $\frac{n-m}{n+m}$ if $2.5m = 0.035n$?

$25/1000\ m = \frac{35n}{1000}$ → 2 ways

$2500m = 35n$

$500\ \ 2500m = 35n$

$n/m = 500/7$

1st short cut

Ratio and proportion (video)

$a/b = c/d$

$\frac{a+b}{a-b} = \frac{c+d}{c-d}$

$\frac{n+m}{n-m} = \frac{500+7}{500-7}$

$\boxed{\frac{493}{507}}$ ← Answer

2nd → $\frac{n-m}{n+m} = \frac{m(n/m-1)}{m(n/m+1)} = \frac{500/7-1}{500/7+1}$

6) Add $17.4\overline{99}$, 17.85 and $17.\overline{333}$

$17.4\overline{99} \Rightarrow 17 + 0.4\overline{99} = 17 + \frac{499-4}{990} = 17 + \frac{495}{990_2} = 17.5$

$17.\overline{333} = 17 + 0.\overline{333} = 17 + \frac{333}{999} = 17 + 0.\overline{33} = 17.\overline{33}$

$= 17 + 1/3$

333 x 3

$17.5 + 17.85 + 17 + 1/3 = 52.35 + 0.333$

$= \boxed{52.683\ldots}$ ← Answer

$52.683\overline{3}$

2 | 17.50
17.85
17.00
52.35

52.350
00.33
52.68

7) What will be the value of $1 \times 0.3 \times 0.01 \times 0.003$?

$1 \times 3 \times 1 \times 3 = 9$ (3 zero) ① ② ③ → 6 decimal places

0.000009

$2 \times 0.003 \times 0.007 \times 0.0008$ $\quad 2 \times 3 \times 7 \times 8 = 336$

③ ② ④ (10)

$0.\_\_\_\_\_$

8) What will be value of $\frac{1}{0.0004659}$ if $\frac{1}{4.659} = .2146$

$\frac{1}{0.0004659} = \frac{1}{4.659 \times 10^{-4}} = \frac{1}{4.659} \times 10^4$

$= 0.2146 \times 10^4$

$= \boxed{2146}$