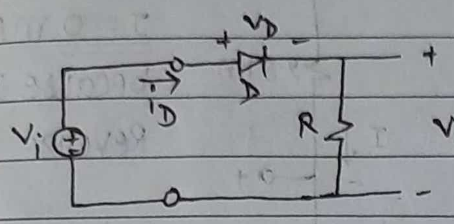
Q→ For the circuit in Fig 4.3(a), sketch the transfer characteristic. V_o versus V_i.



KVL $-V_i + V_D + V_o = 0$

$V_o = V_i - V_D$ — ①

graph of straight line: $y = mx + c$

in equation ① let $V_D = 0.7$

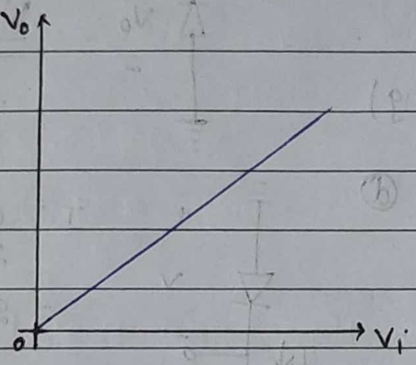
so, $V_o = V_i - 0.7$

here $c = -0.7$

$mx = V_i$

so, graph is straight line.

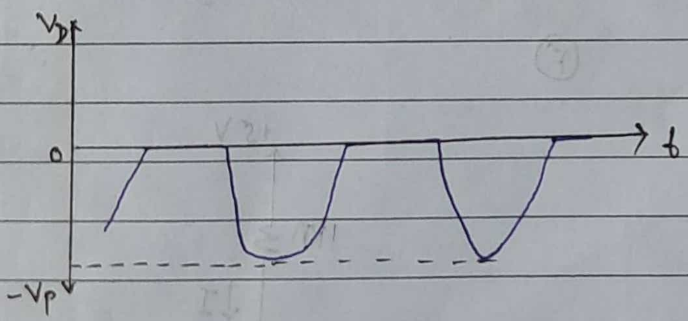
Ans→

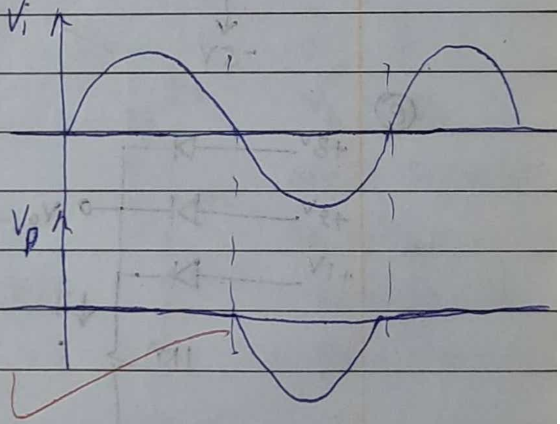


$$V_o = \begin{cases} 0 & V_i < 0.7 \\ V_i - 0.7 & V_i \geq 0.7 \end{cases}$$

Q→ For the circuit in fig 4.3(a), sketch the waveform of V_D.

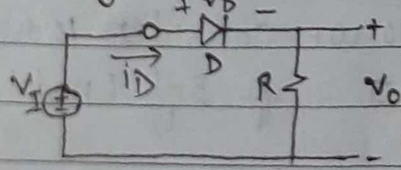
Ans $V_D = V_I - V_o$





Q→ in the circuit of Fig 4.3(a), let V_I have a peak value of 10V and R=5kΩ. Find the peak value of i_D and DC component of V_o (Hint, the average value of half-sine wave is (V_P/π))

Sol^n



Given R = 5kΩ, V_I(Peak value) = 10 V

∴ Peak value (I_D) = $\frac{10V}{5k\Omega}$ = 2mA Ans.

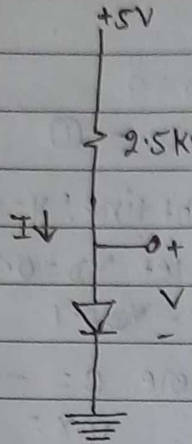
DC component of $V_o = \frac{V_P}{\pi} = \frac{10}{\pi} = 3.18V$ Ans

Subject :

(183)

(4.4) Find the values of I & V in the circuit shown in Fig E4.4.

(a)



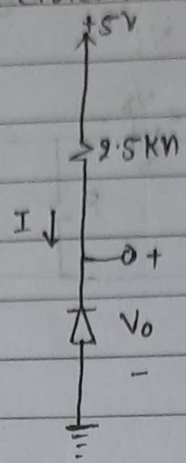
$I = \frac{V}{R}$

$I = \frac{5}{2.5K}$

$\underline{I = 2mA}$

V = 0V (because of grounding)

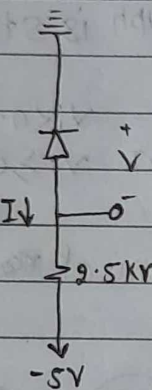
(b)



$\underline{I = 0 \text{ mA}}$ (because Diode is Reverse bias)

$\underline{V = 5V}$

(c)

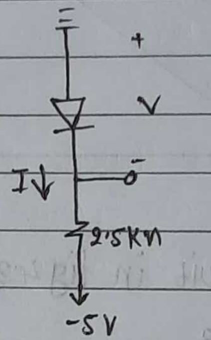


I = 0 mA

(diode is reverse - bias).

V = 5V

(d)

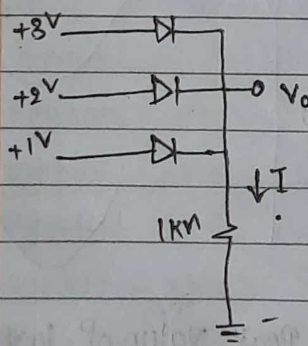


$I = \frac{0+5}{2.5}$

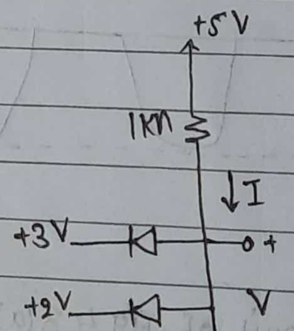
= 2 mA

V = 0 (because diode is grounding)

(e)



(F)



$\underline{V = 3V}$ (logical or gate)

So, we consider higher value)

$I = \frac{3V}{1K\Omega}$

$\underline{\underline{I = 3 \text{ mA}}}$

$\underline{V = 1V}$ (logical and gate)

So we consider lower value)

$I = \frac{5-1}{1K}$ (nodel analysis)

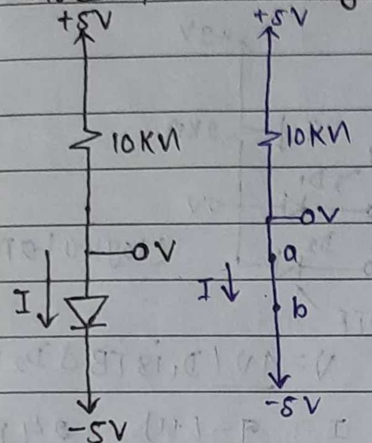
$\underline{I = 4 \text{mA}}$

PAGE NO

230

Q4.2. For the circuits shown in Fig. P4.2 using ideal diodes. Find the values of the voltage & current indicated.

(a)



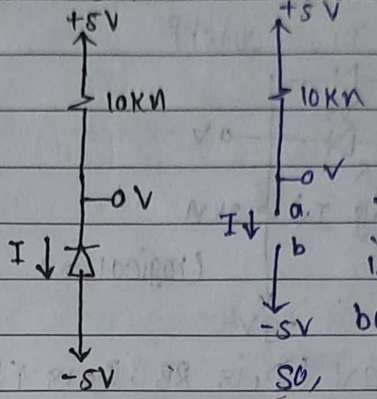
$V_a > V_b$ (5V > -5V)

So diode is forward biased.

$I = \frac{5-(-5)}{10} = 1\,mA$

$V = -5V$

(b)



$V_a > V_b$

5V > -5V

Voltage of anode is ~~more~~ less so diode behave as open circuit

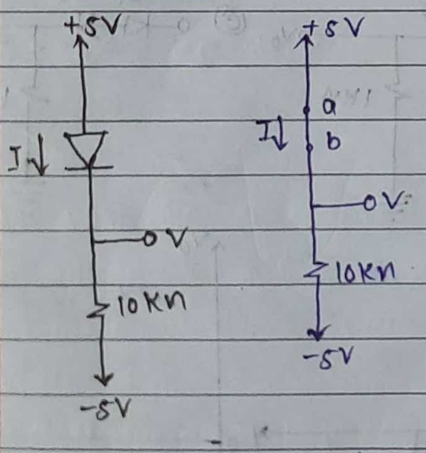
So, I = 0mA

5 = I×10K + V

5 = 0 + V

$\boxed{V = 5V}$

(c)



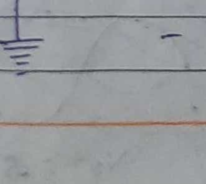
V_a(cathode) > V_b(anode)

So, diode behave as short circuit.

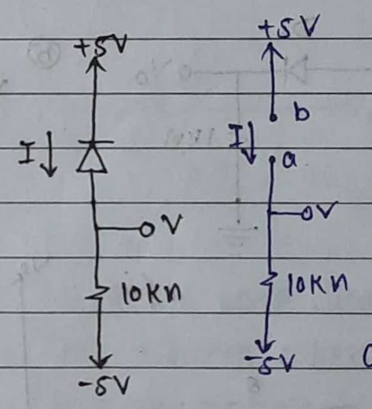
V = 5V

$I = \frac{5-(-5)}{10}$

I = 1 mA



(d)



$V_b > V_a$

anode > cathode.

So, diode behave as a open circuit.

I = 0

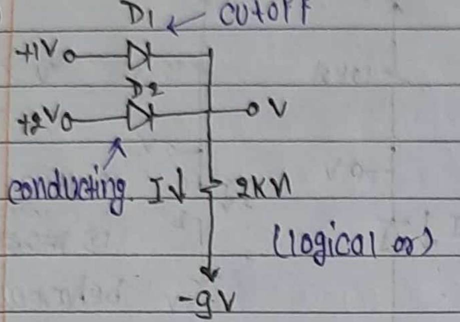
-5 = -I×10K + V

-5 = 0 + V

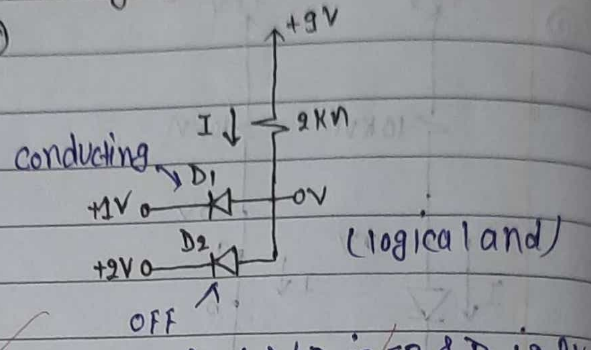
V = -5V

4.3. For the circuit shown in fig P4.3 using ideal diodes, find the values of the labeled voltage & currents.

Ⓐ



Ⓑ



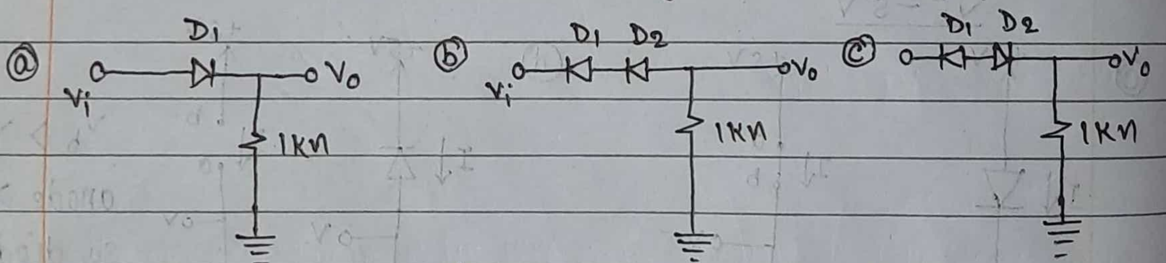
$V = 2V$ (D_1 is RB & D_2 is FB)

$I = \frac{2-(-9)}{2} = \frac{11}{2} = 5.5\,mA.$

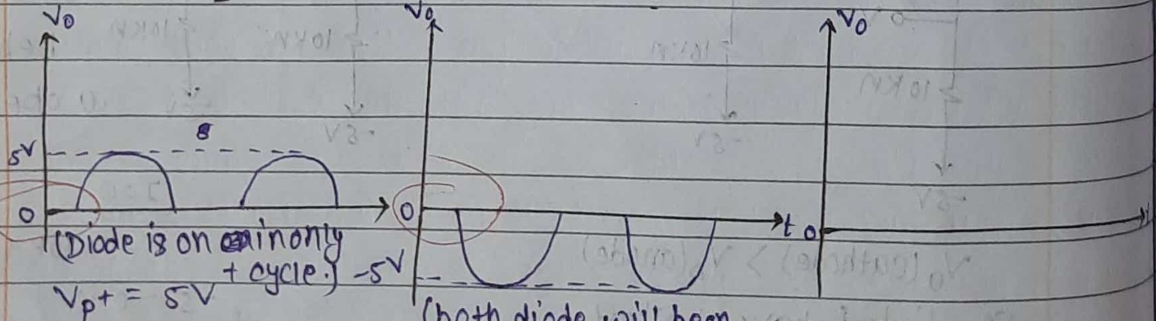
$V = 1V$ (D_1 is FB & D_2 is RV)

$I = \frac{9-(+1)}{2} = 4\,mA$

4.4. in each of the ideal diode circuits shown in Fig P4.4 V_I is a 1-kHz, 5-V peak wave. sketch the waveform resulting at V_o, what are its positive and negative peak values?



Soln



(Diode is on only + cycle.)

$V_{p+} = 5V$

$V_{p-} = 0V$

(both diode will be on -cycle)

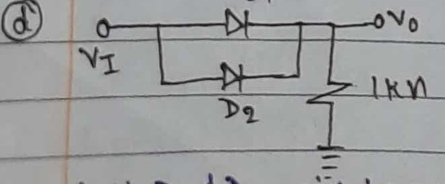
$V_{p+} = 0V$

$V_{p-} = -5V$

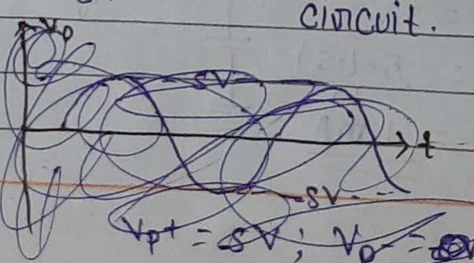
$V_o = 0V$

D_1 & D_2 both are open circuit.

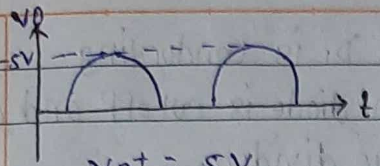
ⓓ



both D_1 & D_2 will be on on only Positive half cycle input.



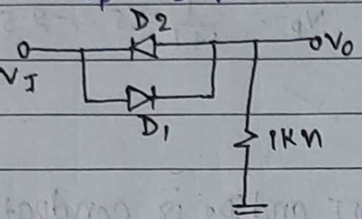
$V_{p+} = 5V$; $V_{p-} = 5V$



$V_{p^+} = 5V$

$V_{p^-} = 0V$

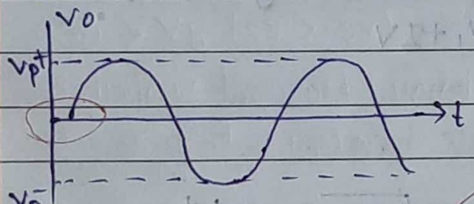
(e)



soln

D_1 conduct when $V_i > 0$ &

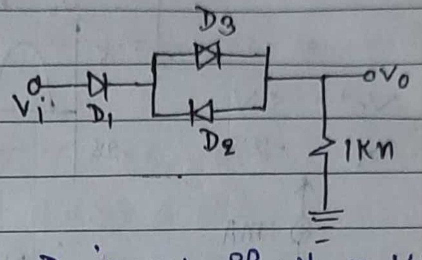
D_2 ——— $V_i < 0$



$V_p = 5V$

$V_{p^-} = -5V$

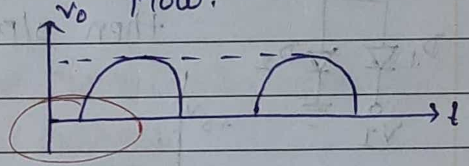
(f)



soln: D_1 is cut off when $V_i < 0$

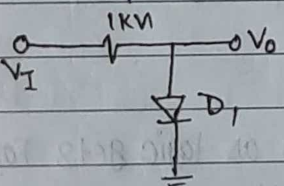
D_2 is conducting only when $V_i < 0$

so negative cycle current will not flow.



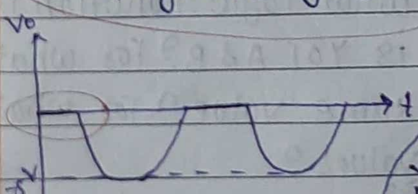
$V_{p^+} = 5V$; $V_{p^-} = 0V$

(g)



D_1 is on when $V_i < 0V$

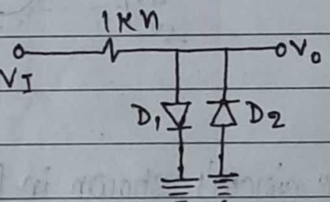
so, diode is conducting only on (negative cycle)



$V_{p^+} = 0V$

$V_{p^-} = -5V$

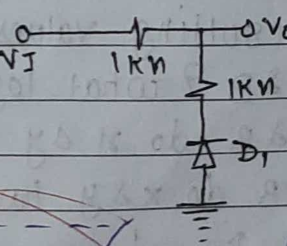
(h)



$V_o = 0V$ (~~both diode will be~~

D_1 conducts when $V_I > 0$ & D_2 Conduct when $V_I < 0$

(i)

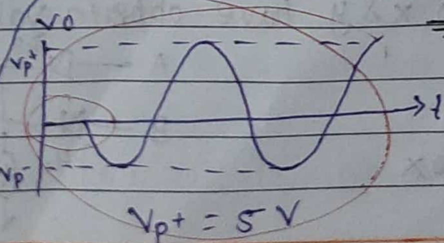


D_1 is off when $V_i > 0$ when $V_i < 0$ D_1 is conducting and negative peak

$$\text{Voltage} = \frac{1k\Omega}{1k\Omega + 1k\Omega} \times -5V$$

$= -2.5V$

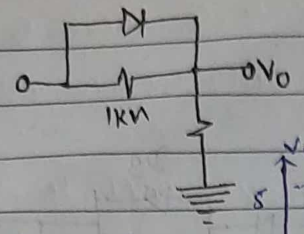
(voltage divider rule)



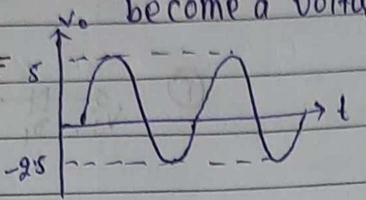
$V_{p^+} = 5V$

$V_{p^-} = -2.5V$

J.



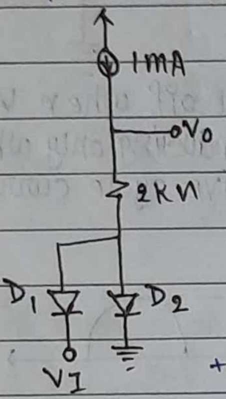
when $V_i > 0$ then D_1 is conducting
when $V_i < 0$ then diode is cut off and circuit become a voltage divider.



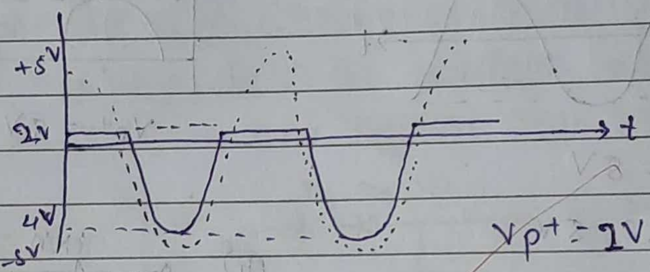
$V_p^- = \frac{1}{1+1} \times \bar{5} = -2.5\ V$

$V_p^+ = 5V$
$V_p^- = -2.5V$

(K)



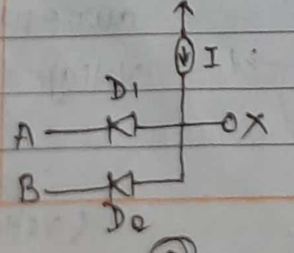
when $V_I > 0$ D_1 is cut off and D_2 is conducting the o/p becomes 2V.
when $V_i < 0$ D_1 is conducting and D_2 will be off then o/p = $V_1 + 2V$



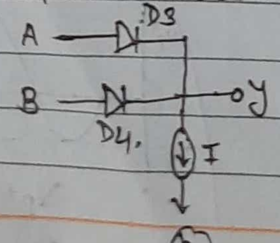
$V_p^+ = 2V$, $V_p^- = -4V$

PP 232

Q4.6. The circuit shown in fig P4.6 can function as logic gets for input voltage that are either high or low using '1' to denote the high values & '0' to denote the low value, prepare a table with four columns including all possible input combinations & the resulting values of x & y. What logic function is x of A & B ? What logic function is Y of A & B? For what value of A & B do x & y have the same value ? For what values of A & B do x & y have opposite values ?



(a)



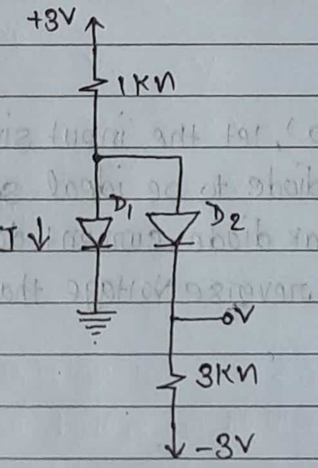
(b)

A	B	X	Y
0	0	0	0
0	1	0	1
1	0	0	1
1	1	1	0

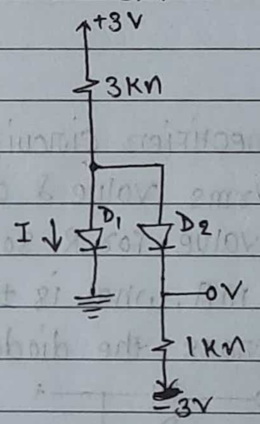
in fig (a) x is connected to the output of AND gate with input A & B.
logic function of $X = A \cdot B$ (AND gate)
in fig (b) y is connected to the output of OR gate with input A & B
logical function of $y = A+B$ (OR gate)
So, from the above table we can say that x & y have same value for $A = B$ and they have opposite values for $A \neq B$

P4.7 Assuming that the diode in the circuit P4.7 are ideal, Find the values of the labeled Voltage & current.

(a)



(b)



soln (a) if we assume both diode are conducting then $V_0 = 0V$

$I_{D_2} = \frac{0-(-3)}{3} = 1mA$ $I_{D_1} = \frac{3-0}{1} = 3mA$

A node equation at the common anode node yields a negative current in D_1, it means our assumption is wrong and D_1 must be off, and D_2 is on.

$I_{D_2} = \frac{3-(-3)}{1+3} = \frac{3}{2}$ mA

$\boxed{I = 0}$
$\boxed{V = 1V}$

$V = \frac{3}{2} \times 3 - 3 \Rightarrow 4.5 - 3 = 1.5V$

Subject :

assume D_1 & D_2 both are conducting.

(b) I_3 at $3k\Omega$ Resistance $= \frac{3-0}{3} = 1mA$

I_1 at $1k\Omega$ resistance $= \frac{0-(-3)}{1} = 3mA$

$I = I_3 - I_1$

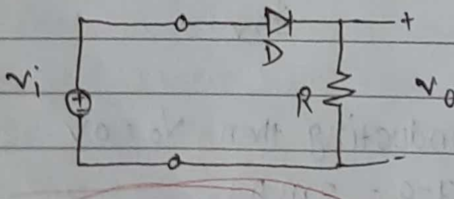
$I = 1mA - 3mA$

$I = -2mA$ Ans

so, $V = 0$ Ans

(983)

E4.9 For the rectifier circuit of Fig 4.3(a), let the input sin wave have 120 V_{rms} value & assume the diode to be ideal. select a suitable value for R so that the peak diode current does not exceed 40 mA, what is the greatest reverse voltage that will appear across the diode.



$R \geq \frac{120\sqrt{2}}{40}$ kΩ

$R \geq 4.24\ k\Omega$

The largest reverse voltage appearing across the diode is equal to the Peak input voltage $120\sqrt{2} = 169.7\ V$

09/08/23