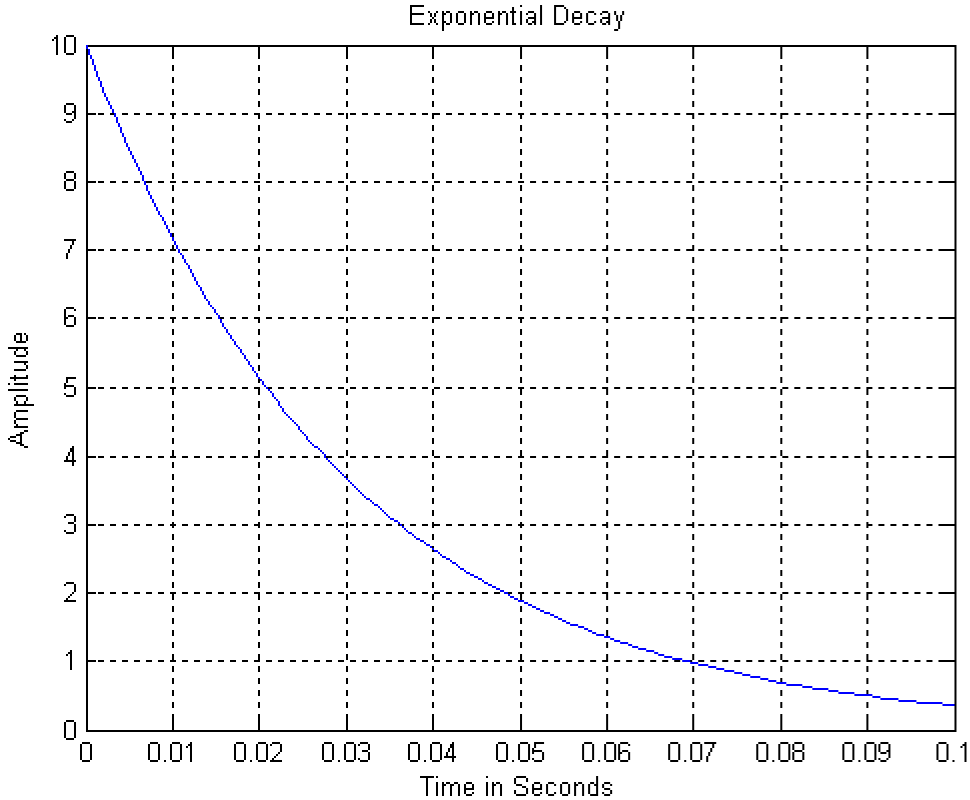
Short Quiz 1

1. What is the time constant for the following plot?



2. What is the relationship between current and voltage for a resistor?
   a. $V = IR$
   b. $I = VR$
   c. $I = L\frac{dV}{dt}$
   d. $I = C\frac{dV}{dt}$
   e. $V = L\frac{dI}{dt}$
   f. $V = C\frac{dI}{dt}$
3. What is the relationship between current and voltage for a capacitor?
   a. $V = IR$
   b. $I = VR$
   c. $I = L\frac{dV}{dt}$
   d. $I = C\frac{dV}{dt}$

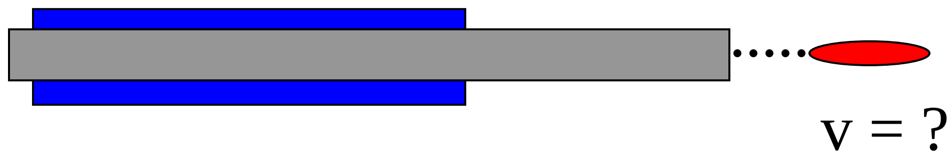
   e. $V = L\frac{dI}{dt}$
   f. $V = C\frac{dI}{dt}$

4. What is the relationship between current and voltage for an inductor?
   a. $V = IR$
   b. $I = VR$
   c. $I = L\frac{dV}{dt}$
   d. $I = C\frac{dV}{dt}$
   e. $V = L\frac{dI}{dt}$
   f. $V = C\frac{dI}{dt}$

5. What is the correct expression for the restoring force in a spring-mass system?
   a. $F = -kx$
   b. $F = kx$
   c. $F = -\frac{1}{2}kx^2$
   d. $F = \frac{1}{2}kx^2$

Short Quiz Two:

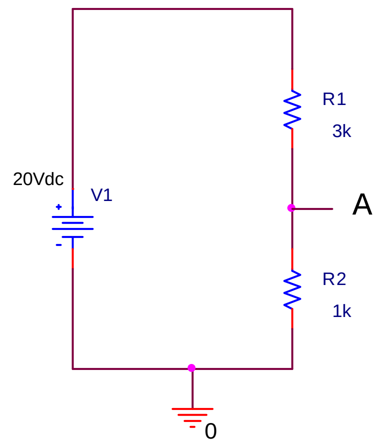
1. A projectile is launched from some kind of a device. Describe a complete method for determining the initial velocity of the projectile.



2. A 1k Ohm resistor has a current of 5mA passing through it. What is the voltage across the resistor?

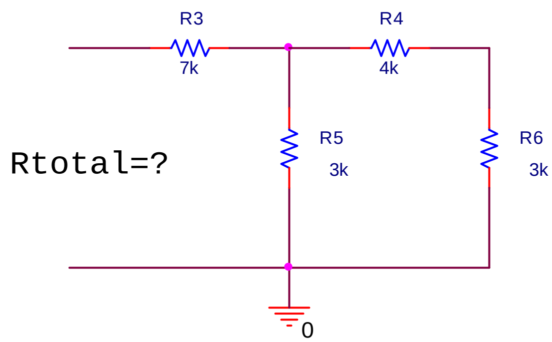
Short Quiz 3:

1. What is the voltage at point A in the circuit below?



   a. 1 Volt
   b. 3 Volts
   c. 5 Volts
   d. 10 Volts
   e. 15 Volts

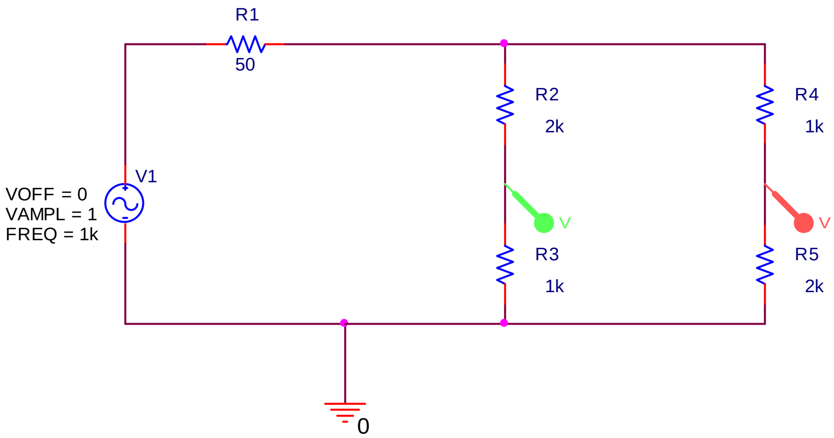
2. What is the total resistance of the combination of resistors below?



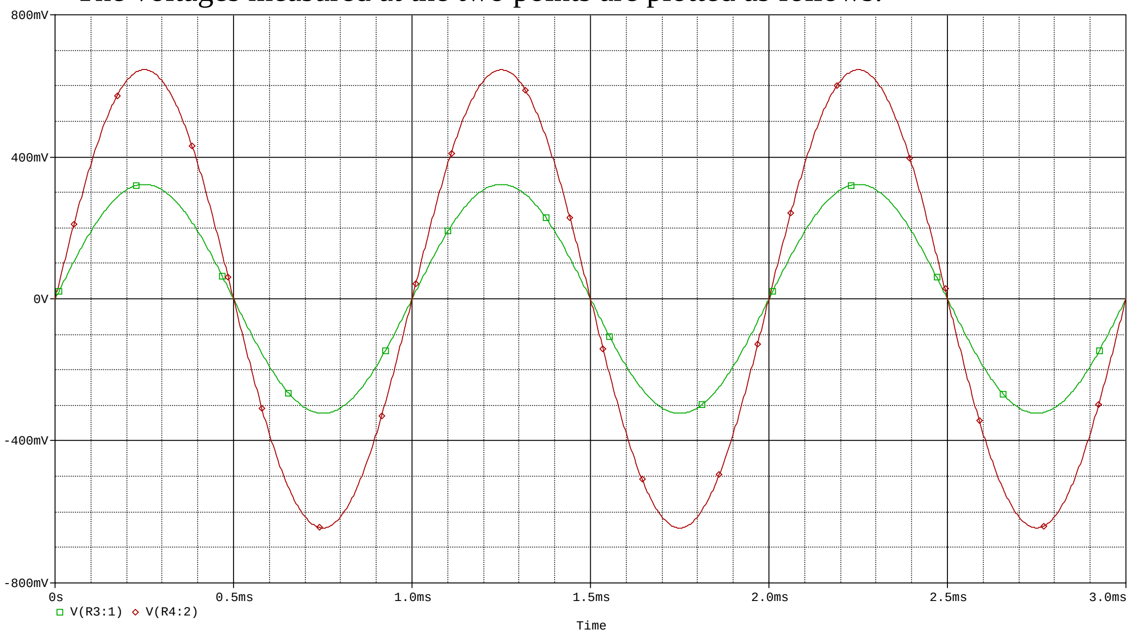
   a. 7.3k
   b. 12.1k
   c. 17k
   d. 9.1k
   e. 8.5k

Short Quiz 4:

1. The following circuit is analyzed using PSpice.



The voltages measured at the two points are plotted as follows:

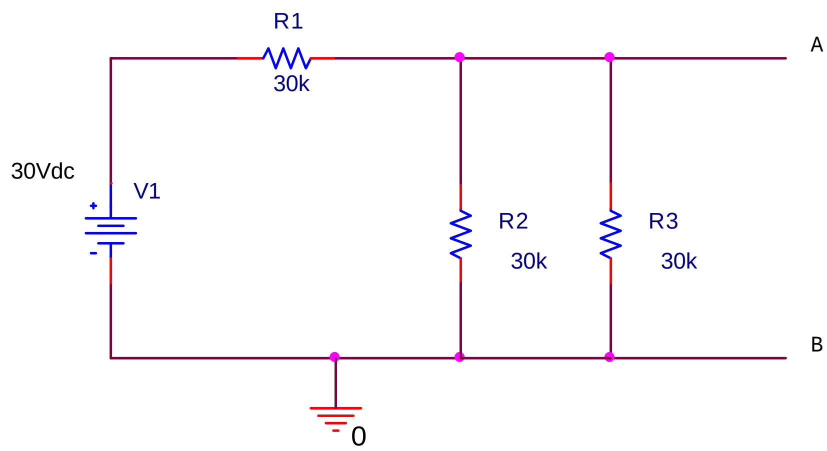


Describe the information displayed in this plot and explain why it makes sense.

2. The complex number $z = x + jy = 6 + j8$ can be written in polar form as
   a. $z = re^{j\theta} = 100e^{j\pi}$
   b. $z = re^{j\theta} = 10e^{j\pi}$
   c. $z = re^{j\theta} = 100e^{j0.927}$
   d. $z = re^{j\theta} = 10e^{j0.927}$
   e. $z = re^{j\theta} = 10e^{j\pi/2}$

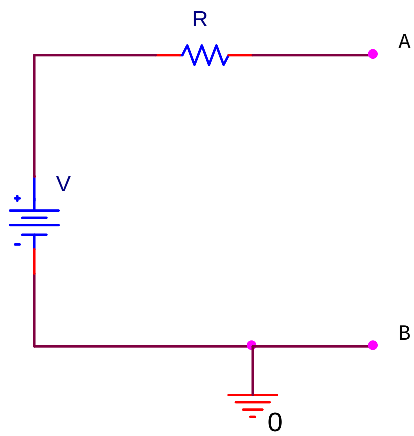
Short Quiz 5:

Given the following circuit:



1. Find the voltage measured between terminals A and B.
    a. 5V
    b. 10V
    c. 15V
    d. 20V
    e. 25V
2. Remove the voltage source and replace it with a short circuit. What is the total resistance observed between the terminals A and B?
    a. 5k
    b. 10k
    c. 15k
    d. 20k
    e. 25k

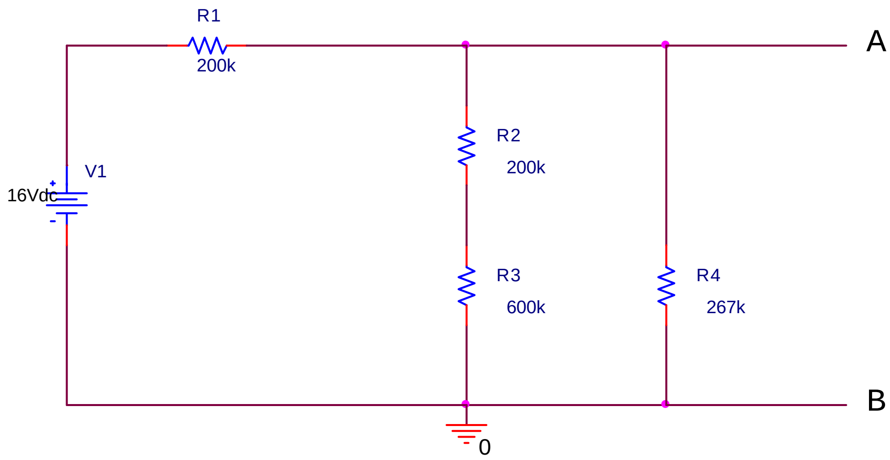
Given the following circuit:



3. What should the value of V be to observe the same voltage across the terminals A and B as in the first circuit?
    a. 5V
    b. 10V
    c. 15V
    d. 20V
    e. 25V
4. What should the value of R be to observe the same resistance across the terminals A and B as in the first circuit?
    a. 5k
    b. 10k
    c. 15k
    d. 20k
    e. 25k

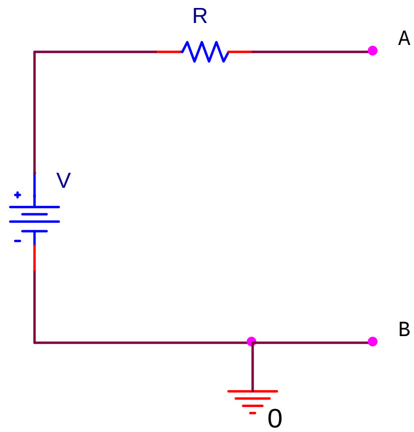
Short Quiz 6:

Given the following circuit:



1. Find the voltage measured between terminals A and B.
    a. 4V
    b. 8V
    c. 16V
    d. 10V
    e. 5V
2. Remove the voltage source and replace it with a short circuit. What is the total resistance observed between the terminals A and B?
    a. 100k
    b. 200k
    c. 300k
    d. 50k
    e. 400k

Given the following circuit:



3. What should the value of R be to observe the same resistance across the terminals A and B as in the first circuit (question 2)?
    a. 100k
    b. 200k
    c. 300k
    d. 50k
    e. 400k

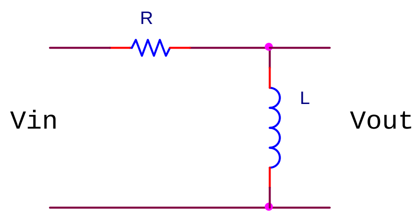
4. What should the value of V be to observe the same voltage across the terminals A and B as in the first circuit (question 1)?
    a. 4V
    b. 8V
    c. 16V
    d. 10V
    e. 5V

Short Quiz 7:

1. At high frequencies, a capacitor behaves as if it is an open circuit.
   a. True
   b. False
2. At low frequencies, a capacitor behaves as if it is a short circuit.
   a. True
   b. False
3. At high frequencies, an inductor behaves as if it is an open circuit.
   a. True
   b. False
4. At low frequencies, an inductor behaves as if it is a short circuit.
   a. True
   b. False
5. At high frequencies, a resistor behaves as if it is an open circuit.
   a. True
   b. False
6. At low frequencies, a resistor behaves as if it is a short circuit.
   a. True
   b. False

Short Quiz 8:

1. The voltage measured across two points in some circuit is represented mathematically as $V = 10\sin(60\pi t)$. Write this voltage in phasor form. *Hint: the time varying form of V(t) is obtained from the phasor V using* $V(t) = \mathrm{Re}(Ve^{j\omega t})$
   a. $V = 10$
   b. $V = 10e^{j60\pi t}$
   c. $V = j10$
   d. $V = -j10$
2. A simple circuit consists of a resistor and an inductor as shown. What is the complex transfer function for this circuit?

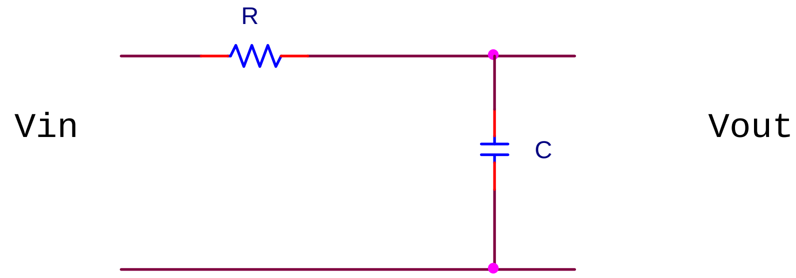


   a. $H(j\omega) = \dfrac{j\omega L}{R + j\omega L}$
   b. $H(j\omega) = \dfrac{R}{R + j\omega L}$
   c. $H(j\omega) = \dfrac{R}{R + 1/j\omega L}$
   d. $H(j\omega) = \dfrac{1/j\omega L}{R + 1/j\omega L}$

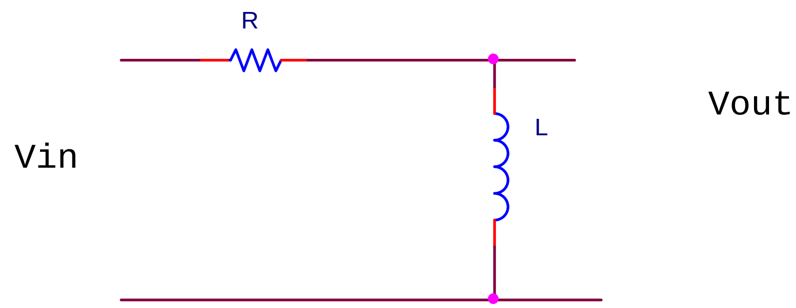
Short Quiz 9:

1. Which of the following is the differential equation for a simple spring-mass system? (Obviously the mass is *m*, the spring constant is *k*, and the displacement is *x*.)
   a. $m\frac{d^2x}{dt^2} - kx = 0$
   b. $m\frac{d^2x}{dt^2} + kx = 0$
   c. $m\frac{dx}{dt} + kx = 0$
   d. $m\frac{dx}{dt} - kx = 0$
   e. $m^2\frac{d^2x}{dt^2} + k^2x = 0$
2. Which of the following is a solution to the differential equation for the spring-mass system?
   a. $x = x_o e^{-\frac{mt}{k}}$
   b. $x = x_o e^{-\frac{kt}{m}}$
   c. $x = x_o \cos\sqrt{\frac{k}{m}}t$
   d. $x = x_o \cos\sqrt{\frac{m}{k}}t$
   e. $x = x_o \cos\frac{k}{m}t$
3. Show that your answer to question 2 is a solution to question 1.

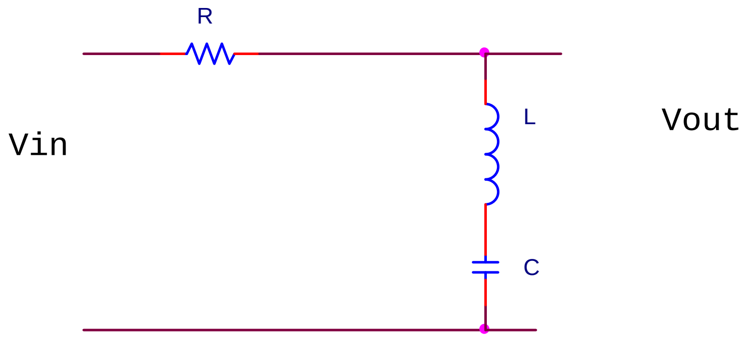
Short Quiz 10:



1. For the circuit above, what is the corner frequency?
   a. $\omega = RC$
   b. $\omega = \dfrac{1}{RC}$
   c. $\omega = \dfrac{C}{R}$
   d. $\omega = \dfrac{R}{C}$



2. For the circuit above, what is the corner frequency?
   a. $\omega = RL$
   b. $\omega = \dfrac{1}{RL}$
   c. $\omega = \dfrac{L}{R}$
   d. $\omega = \dfrac{R}{L}$



3. For the circuit above, what is the resonant frequency?
   a. $\omega = \sqrt{LC}$
   b. $\omega = \sqrt{\frac{1}{LC}}$
   c. $\omega = \sqrt{\frac{L}{C}}$
   d. $\omega = \sqrt{\frac{C}{L}}$

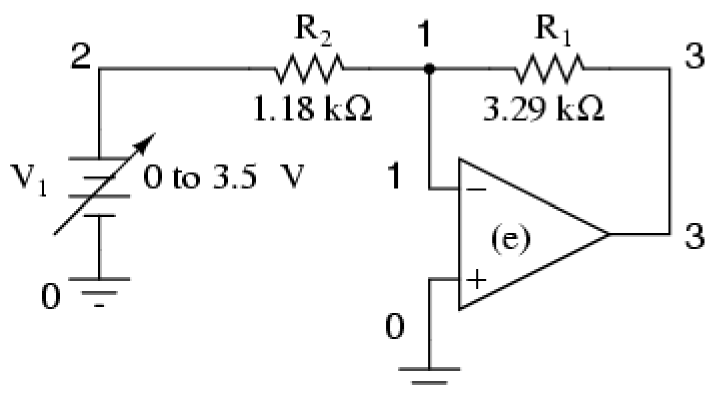
Name ___________ **Date___________**

Short Quiz 11:

1. Which of the following are the Golden Rules of Op Amps?

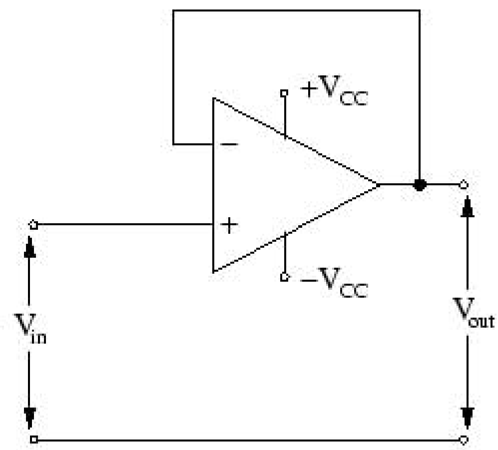
   a. Don't look back. Something might be gaining on you.
   b. The output attempts to do whatever is necessary to make the voltage difference between the inverting and non-inverting inputs zero.
   c. The second mouse gets the cheese
   d. Neither of the two inputs draw any current.
   e. You can't plow a field by turning it over in your mind.
   f. Do unto others as you would have others do unto you.

2. What is the gain of the following Op Amp circuit?



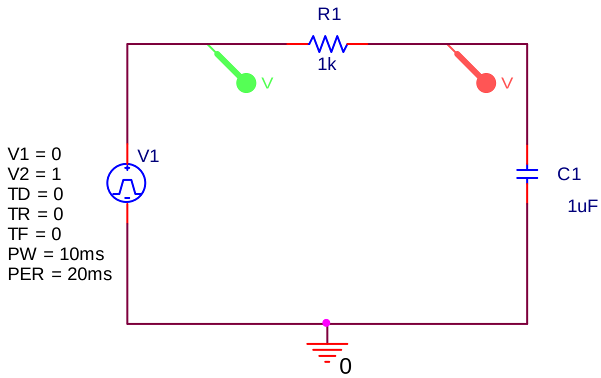
   a. 3.29
   b. 1.18
   c. -3.29
   d. -1.18
   e. 2.67
   f. -2.67
   g. 3.88
   h. -3.88
   i. 2.79
   j. -2.79
   k. 0.36
   l. -0.36

3. What is the gain of the following Op Amp Configuration?



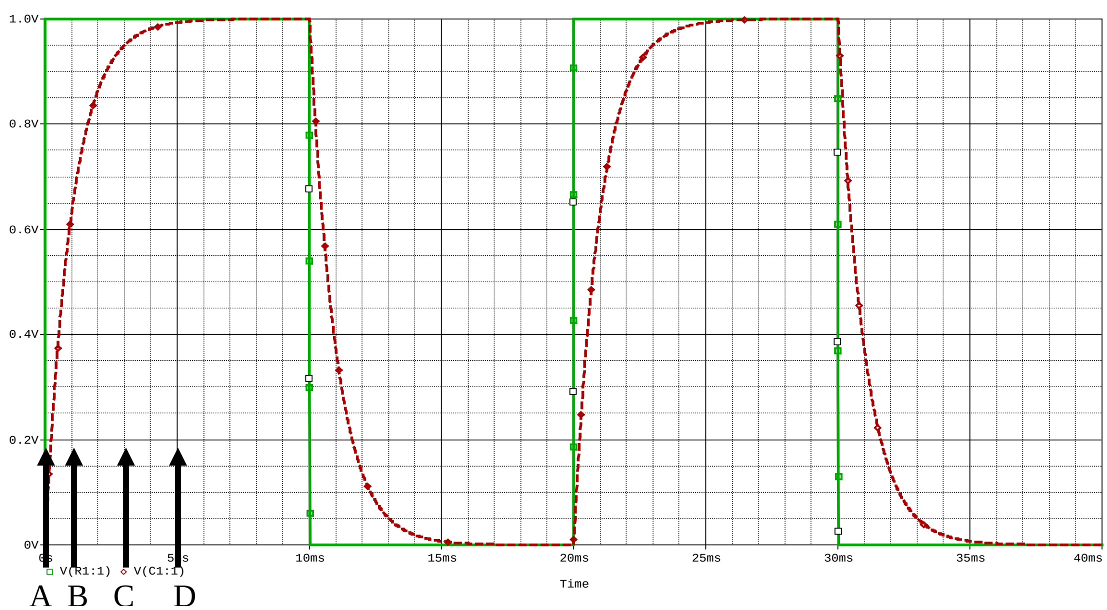
a. 0
b. 1
c. -1
d. ∞
e. $-\infty$
f. V_{CC}
g. $-V_{CC}$
h. Cannot tell

Short Quiz 12:



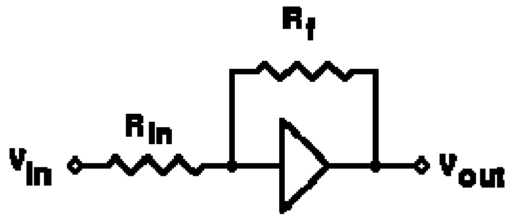
1. A pulsed voltage source charges and discharges a capacitor through a resistor. The characteristic time constant of the RC combination is
   a. 1ms
   b. 5ms
   c. 10ms
   d. 0.5ms
   e. 0.1ms

2. The voltages measured at the two locations above look like the following:

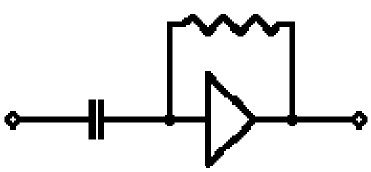


   a. The voltage to the left of the resistor is
      i. The solid line
      ii. The dashed line
   b. The time constant is the time between the following points
      i. A and B
      ii. B and C
      iii. C and D
      iv. A and C

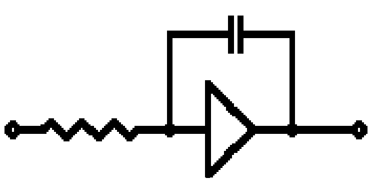
Short Quiz 13:
Op-Amp Circuit Review



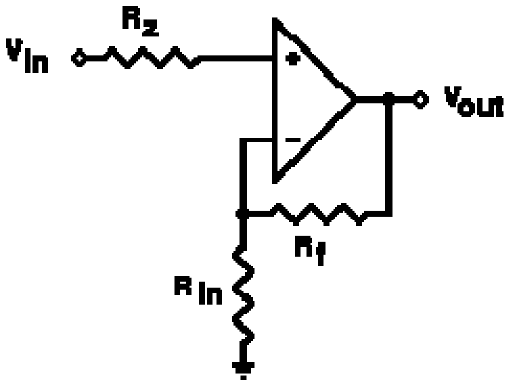
1. The circuit above is
    a. A non-inverting op-amp
    b. A differentiator
    c. An integrator
    d. An inverting op-amp
    e. A buffer



2. The circuit above is
    a. A non-inverting op-amp
    b. A differentiator
    c. An integrator
    d. An inverting op-amp
    e. A buffer

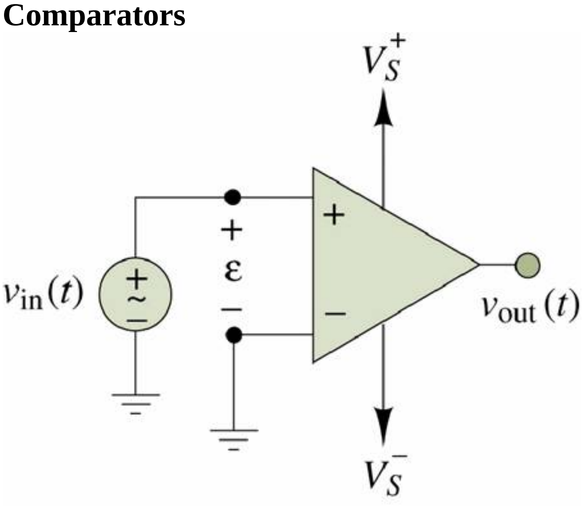


3. The circuit above is
    a. A non-inverting op-amp
    b. A differentiator
    c. An integrator
    d. An inverting op-amp
    e. A buffer

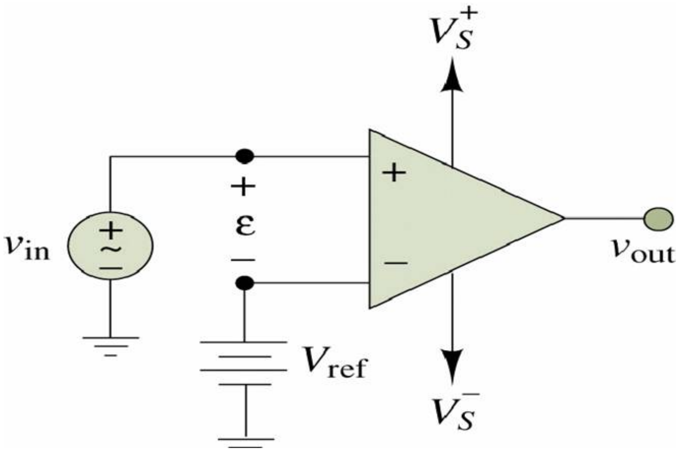


4. The circuit above is
   a. A non-inverting op-amp
   b. A differentiator
   c. An integrator
   d. An inverting op-amp
   e. A buffer

Comparators

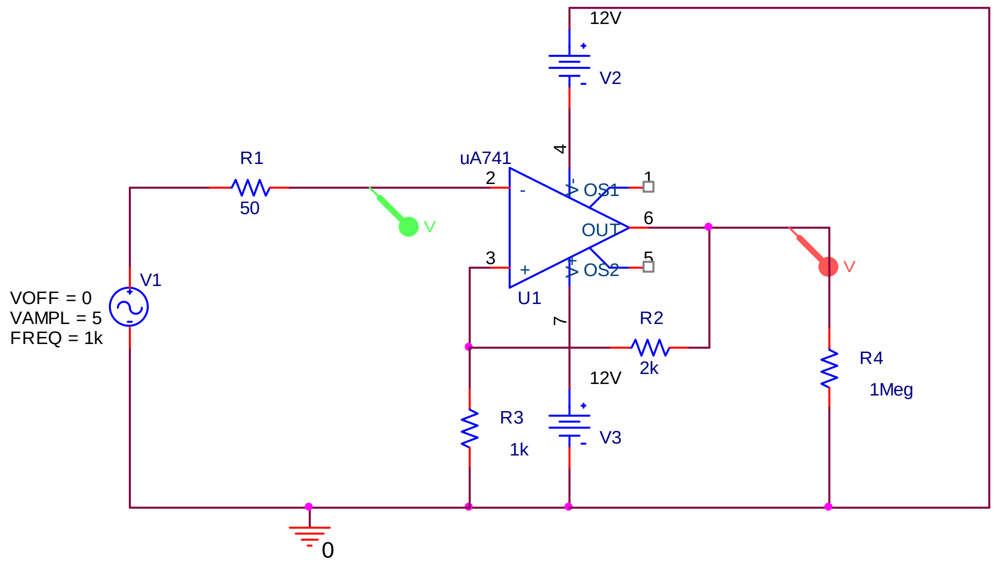


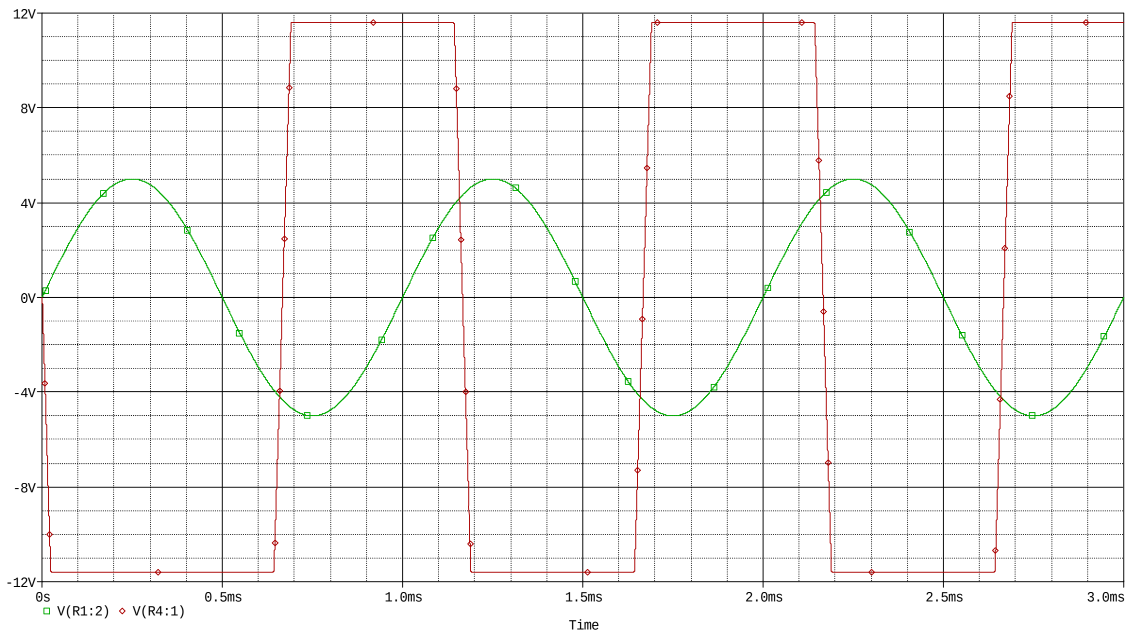
5. For the circuit above, what will the output voltage v_{out} be when the input voltage v_{in} is positive?
   a. $v_{out} = v_{in}$
   b. $v_{out} = -v_{in}$
   c. $v_{out} = V_S^{\ +}$
   d. $v_{out} = V_S^{\ -}$
   e. $v_{out} = 0$



6. For the circuit above, what will the output voltage v_{out} be when the input voltage v_{in} is less than V_{ref}?
   a. $v_{out} = v_{in}$
   b. $v_{out} = -v_{in}$
   c. $v_{out} = V_S^{+}$
   d. $v_{out} = V_S^{-}$
   e. $v_{out} = V_{ref}$

Short Quiz 14:





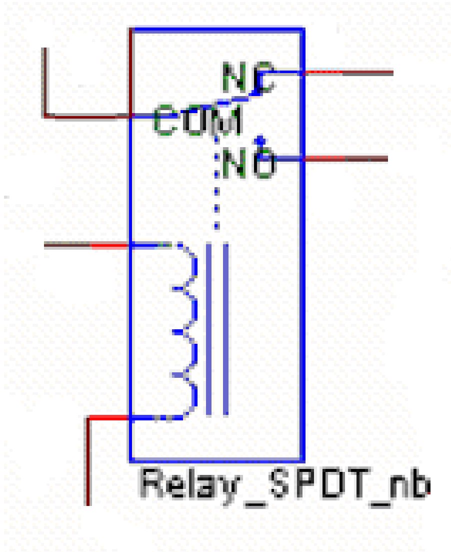
1. For the circuit above, show that the plot found by PSpice is correct.

2. What kind of a circuit is this?

    a. Inverting Op Amp
    b. Non Inverting Op Amp
    c. Schmitt Trigger
    d. Inverter
    e. Buffer

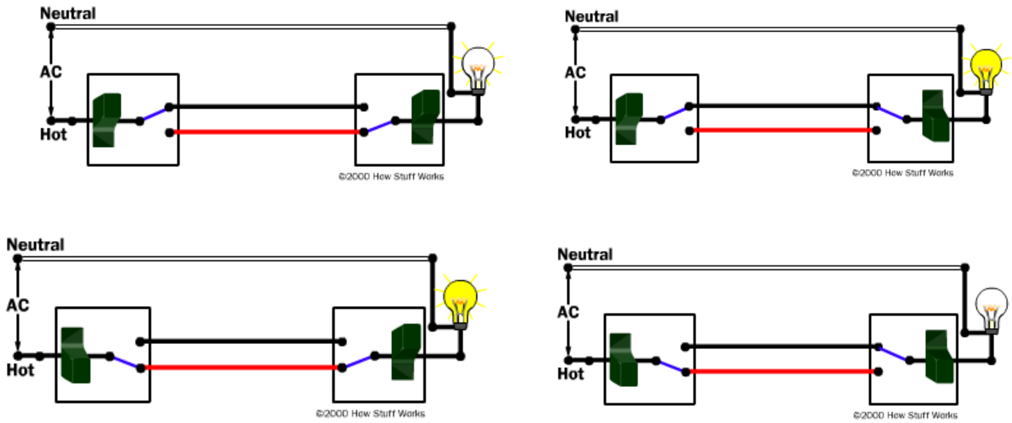
3. Three engineers and three accountants were traveling by train to a conference. At the station, the three accountants each bought tickets and watched as the three engineers bought only one ticket. "How are three people going to travel on only one ticket?" asked an accountant. "Watch and you'll see", answered an engineer. They all boarded the train. The accountants took their respective seats, but the three engineers all crammed into a rest room and closed the door behind them. Shortly after the train departed, the conductor came around collecting tickets. He knocked on the restroom door and said, "Ticket, please". The door opened just a crack and a single arm emerged with a ticket in hand. The conductor took it and moved on. The accountants saw this and agreed it was a quite clever idea. So, after the conference, the accountants decide to copy the engineers on the return trip and save some money (being clever with money, and all that). When they got to the station, they bought a single ticket for the return trip. To their astonishment, the engineers didn't buy a ticket at all. "How are you going to ride without a ticket?" said one perplexed accountant. "Watch and you'll see", answered an engineer. When they boarded the train, the three accountants crammed into a restroom and the three engineers crammed into another one nearby. The train departed. What did the engineers do to ride on the train with no ticket?

Short Quiz 15:



1. Shown above is a diagram for a relay. From the list at the left, draw a line from the abbreviation shown above to its correct meaning.

NC	Single Pole Double Throw
	Communicator
NO	Normally Closed
	Never Closed
SPDT	Normally Open
	Space Partnership Development Taskforce
COM	Never Open
	Common



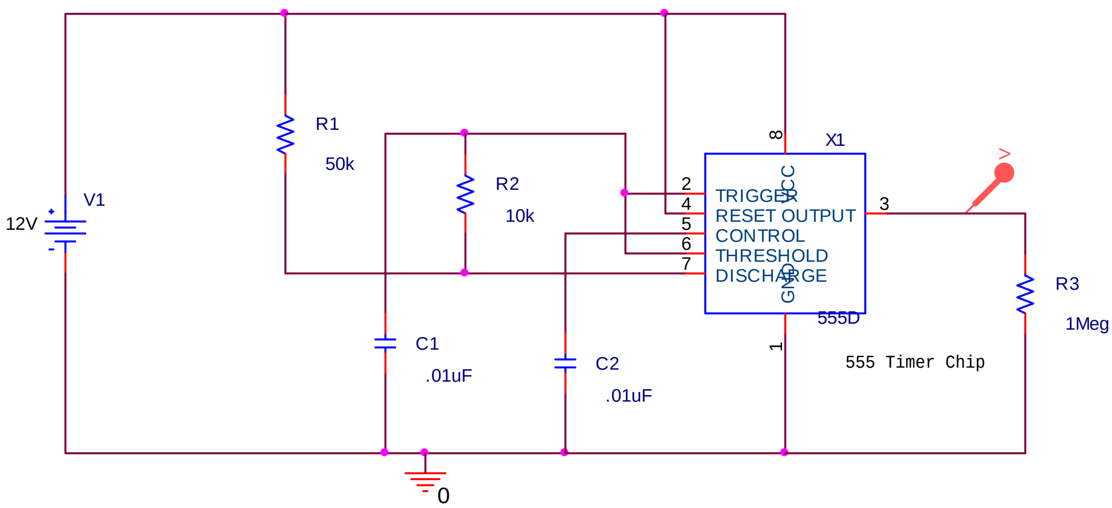
2. You have probably seen the combination of switches shown above in your home. All possible combinations of switch positions are shown. What are they used for?

   What are they called?

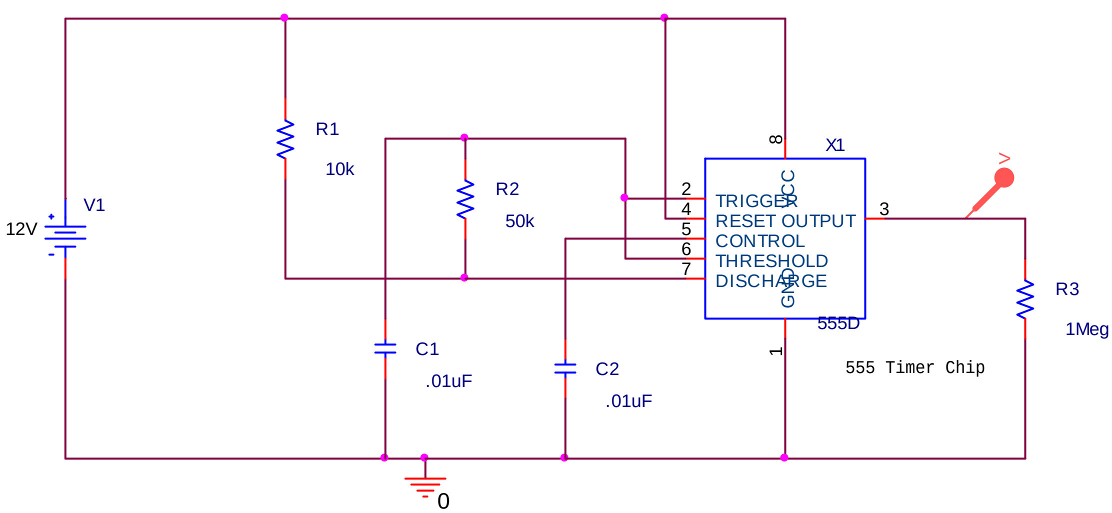
   a. Magic switches
   b. Two Way switches
   c. Three Way switches
   d. Toggle switches
   e. LAN switches
   f. Rocker switches
   g. Push Button switches
   h. Slide switches
   i. DIP switches
   j. Rotary switches
   k. Touch switches

Short Quiz 16:

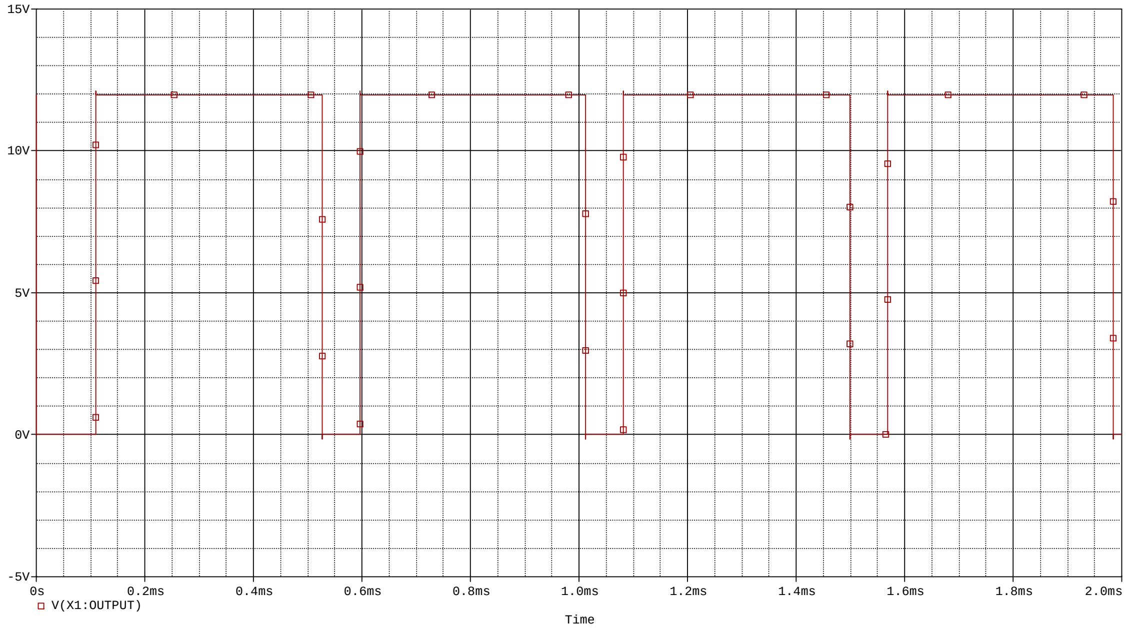
1. An astable multivibrator circuit is configured with two different choices of resistors, as shown below. On the next page the output voltages are shown for the two cases. Identify which output voltage goes with which circuit.

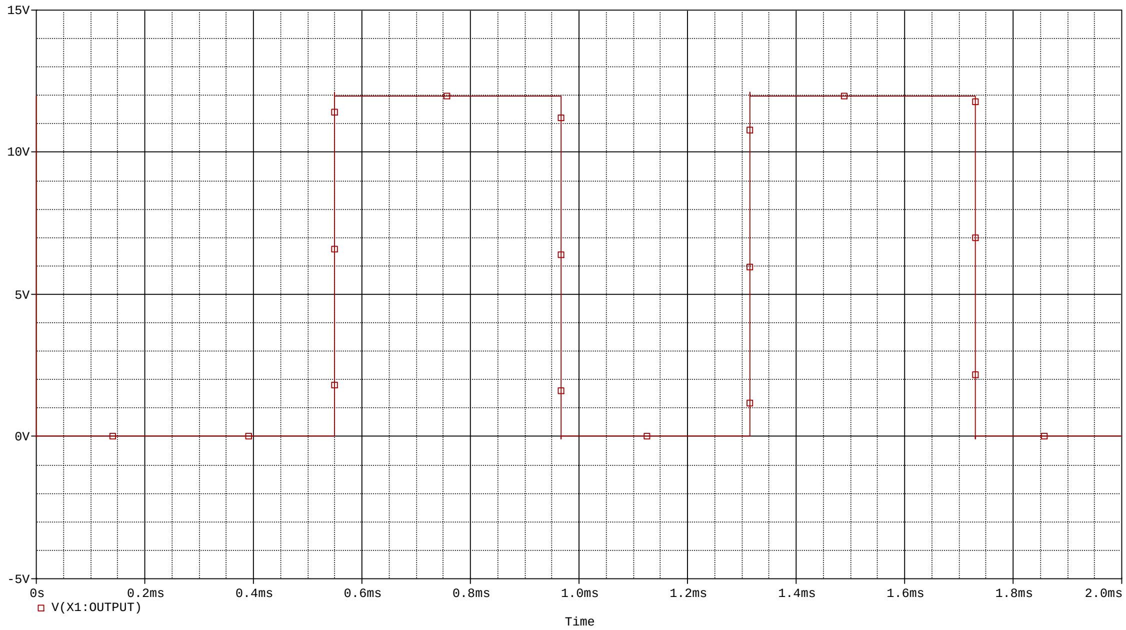


Case A: R1>R2



Case B: R2>R1


15V
10V
5V
0V
-5V
0s
0.2ms
0.4ms
0.6ms
0.8ms
1.0ms
1.2ms
1.4ms
1.6ms
1.8ms
2.0ms
V(X1:OUTPUT)
Time

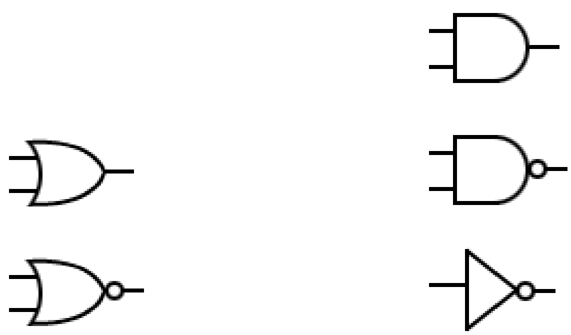

15V
10V
5V
0V
-5V
0s
0.2ms
0.4ms
0.6ms
0.8ms
1.0ms
1.2ms
1.4ms
1.6ms
1.8ms
2.0ms
V(X1:OUTPUT)
Time

Short Quiz 17:

1. Convert the following number from decimal to binary form: 13
   a. 10011
   b. 01101
   c. 01010
   d. 10101
   e. 11100

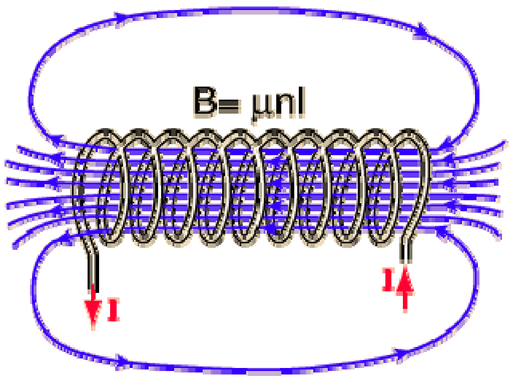
2. Convert the following number from binary to decimal form: 11001
   a. 5
   b. 13
   c. 17
   d. 25
   e. 31

3. Identify the name of each logic gate:



   a. OR
   b. AND
   c. NOR
   d. NAND
   e. Inverter

Short Quiz 18:



A solenoidal inductor is made by winding wire around a cylindrical core. This can be a plastic or paper tube or an iron rod. If the core cylinder has a radius equal to r_c and we wind a coil N times around the cylinder to cover a length d, the inductor will have an inductance equal to:

$$L = \frac{(\mu_0 N^2 \pi r_c^{\ 2})}{d} Henries$$

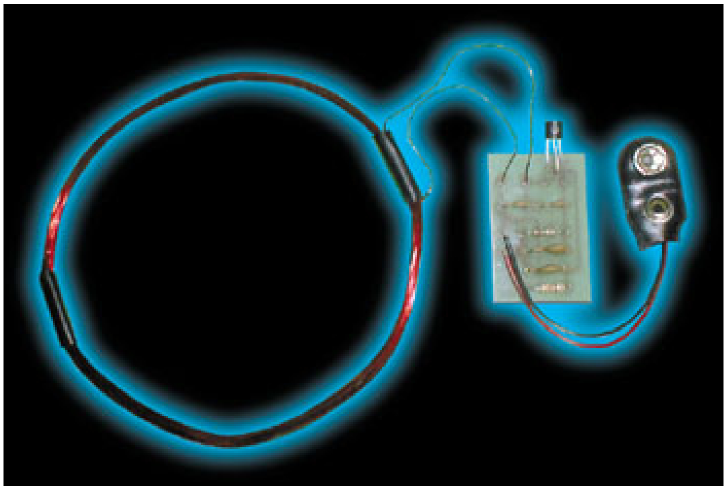
where $\mu_o = 4\pi \times 10^{-7}$ Henries/meter. If the core is not air, but rather some magnetic material, replace μ_o with μ, which is usually many times larger than μ_o. By many times we can mean as much as 10^5 times larger. You should know that this formula only works well when the length d is much larger than the radius r_c.

For other applications, it tends to over-estimate the value of the inductance and, thus, it is only useful to find a ballpark number. For example, if the coil has a radius and a length similar to that of a coin, it will look something like a finger ring. Then, the inductance is given approximately by

$$L \cong \mu N^2 r_c \{\ln(\frac{8r_c}{r_w}) - 2\}$$

where r_c is the major radius of the coil and r_w is the radius of the wire.

1. The inductance of a 1000 turn, air-core solenoid with a radius of 2cm and a length of 20cm is approximately
    a. *8mH*
    b. *0.8mH*
    c. *3.2mH*
    d. *.32mH*
    e. *80mH*



2. The inductance of a 10 turn, air-core coil (like the one shown above) with a radius of 10cm and a wire radius of 2mm is
   a. *50mH*
   b. *5mH*
   c. *.5mH*
   d. *.05mH*
   e. *.005mH*

One of the characteristics of practical inductors that is quite different from practical capacitors is their loss. Loss in a capacitor comes from the leakage through the insulator that separates the capacitor plates. Insulators are so good now that this leakage is generally negligible. Loss in an inductor comes from the finite, if small, resistance of the wires used to make the inductors. Unless we use superconductors to make coils, this resistance will always be an issue and any circuit model of an inductor must include a resistance. To see this, calculate the resistance of the 10 turn, air-core coil of the previous problem. The resistance of the wire can be determined from

$$R = \frac{l}{\sigma A}$$

where *l* is the length of the wire, *A* is the cross-sectional area of the wire (not the loop), and σ is the conductivity of the wire (for copper, $\sigma = 5.8x10^7$).

3. The total length of wire used in this coil is (in meters)
   a. 20π
   b. 0.002π
   c. 2π
   d. 0.004π
   e. 200π

4. The cross-sectional area of the wire is (in meters)
   a. $\left(2x10^{-6}\right)\pi$
   b. $\left(4x10^{-3}\right)\pi$
   c. 2π
   d. $\left(4x10^{-6}\right)\pi$
   e. $\left(2x10^{-3}\right)\pi$

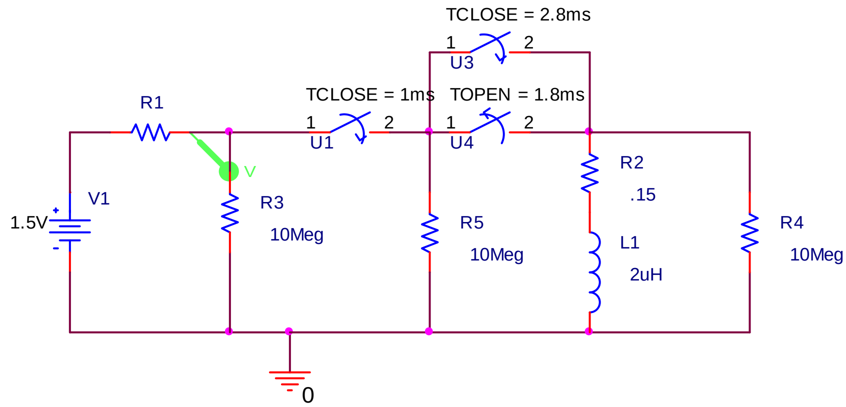
5. The resistance of the wire is (in Ohms)
   a. 0.00086
   b. 0.0086
   c. 0.086
   d. 0.86
   e. 8.6

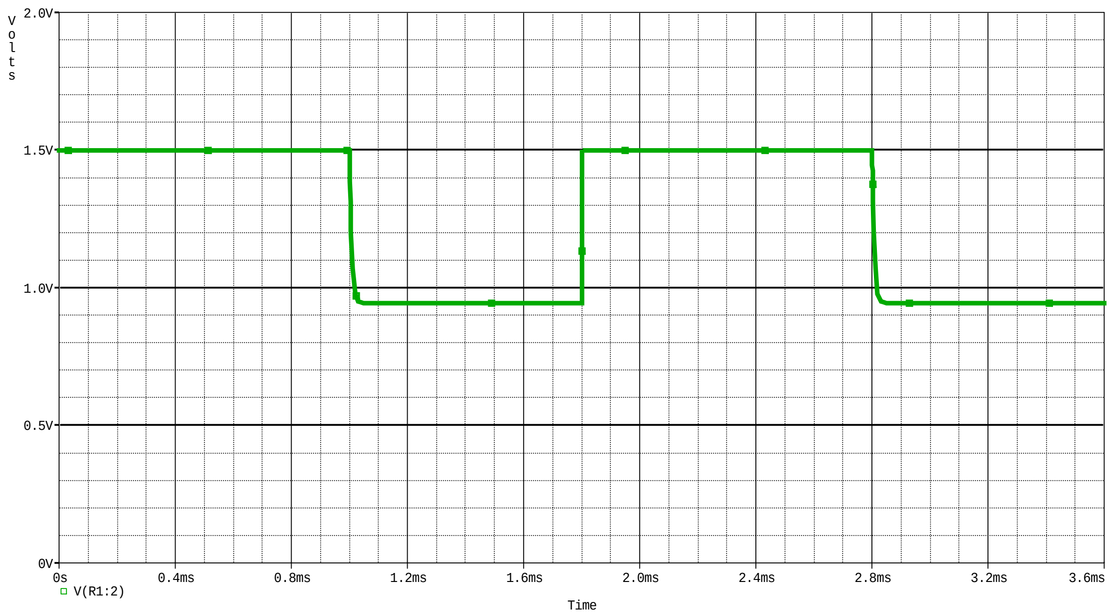
Check your result using the wire resistance calculator at the online site Megaconverter http://www.megaconverter.com/mega2/ . You cannot specify the radius of the wire, so you will have to choose the wire gauge that has a radius that is closest to 2mm.

6. What gauge wire has the closest dimensions?
   a. 4
   b. 5
   c. 6
   d. 7
   e. 8

Short Quiz 19:

The following circuit was used to simulate the operation of the Beakman's motor as it connects to and disconnects from the battery each cycle. The values used are typical for smaller coils. The 10Meg resistors are included only so that one end of the switches does not float since PSpice does not like floating terminals.

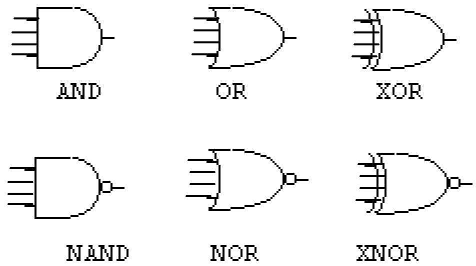




Given this information, what is the resistance of the battery R1?

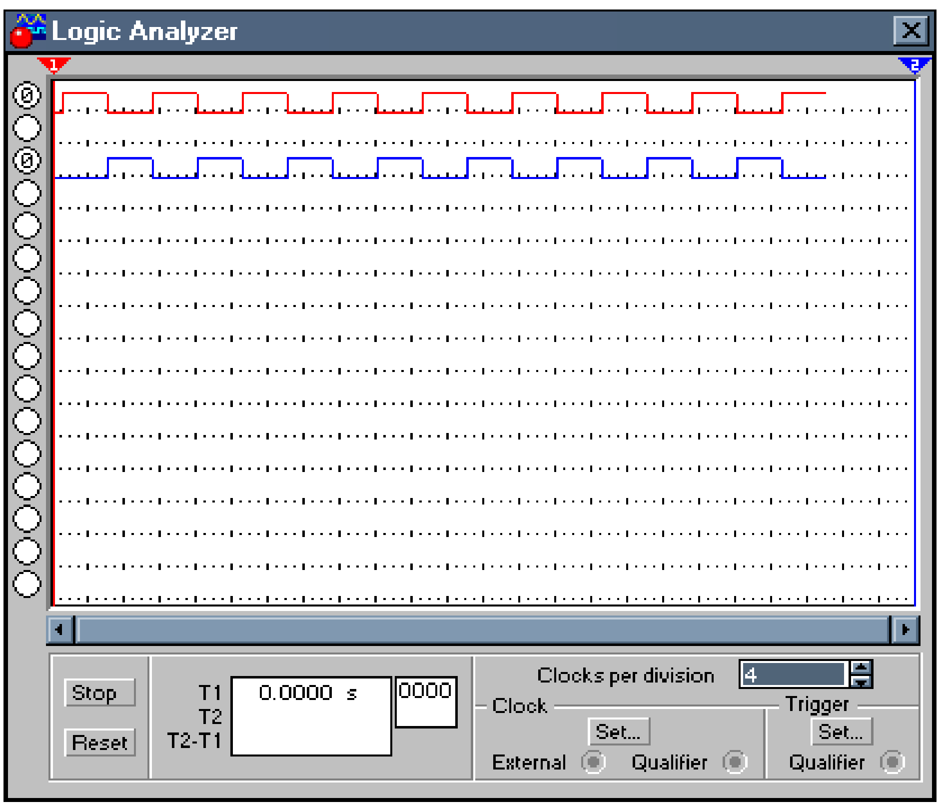
a. 1 Ω
b. 0.5 Ω
c. 0.1 Ω
d. 0.05 Ω
e. 0.001 Ω

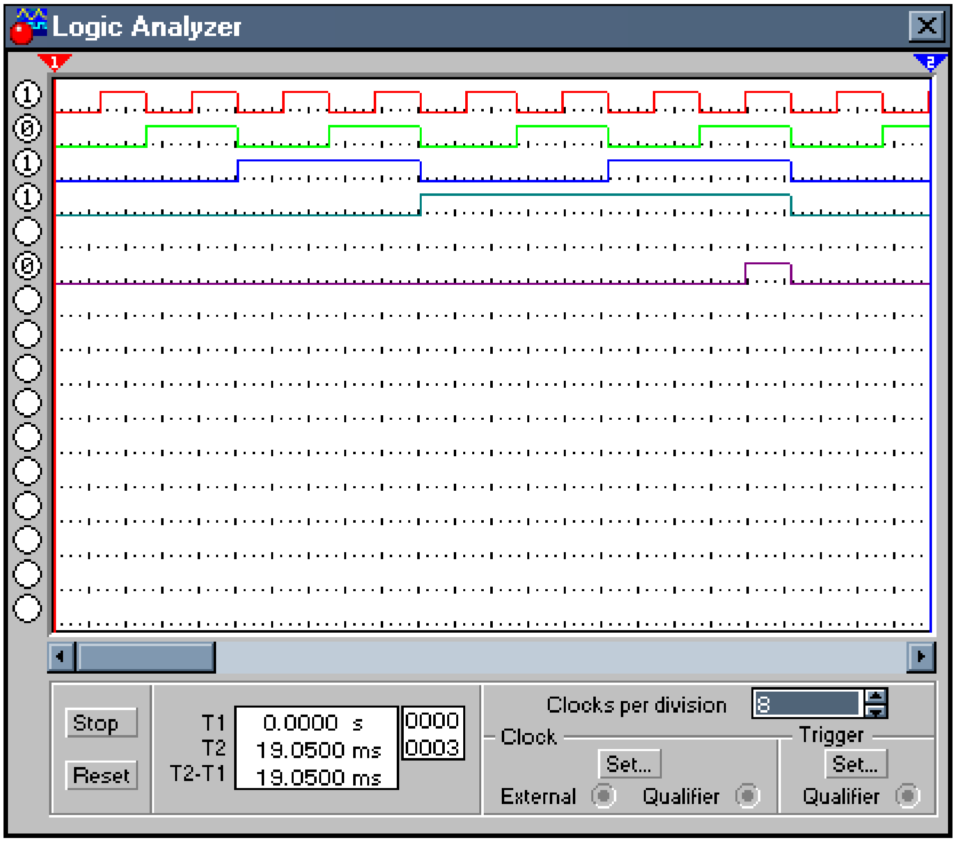
Short Quiz 20:

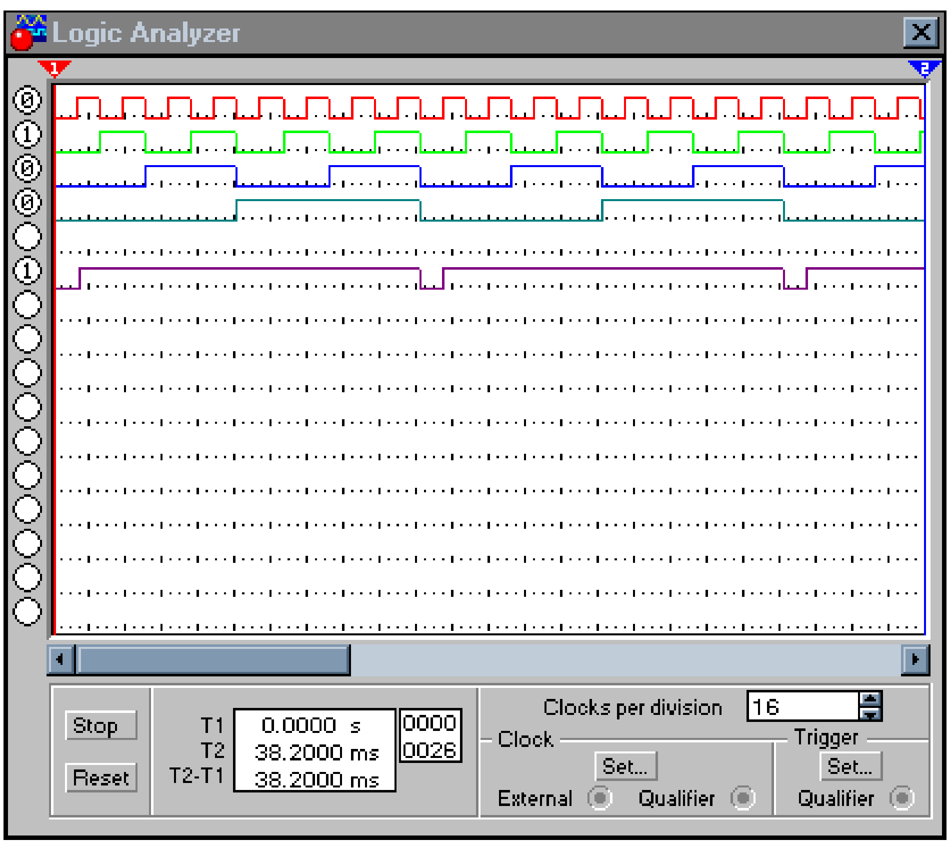


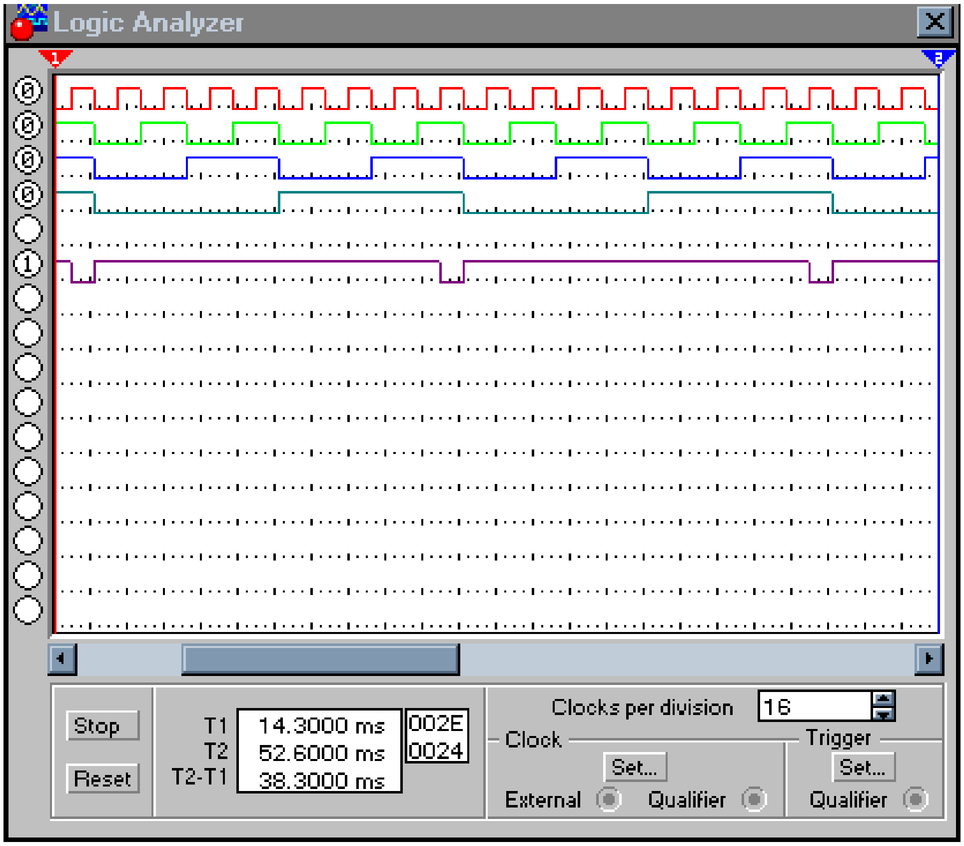
On the following pages, you will find timing diagrams for the basic logic gates. Identify which diagram goes with which gate. For the inverter there is only one input and one output. For the other gates, there are four inputs and one output. The first four signals are the inputs and the fifth is the output. All devices trigger on the leading edge of pulses.

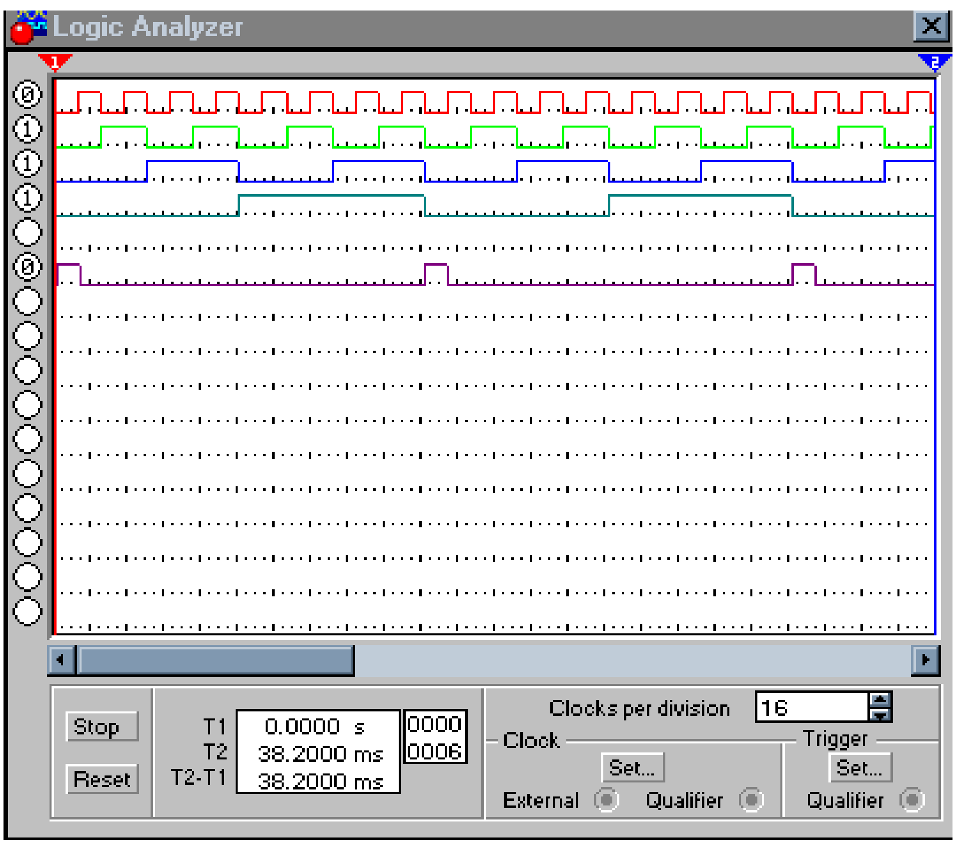
1. Inverter
2. NAND
3. OR
4. AND
5. NOR



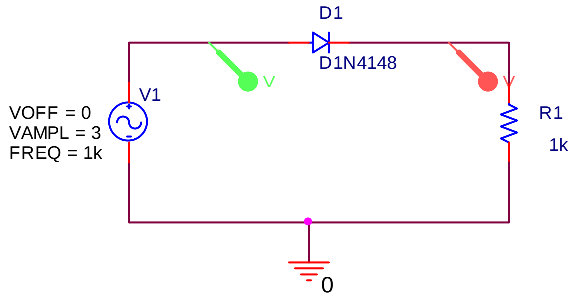

Logic Analyzer
1
0
1
1
0
Stop
Reset
T1
T2
T2-T1
0.0000 s
19.0500 ms
19.0500 ms
0000
0003
Clocks per division
8
Clock
Set...
External
Qualifier
Trigger
Set...
Qualifier


Logic Analyzer
0
1
0
0
1
Stop
Reset
T1
T2
T2-T1
0.0000 s
38.2000 ms
38.2000 ms
0000
0026
Clocks per division
16
Clock
Set...
External
Qualifier
Trigger
Set...
Qualifier


Logic Analyzer
Stop
Reset
T1
T2
T2-T1
14.3000 ms
52.6000 ms
38.3000 ms
002E
0024
Clocks per division
16
Clock
Trigger
Set...
Set...
External
Qualifier
Qualifier

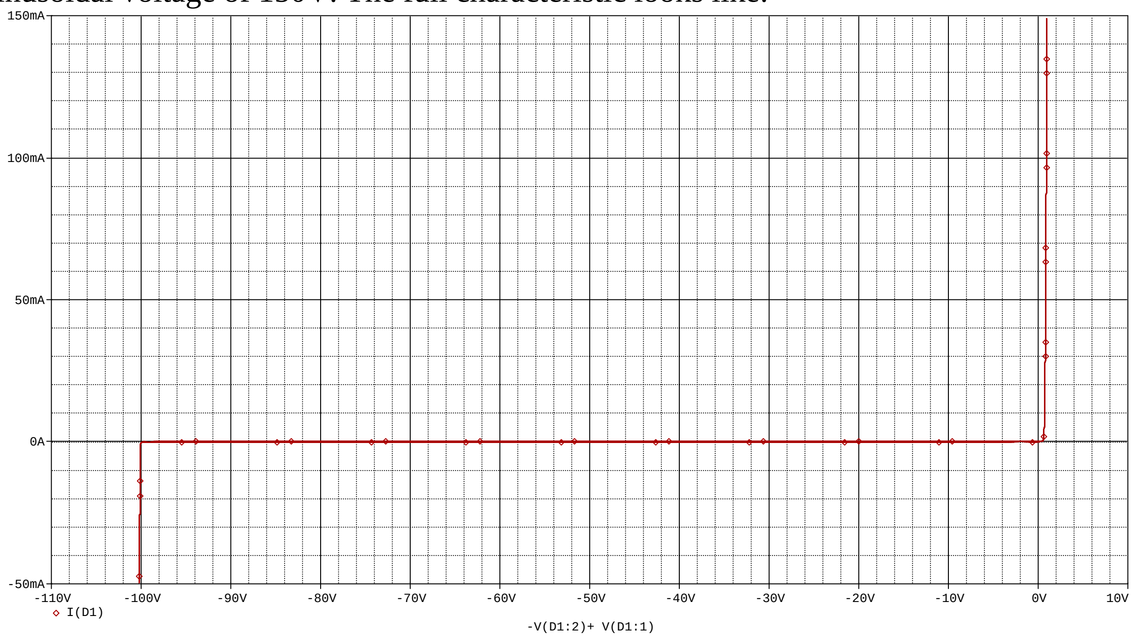

Logic Analyzer
Stop
Reset
T1
T2
T2-T1
0.0000 s
38.2000 ms
38.2000 ms
0000
0006
Clocks per division
16
Clock
Trigger
Set...
Set...
External
Qualifier
Qualifier

Short Quiz 21:

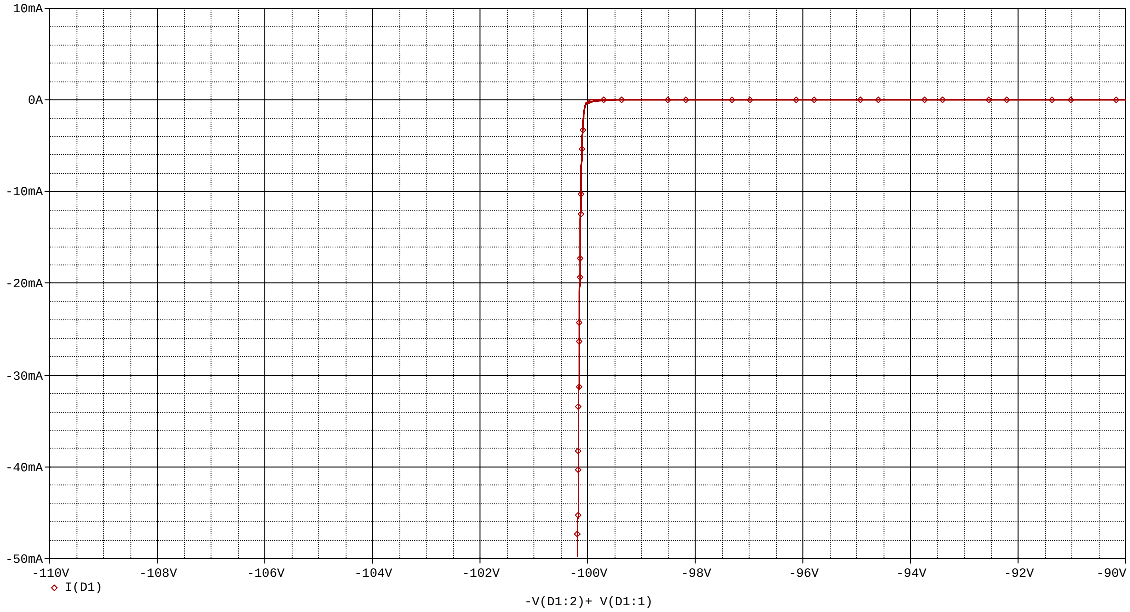


1. The circuit above is called
    a. a full wave rectifier
    b. a half wave rectifier
    c. Cam Ward

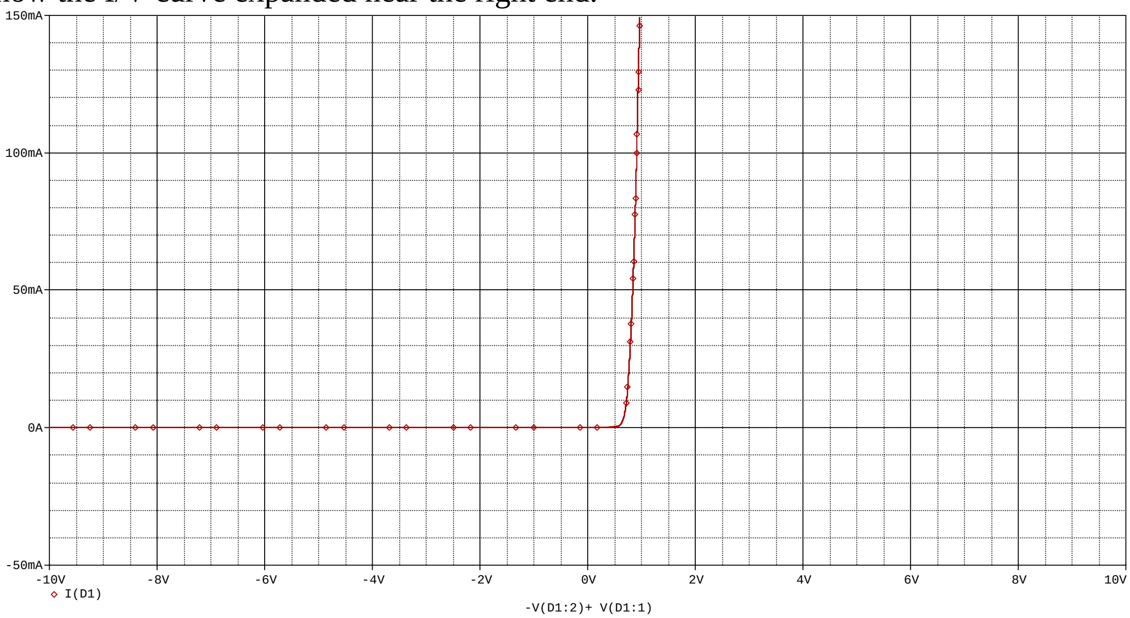
It is possible to obtain the full I/V characteristic of the 4148 diode by applying a sinusoidal voltage of 150V. The full characteristic looks like:



2. From this plot, what is the reverse breakdown voltage for this diode?
    a. 0.7V
    b. 0V
    c. -0.7V
    d. -100V
    e. Cannot tell from this plot



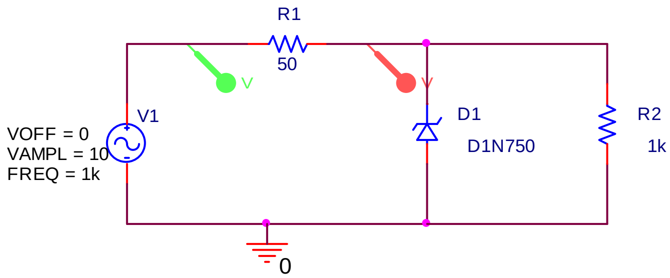
Shown above is an expanded version of the I/V curve near the left end, while below we show the I/V curve expanded near the right end.

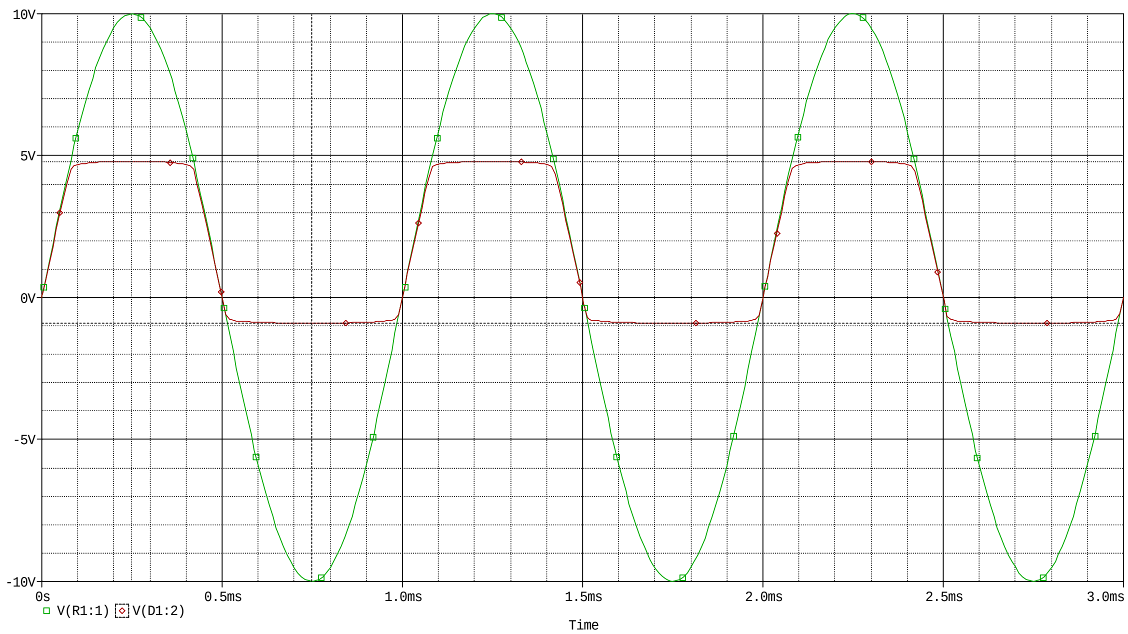


3. From this plot, what voltage does it take to turn on this diode?
   a. 0.7V
   b. 0V
   c. -0.7V
   d. -100V
   e. Cannot tell from this plot

Short Quiz 22:

1. A zener diode is connected to a 10V sinusoidal source as shown.

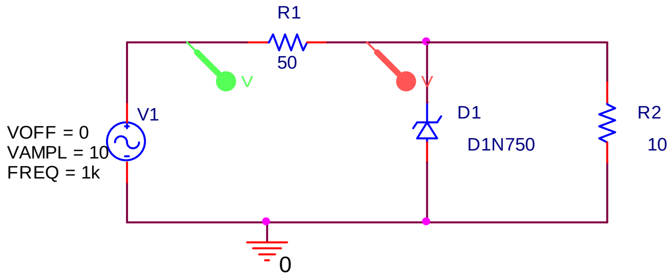


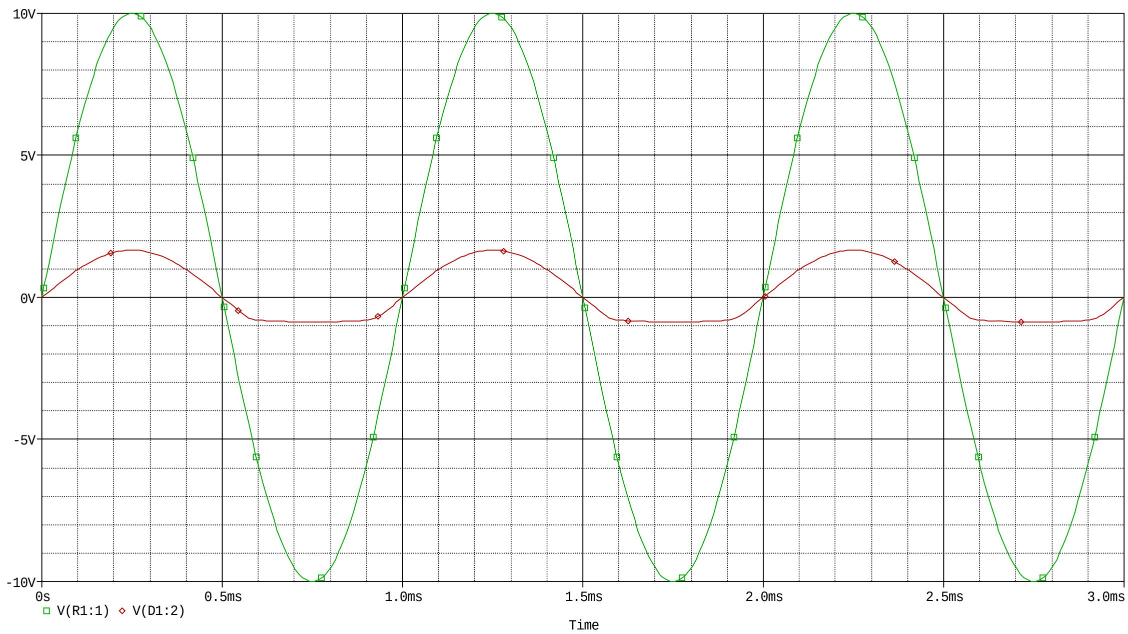


What is the Zener voltage for this diode?

a. 0.9V
b. 10V
c. 0V
d. 4.8V
e. 2.4V
f. 5V

2. The load resistor is changed from 1k to 10 Ohms.

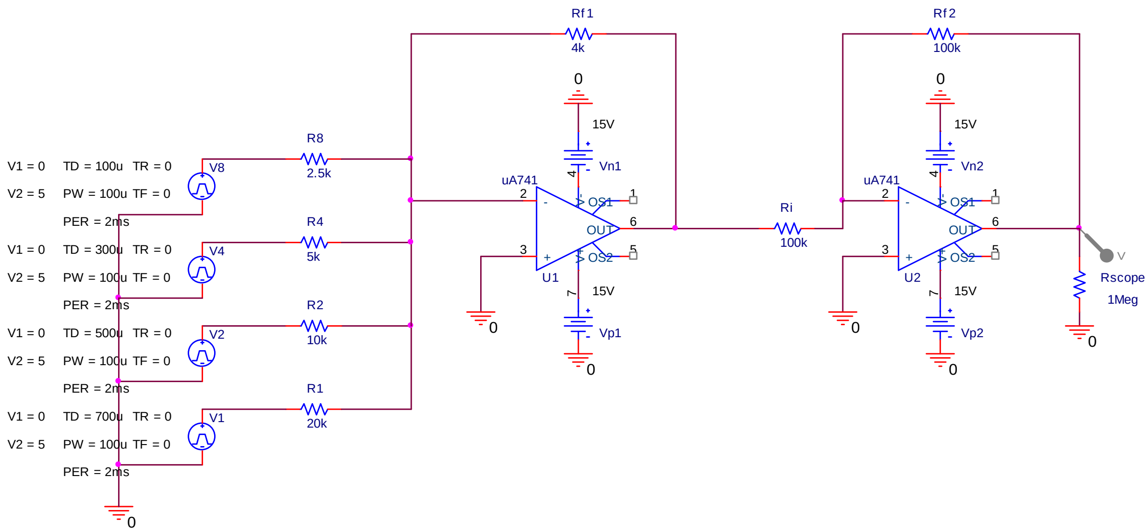




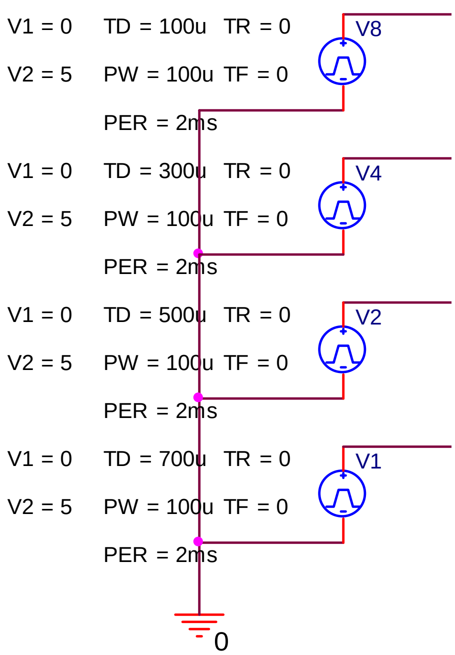
Explain the changes in the output.

Short Quiz 23:

The following configuration is constructed with some resistors and op-amps.

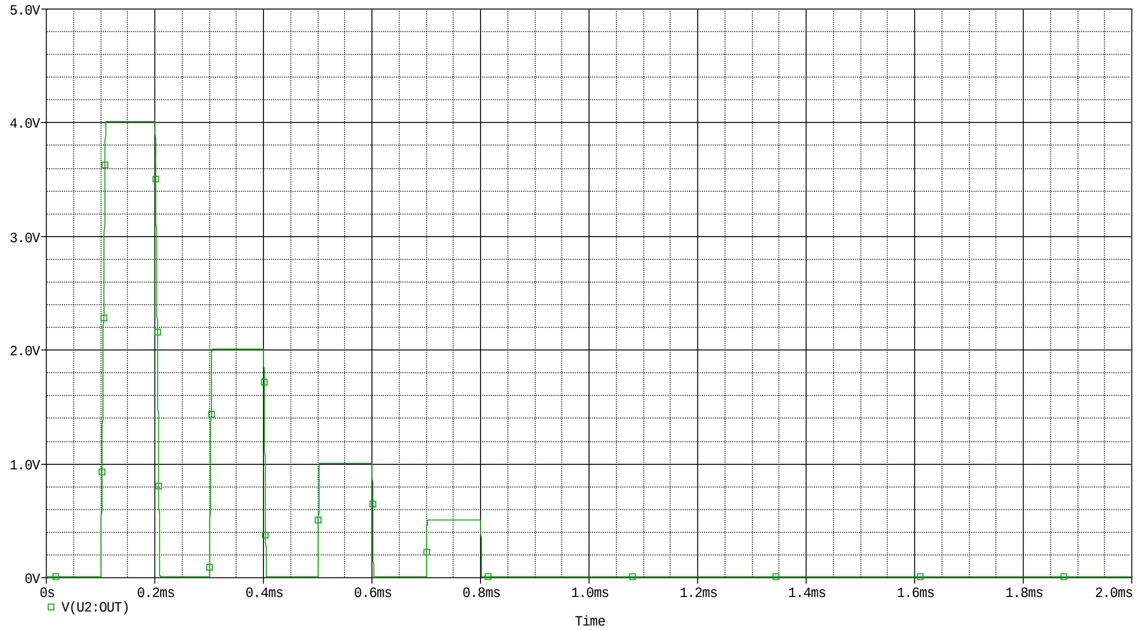


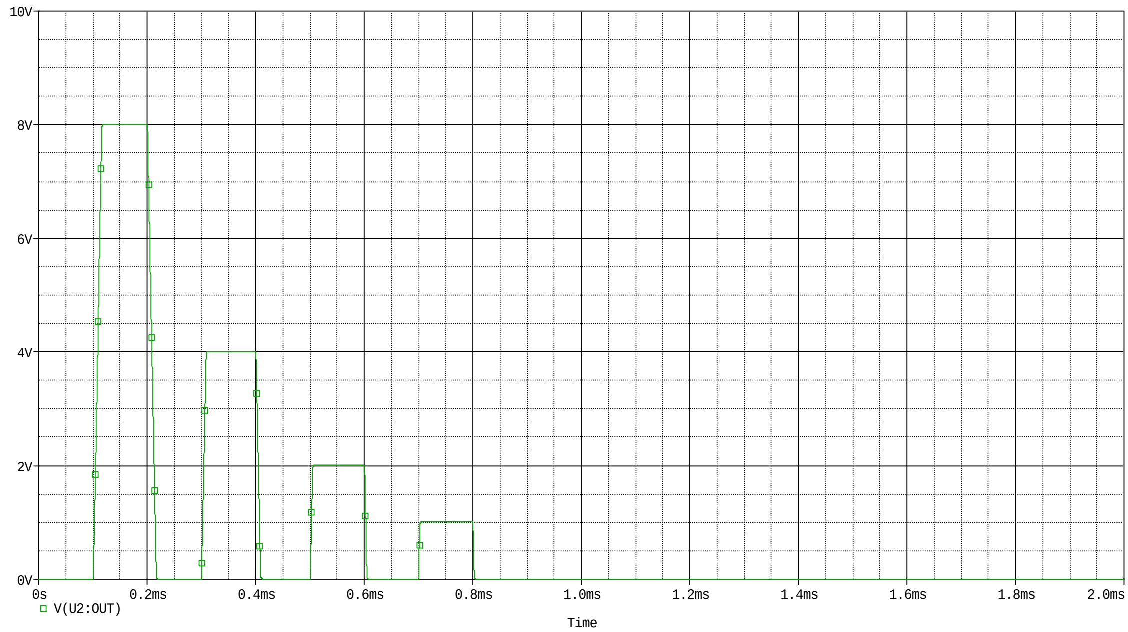
Because the parts on this figure are small, an expanded version of the sources is shown below.

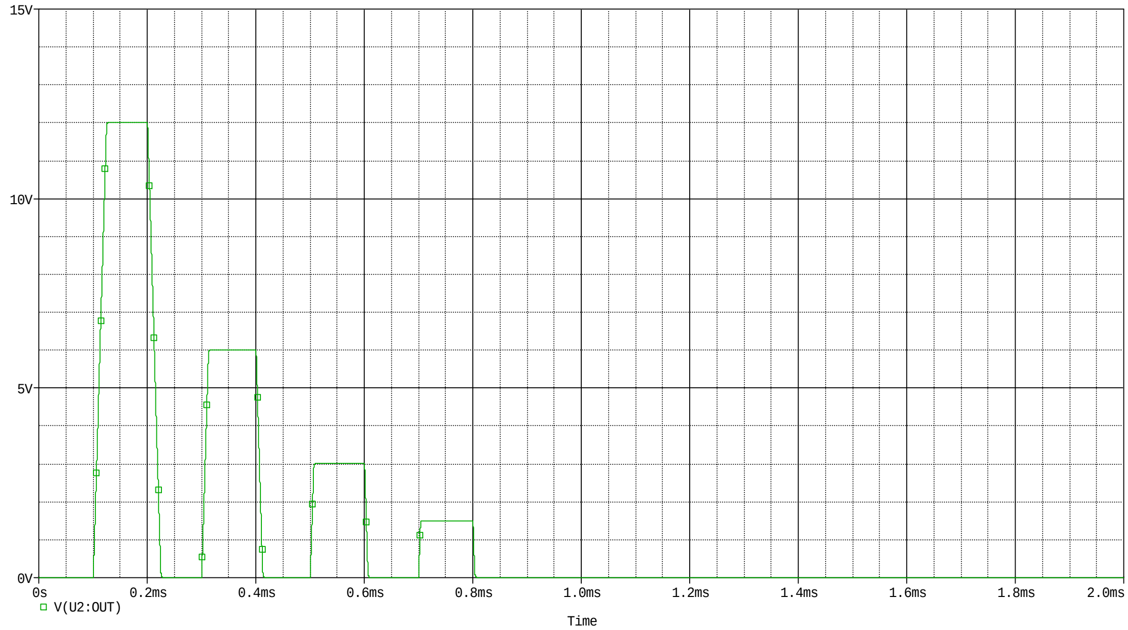


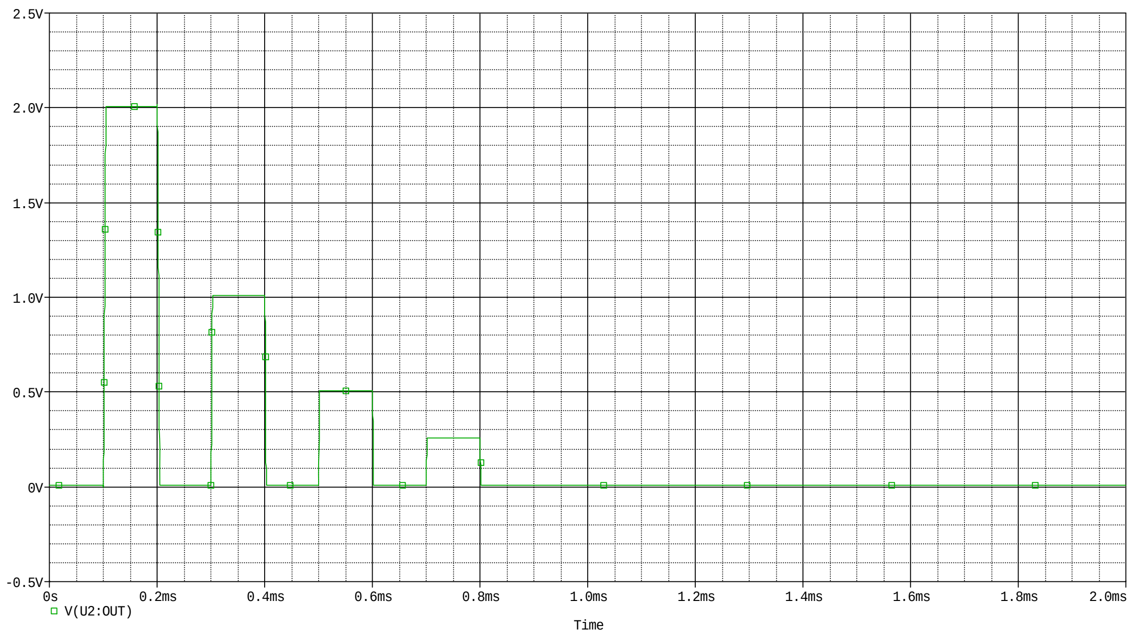
Which of the plots on the next two pages shows the correct voltages observed by an oscilloscope across the output? (Circle the correct plot and explain your answer.)

If the voltage sources represent the 0 and 5V logical levels of a digital circuit, what does the output of this circuit give us?


5.0V
4.0V
3.0V
2.0V
1.0V
0V
0s
0.2ms
0.4ms
0.6ms
0.8ms
1.0ms
1.2ms
1.4ms
1.6ms
1.8ms
2.0ms
V(U2:OUT)
Time

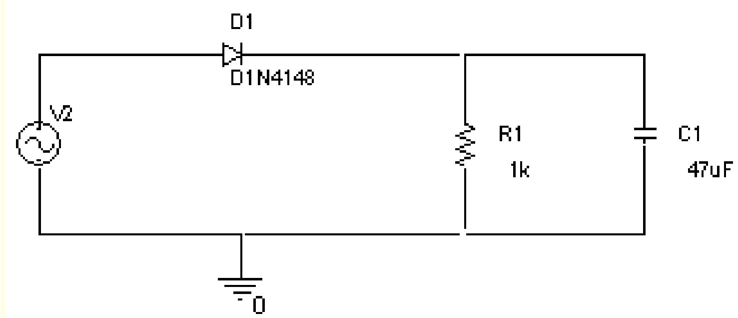

10V
8V
6V
4V
2V
0V
0s
0.2ms
0.4ms
0.6ms
0.8ms
1.0ms
1.2ms
1.4ms
1.6ms
1.8ms
2.0ms
V(U2:OUT)
Time


15V
10V
5V
0V
0s
0.2ms
0.4ms
0.6ms
0.8ms
1.0ms
1.2ms
1.4ms
1.6ms
1.8ms
2.0ms
V(U2:OUT)
Time


2.5V
2.0V
1.5V
1.0V
0.5V
0V
-0.5V
0s
0.2ms
0.4ms
0.6ms
0.8ms
1.0ms
1.2ms
1.4ms
1.6ms
1.8ms
2.0ms
V(U2:OUT)
Time

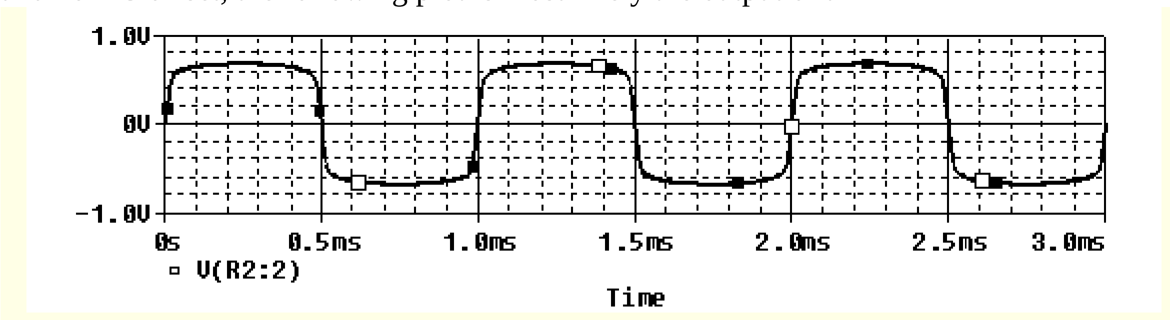
Short Quiz 24:

1. The following circuit is called a



a. half-wave rectifier
b. full-wave rectifier
c. voltage limiter
d. half-wave rectifier with smoothing

2. Assuming the input voltage is a sine wave with an amplitude of 5V, frequency of 1kHz and no DC offset, the following plot is most likely the output of a

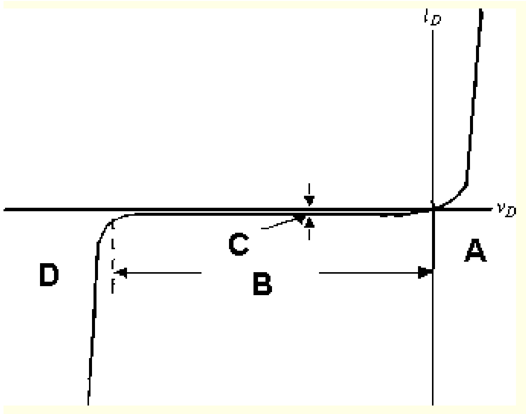


a. voltage limiter
b. half-wave rectifier
c. half-wave rectifier with smoothing
d. full-wave rectifier

3. In the following equation, $i_D = I_s\left(e^{-\frac{v_D}{nV_T}} - 1\right)$, what does I_s stand for?

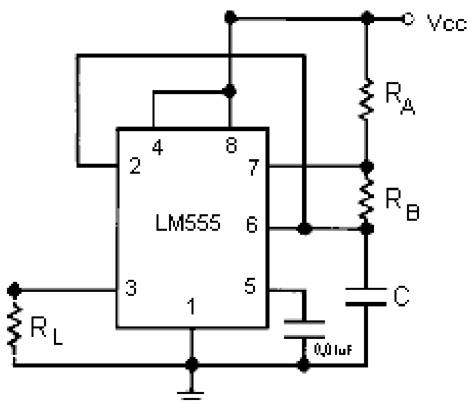
a. the voltage across the diode
b. the thermal voltage
c. the current through the diode
d. a parameter dependent on diode construction usually between 1 and 2
e. the saturation current of the diode

4. In the following picture of the V-I characteristic curve of a diode, the region D is called



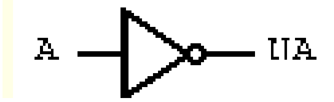
a. the saturation current
b. the reverse bias region
c. the forward bias region
d. the breakdown region

5. What is the correct form of the equation for the period (T) of the astable multivibrator pictured below?



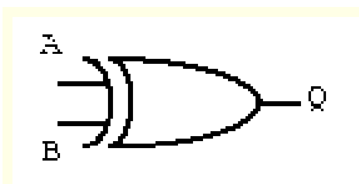
a. $T=0.693(R_A+R_B)C$
b. $T=0.693(R_B)C$
c. $T=(R_A+2R_B)$
d. $T=1.44(R_A+2R_B)C$
e. $T=0.693(R_A+2R_B)C$

6. What is the name for the following gate?



a. NOT
b. XOR
c. XNOR

7. What is the truth table for the following gate?



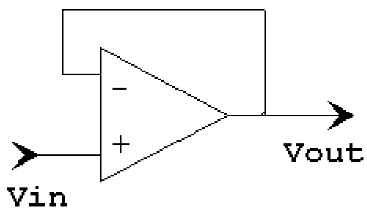
A	B	Q
0	0	0
0	1	1
1	0	1
1	1	0

A	B	Q
0	0	1
0	1	0
1	0	0
1	1	1

A	Q
0	1
1	0

Short Quiz 25:

1. What is the transfer function (V_{out}/V_{in}) for the following circuit?



a. $\frac{V_{out}}{V_{in}} = -\frac{R_f}{R_i}$

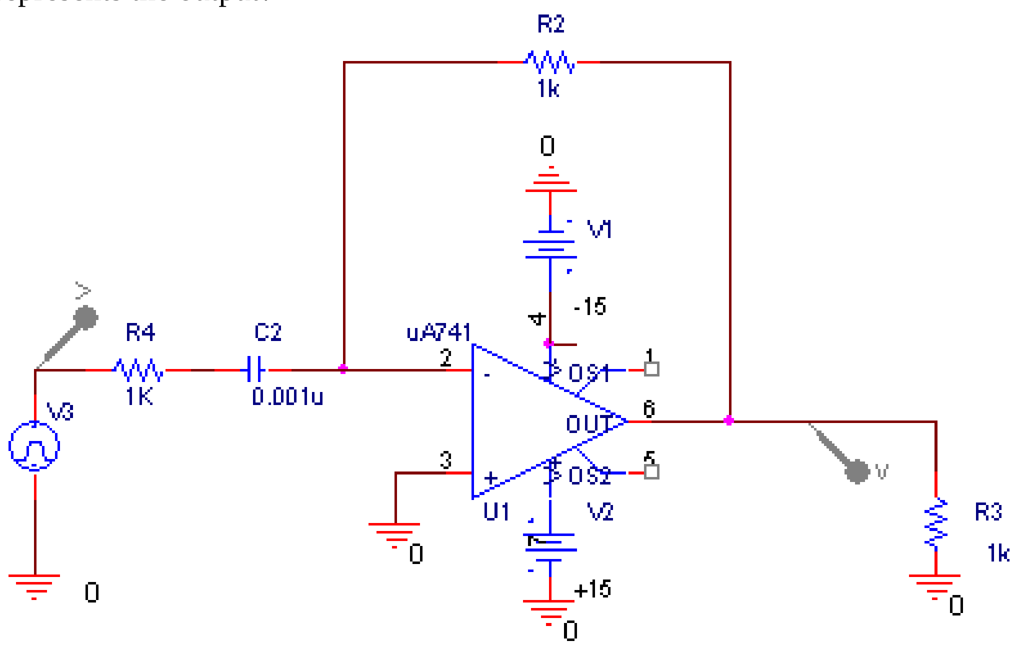
b. $\frac{V_{out}}{V_{in}} = -\frac{1}{j\omega R_i C}$

c. $\frac{V_{out}}{V_{in}} = -R_f\left(\frac{V_1}{R_1} + \frac{V_2}{R_2}\right)$

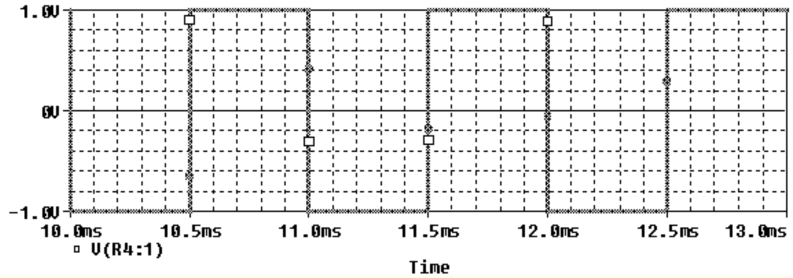
d. $\frac{V_{out}}{V_{in}} = -j\omega R_f C$

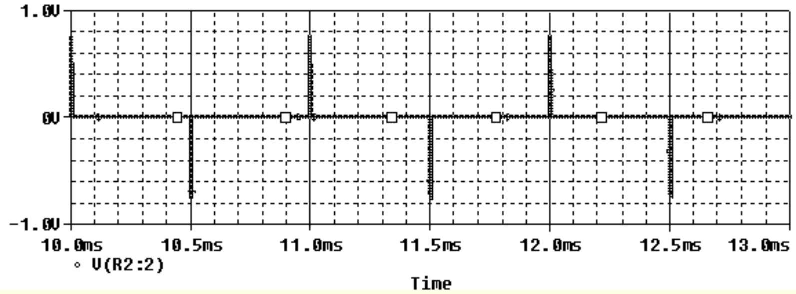
e. $\frac{V_{out}}{V_{in}} = 1$

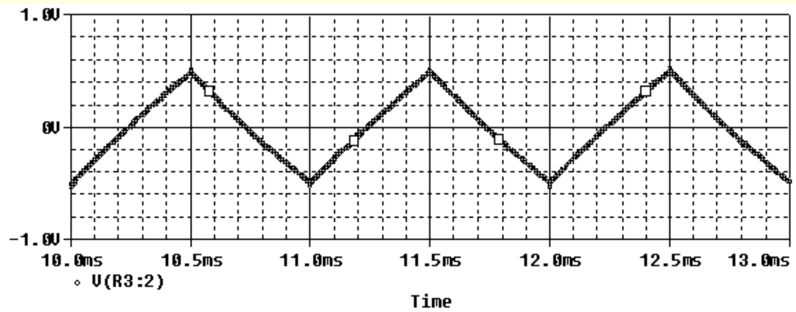
2. Given the following op amp configuration and the input shown, which picture below represents the output?

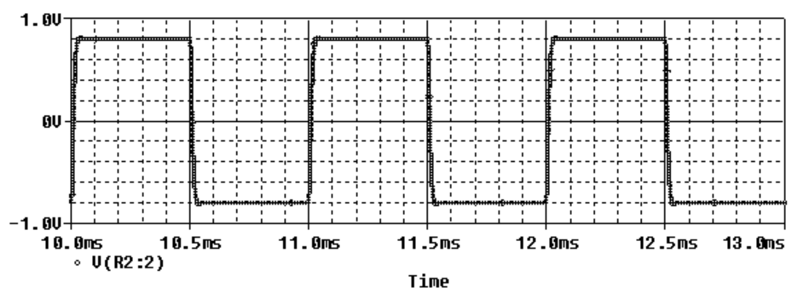


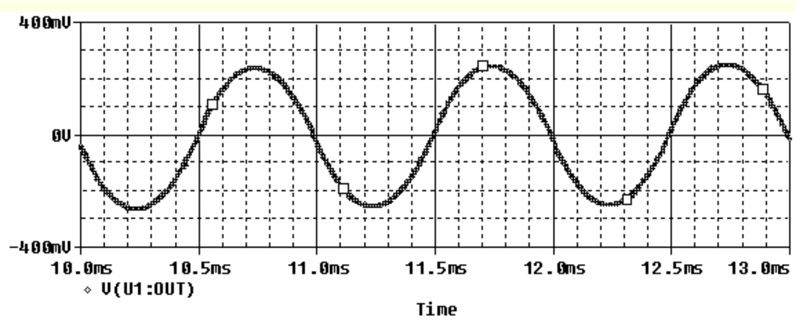
Input:


1.0V
0V
-1.0V
10.0ms
10.5ms
11.0ms
11.5ms
12.0ms
12.5ms
13.0ms
V(R4:1)
Time

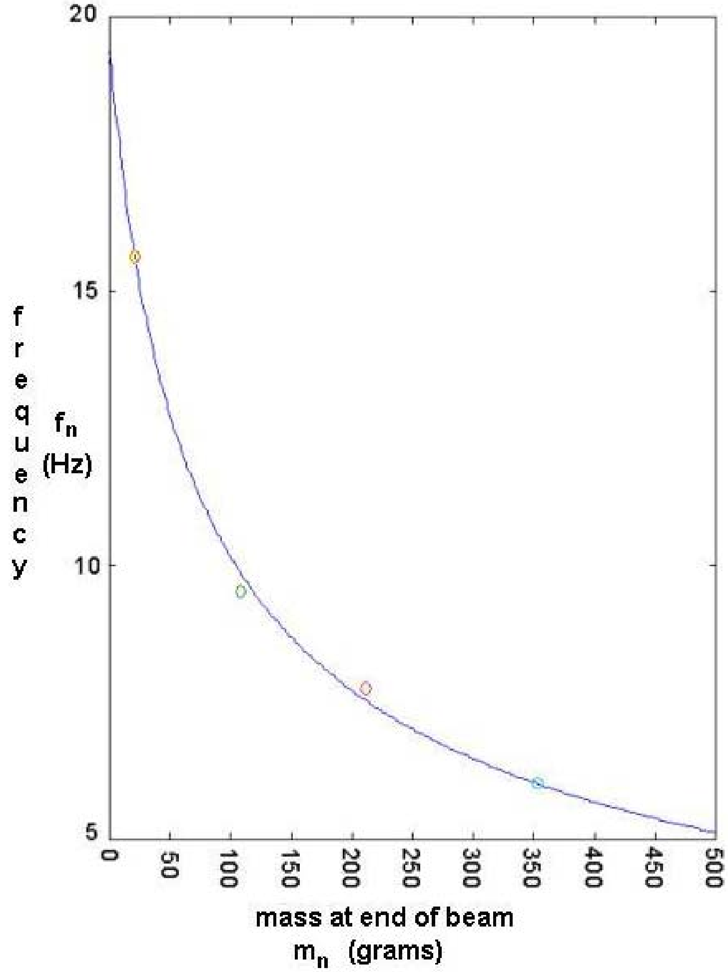

1.0V
0V
-1.0V
10.0ms
10.5ms
11.0ms
11.5ms
12.0ms
12.5ms
13.0ms
V(R2:2)
Time


1.0V
0V
-1.0V
10.0ms
10.5ms
11.0ms
11.5ms
12.0ms
12.5ms
13.0ms
V(R3:2)
Time


1.0V
0V
-1.0V
10.0ms
10.5ms
11.0ms
11.5ms
12.0ms
12.5ms
13.0ms
V(R2:2)
Time

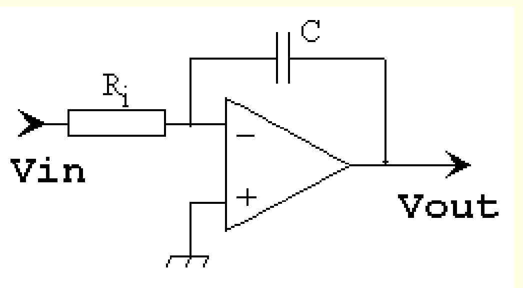

400mV
0V
-400mV
10.0ms
10.5ms
11.0ms
11.5ms
12.0ms
12.5ms
13.0ms
V(U1:OUT)
Time

3. The plot shows the behavior of an oscillating cantilever beam with a variety of different masses added at the end of the end. Use the plot to estimate the resonant frequency of the beam with no load at all at the end.



a. 19 Hertz
b. 16 Hertz
c. 9 Hertz
d. 7.5 Hertz
e. 6 Hertz
f. 5 Hertz

4. The following diagram is a picture of which type of op-amp configuration?



a. voltage follower
b. weighted adder
c. inverting amplifier
d. ideal differentiator
e. ideal integrator