* For which of the following circuit elements does the phase of the voltage across the element lead the phase of the current flowing through it by 90 degrees?
  + **Answer: Inductors**
* Which of the following is NOT true for Thevenin’s and Norton’s equivalent circuits ?

1. The Thevenin’s equivalent resistance is equal to the Norton’s equivalent resistance
2. The Thevenin’s equivalent voltage is the output voltage with an open circuit at the output
3. The Norton’s equivalent current is the output current with a short circuit at the output
4. **None of these**
5. The Thevenin’s equivalent voltage is equal to the Norton’s equivalent current multiplied by the Thevenin’s equivalent resistance

* If at t=0 the voltage applied across an ideal current source is suddenly increased, then the current flowing through the source will

1. Increase more slowly than the voltage
2. None of these
3. Increase at the same rate as the voltage
4. Increase more quickly than the voltage
5. **Stay constant and not increase**

* Capacitors in series can be combined to find the total equivalent capacitance by taking the reciprocal of the sum of the reciprocals of each capacitance

**Answer: True**

* The Thevenin’s equivalent voltage for a circuit is found by measuring the open circuit output voltage of the circuit

**Answer: True**

* If a voltage source is applied across two resistors in parallel, both resistors will have the same voltage across them

**Answer: True**

* If a current source is applied to two resistors in parallel, R1 and R2, and more current flows through R1 than through R2, then

**Answer: R1 has a lower resistance than R2**

* If a circuit has 2 nodes and 3 loops in it, then

**Answer: Mesh analysis will require solving more equations than Nodal analysis**

* Resistors in parallel can be combined to find the total equivalent resistance by taking the reciprocal of the sum of the reciprocals of each resistance

**Answer:True**

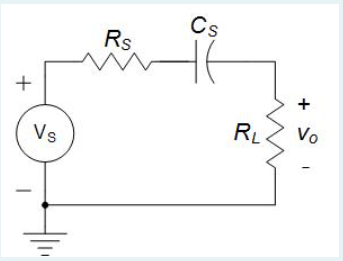
* The Norton’s equivalent resistance for a circuit is found by measuring the resistance looking into the output terminals of the circuit while all dependent voltage and current sources are set equal to zero

**Answer: False**

* If a voltage source is applied across two resistors in series, the one with the higher resistance will have a larger current flowing through it than the other resistor

**Answer:False**

* Question:

****

**The circuit shown has a high pass response**

* For an amplifier with a single-time constant low pass response, the phase of the gain increases at +45 degrees/decade as the frequency is increased from one decade below the corner frequency to one decade above the corner frequency.

**Answer: False**

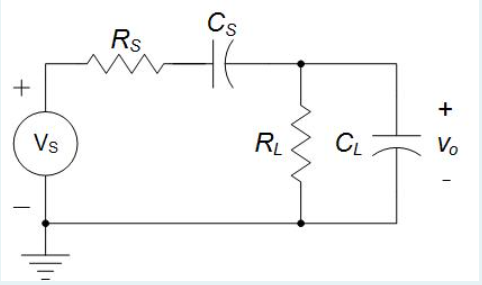
For an amplifier with a single-time constant low pass response, the phase of the gain decreases at -45 degrees/decade as the frequency is increased from one decade below the corner frequency to one decade above the corner frequency.

**TRUE**

* A transresistance amplifier has

1. **current input and a voltage output**
2. A current input and a current output
3. A voltage input and a voltage output
4. A voltage input and a current output
5. None of these

* Question:

****

**The circuit shown has a bandpass response**

* The gain for a current amplifier has units of A/V

**Answer: False**

* Differentiators built with opamps use a capacitor between the negative opamp input and the input source.

**Answer: True**

Differentiators built with opamps use a capacitor between the negative opamp input and the output.

**FALSE**

* Non-ideal effects in real integrated circuit operational amplifiers will NOT cause :

**Answer: The difference in voltage between the + and – inputs to decrease as the signal frequency increases**

If two opamps are cascaded to create a summing amplifier with both positive and negative inputs, the voltage gain for one input does not depend on the voltage gain for any other input.

**Answer: True**

Which of the following is NOT true for ideal opamps?

a.They can output voltages above and below the power supply voltages

**b.They only amplify the average in voltage between the + and – inputs**

c.They can amplify input frequencies up to infinity

d.They can output an infinite amount of current

e.None of these

The output voltage of an ideal opamp is limited to the power supply voltages it uses.

**Answer: False**

The closed-loop gain of an inverting amplifier built using resistors to provide negative feedback around an integrated circuit opamp is slightly less than minus one times the ratio of the resistors used.

**Answer: True**

The negative input terminal of an opamp connected in a non-inverting amplifier configuration is at almost the same voltage as the positive input terminal of the opamp because of negative feedback

**Answer: True**

Non-ideal effects in real integrated circuit operational amplifiers can cause

A. The difference in voltage between the + and – inputs to increase as the signal frequency increases

B. The output voltage to be greater than zero when the voltage between the + and – inputs is zero

C. The difference in voltage between the + and – inputs to be greater than zero

**D. All of these (ANSWER)**

E. The input currents into the + and – inputs to be greater than zero

Non-ideal effects in real integrated circuit operational amplifiers can cause:

a.All of these

b.The input currents into the + and – inputs to be zero

c.The difference in voltage between the + and – inputs to be zero

**d.The output voltage to be greater than zero when the voltage between the + and – inputs is zero**

e.The difference in voltage between the + and – inputs to decrease as the signal frequency increases

An ideal opamp has a zero common-mode rejection ratio

**Answer: False**

Actual integrated circuit opamps typically have a high voltage gain at low frequencies, which decreases to lower values as frequency increases.

**Answer: True**

Above the -3dB frequency of an integrated circuit opamp, the open-loop voltage gain will

A. Decrease with decreasing frequency

B. All of these

C. Change by 6dB if the frequency changes by an decade

**D. Change by 20dB if the frequency changes by a decade (ANSWER)**

E. Be equal to the frequency of the signal divided by the unity gain frequency

To provide the largest output voltage swing possible without clipping, the bias point for the output is typically chosen equal to the middle of the power supply range

**Answer: True**

If at t=0 a constant voltage is applied across an ideal inductor which initially has zero current flowing through it, then the current in the inductor will :

a.Grow at an increasing rate as time passes

b.None of these

c.Stay at zero amperes and not change

d.Grow at first, but then reach a constant value

**e.Grow at a constant rate**

If a voltage source is applied across two resistors in parallel, R1 and R2, and the same current flows through both R1 and R2, then :

a.No way to determine

b.None of these

c.R1 has a higher resistance than R2

d.R1 has a lower resistance than R2

**e.R1 has the same resistance as R2**

As the current through an ideal voltage source varies :

a.The voltage across the source increases as the current through it increases

b.The voltage across the source increases as the current through it decreases

**c.None of these**

d.All of these

e.The voltage across the source decreases as the current through it decreases

The current flowing through a resistor is equal to the value of the voltage across it divided by the resistance.

**Answer: True**

The Norton’s equivalent resistance for a circuit is found by measuring the resistance looking into the output terminals of the circuit while all independent voltage and current sources are set equal to zero.

**Answer: True**

The Thevenin’s equivalent voltage for a circuit is found by measuring the short circuit output voltage of the circuit

**Answer: False**

If a voltage source is applied across two resistors in series, R1 and R2, and the same voltage appears across both R1 and R2, then :

a.No way to determine

b.R1 has a higher resistance than R2

c.None of these

**d.R1 has the same resistance as R2**

e.R1 has a lower resistance than R2

If the frequency of a constant AC current source applied to an ideal resistor is increased, then the voltage across the resistor will

a.No way to determine

**b.Stay constant**

c.Decrease

d.None of these

e.Increase

In the phrase “ELI the ICE man” the letter I stands for :

a.Voltage

b.Energy

c.Power

d.None of these

**e.Current**

Capacitors in parallel can be combined to find the total equivalent capacitance by adding the capacitances together

**Answer: True**

If a current source is applied to two resistors in parallel, the one with the higher resistance will have a larger voltage across it than the other resistor

**Answer: False**

If a current source is applied to two resistors in series, the one with the higher resistance will have a smaller voltage across it than the other resistor

**Answer: False**

If the frequency of a constant AC voltage source applied across an ideal inductor is decreased, then the current flowing through the inductor will :

**a.Increase**

b.Stay constant

c.No way to determine

d.Decrease

e.None of these

If the frequency of a constant AC voltage source applied across an ideal capacitor is increased, then the current flowing through the capacitor will

a.Decrease

b.Stay constant

**c.Increase**

d.No way to determine

e.None of these

If the frequency of a constant AC current source applied to an ideal inductor is decreased, then the voltage across the inductor will

a.No way to determine

b.Stay constant

c.Increase

**d.Decrease**

e.None of these

The Norton’s equivalent current for a circuit is equal to the Thevenin’s equivalent voltage divided by the Thevenin’s equivalent resistance for the same circuit

**Answer: True**

The Norton’s equivalent current for a circuit is equal to the Thevenin’s equivalent voltage multiplied by the Thevenin’s equivalent resistance for the same circuit.

**Answer: False**

The power dissipated by an ideal inductor is always equal to zero

**Answer: True**

Mesh analysis is easier to perform than Nodal analysis for circuits that have fewer loops than nodes

**Answer: True**

The gain for a current amplifier has units of

a.Amps per Volt

b.Volts per Amp

c.None of these

d.Volts per Volt

**e.Amps per Amp**

The gain for a transresistance amplifier has units of

a.Volts per Volt

b.None of these

c.Amps per Amp

d.Amps per Volt

**e.Volts per Amp**

Which of the following is true regarding the effect of a single pole on an amplifier’s transfer function?

a.The magnitude of the transfer function increases by +20dB/decade as frequency is increased above the pole frequency

b.None of these

**c.The phase of the transfer function decreases by -45 degrees/decade from one decade below the pole frequency to one decade above it**

d.The most phase shift that is possible from a single pole is +90 degrees

e.The magnitude of the transfer function increases by +6dB/octave as frequency is increased above the pole frequency

Which of the following is true for an AC coupled amplifier with a single high frequency pole?

**a.Above the upper corner frequency, the magnitude of the gain will roll off at -20dB/decade as frequency increases**

b.Above the lower corner frequency, the phase of the gain will increase at +45 degrees/decade for one decade as frequency increases

c.All of these

d.Above the lower corner frequency, the magnitude of the gain will roll off at -20dB/decade as frequency increases

e.Below the upper corner frequency, the phase of the gain will decrease at -45 degrees/decade for one decade as frequency decreases

An amplifier which needs a low input resistance and a low output resistance is

**a.A transresistance amplifier**

b.A voltage amplifier

c.None of these

d.A current amplifier

e.A transconductance amplifier

Which of the following is one of the ideal opamp assumptions?

a.Ideal opamps have infinite gain for common-mode input signals

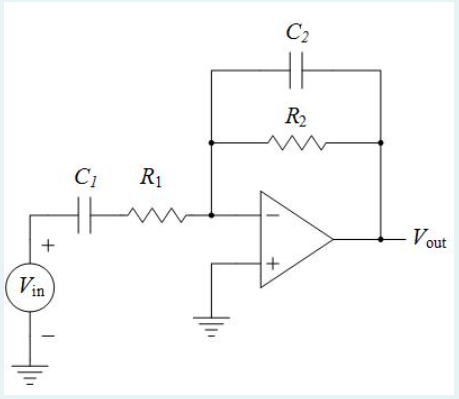
b.All of these

c.Ideal opamps have zero gain for differential-mode input signals

**d.Ideal opamps have zero output resistance**

e.Ideal opamps have zero input resistance

The active filter shown has



a.Impossible to determine

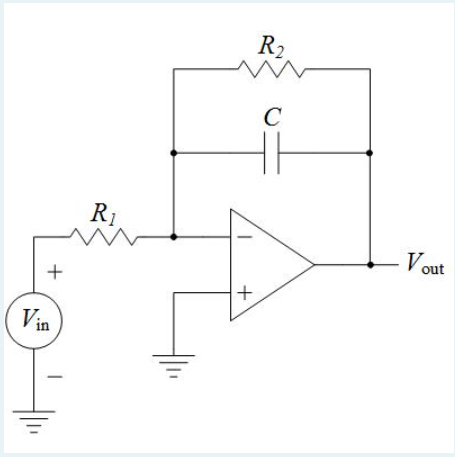
b.High pass response

c.Low pass response

d.None of these

**e.Bandpass response**

The active filter shown has a



a.Impossible to determine

**b.Low pass response**

c.Bandpass response

d.High pass response

e.None of these

Which of the following is true for actual integrated circuit opamps?

a. They trade away extra open-loop gain to achieve more accurate closed-loop gain values

b. They are almost always used to build amplifiers employing negative feedback

**c. All of these**

d. Their open-loop gain decreases as frequency increases

e. They depend on the ratio of resistors to set accurate closed-loop gain values

Which of the following is true for actual integrated circuit opamps?

a.None of these

b.Their open-loop gain decreases as frequency decreases

**c.They trade away extra open-loop gain to achieve more accurate closed-loop gain values**

d.They are almost always used to build amplifiers employing positive feedback

e.They depend on accurate resistor values to set accurate closed-loop gain values

Which of the following is true for actual integrated circuit opamps?

**a.They are almost always used to build amplifiers employing negative feedback**

b.They trade away extra closed-loop gain to achieve more accurate open-loop gain values

c.They depend on accurate resistor values to set accurate closed-loop gain values

d.All of these

e.Their open-loop gain decreases as frequency decreases

Which of the following is true for actual integrated circuit opamps?

a. They trade away extra closed-loop gain to achieve more accurate open-loop gain values

**b. They depend on the ratio of resistors to set accurate closed-loop gain values**

c. None of these

d. Their open-loop gain decreases as frequency decreases

e. They are almost always used to build amplifiers employing positive feedback

* Errors in the output voltage of an opamp can occur if the input signal changes too quickly due to :

1. Limited supply voltages
2. **None of these**
3. Limited voltage gain
4. Limited output resistance
5. Limited input resistance

* Errors in the output voltage of an opamp can occur if the input signal changes too quickly due to:

1. Limited supply voltages
2. Limited voltage gain
3. None of these
4. Limited input resistance
5. **Limited slew rate**

* If an amplifier uses a voltage input signal and a current output signal, then it is a transconductance amplifier.

**Answer: TRUE**

* If an amplifier uses a current input signal and a current output signal, then it is a current amplifier.

**Answer: TRUE**

* For an AC coupled amplifier with a single high frequency pole, the magnitude of the gain decreases at -20dB/decade as the frequency is increased above the upper corner frequency.

**Answer: TRUE**

* For an AC coupled amplifier, the phase of the gain approaches 0 degrees for frequencies in the midband which are well below the upper corner frequency but still well above the lower corner frequency.

**Answer: TRUE**

* For an AC coupled amplifier, the phase of the gain approaches +90 degrees for frequencies in the midband which are well below the upper corner frequency but still well above the lower corner frequency.

**Answer: FALSE**

For an AC coupled amplifier, the phase of the gain approaches 0 degrees for frequencies in the midband which are well above the lower corner frequency but still well below the upper corner frequency.

**TRUE**

A transconductance amplifier needs a high input resistance and a high output resistance.

**Answer: True**

A transresistance amplifier needs a low input resistance and a low output resistance.

**Answer: True**

The CMRR for an opamp typically depends on how well the devices inside the opamp match to each other.

**Answer: True**

The closed-loop gain of a unity gain buffer built using negative feedback around an ideal opamp is always slightly less than one.

**Answer: False**

The output voltage of an integrated circuit opamp will clip if the desired output voltage divided by the load resistance is less than the minimum output current that the opamp can supply

**Answer: False**

If two opamps are cascaded to create a summing amplifier with both positive and negative inputs, the voltage gain for one input also depends on the voltage gain for the other inputs.

**Answer: False**

The output voltage of an integrated circuit opamp will clip if the input voltage multiplied by the open-loop gain of the opamp exceeds the power supply voltage.

**Answer: False**

If an amplifier uses a current input and a voltage output, then it is :

a.A voltage amplifier

b.None of these

**c.A transresistance amplifier**

d.A current amplifier

e.A transconductance amplifier

A transconductance amplifier has :

a.A current input and a current output

b.None of these

c.A current input and a voltage output

**d.A voltage input and a current output**

e.A voltage input and a voltage output

Which of the following is true for an AC coupled amplifier with a single high frequency pole?

a. Above the lower corner frequency, the phase of the gain will increase at +45 degrees/decade for one decade as frequency increases

**b. Above the upper corner frequency, the phase of the gain will decrease at -45 degrees/decade for one decade as frequency increases**

c. All of these

d. Above the lower corner frequency, the magnitude of the gain will roll off at -20dB/decade as frequency increases

e. Below the upper corner frequency, the magnitude of the gain will roll off at -20dB/decade as frequency decreases

Which of the following is true for an AC coupled amplifier with a single high frequency pole?

a. Below the upper corner frequency, the phase of the gain will decrease at -45 degrees/decade for one decade as frequency decreases

b. None of these

**c. Below the lower corner frequency, the phase of the gain will increase at +45 degrees/decade for one decade as frequency decreases**

d. Below the upper corner frequency, the magnitude of the gain will roll off at -20dB/decade as frequency decreases

e. Above the lower corner frequency, the magnitude of the gain will roll off at -20dB/decade as frequency increases

Which of the following is true for an AC coupled amplifier with a single high frequency pole?

**a. None of these**

b. Below the upper corner frequency, the magnitude of the gain will roll off at -20dB/decade as frequency decreases

c. Above the lower corner frequency, the phase of the gain will increase at +45 degrees/decade for one decade as frequency increases

d. Above the lower corner frequency, the magnitude of the gain will roll off at -20dB/decade as frequency increases

e. Below the upper corner frequency, the phase of the gain will decrease at -45 degrees/decade for one decade as frequency decreases

Which of the following is true regarding the effect of a single pole on an amplifier’s transfer function?

a.The most phase shift that is possible from a single pole is +90 degrees

**b.The magnitude of the transfer function decreases by -20dB/decade as frequency is increased above the pole frequency**

c.The phase of the transfer function increases by +45 degrees/decade from one decade below the pole frequency to one decade above it

d.The magnitude of the transfer function increases by +6dB/octave as frequency is increased above the pole frequency

e.None of these

In order to minimize signal loss, a transconductance amplifier needs

**a.A high input resistance and a high output resistance**

b.A low input resistance and a low output resistance

c.A high input resistance and a low output resistance

d.A low input resistance and a high output resistance

e.None of these

Which of the following is true for an inverting summing amplifier built using a single opamp?

a. The gain for each input varies as the resistors connected to the other inputs change

**b. The gain for each input will go up as the input resistance for that input goes down**

c. The gain for each input depends only on the value of the resistor connected to that input

d. The gain for each input can be varied independently by changing the resistor connected in feedback

e. All of these

Which of the following is true for an inverting summing amplifier built using a single opamp?

a. The gain for all inputs can be varied by changing the resistor connected in feedback

b. The gain for each input can be varied without changing the gain for any other input

c. The gain for each input can be varied by changing the resistor connected to that input

**d. All of these**

e. The gain for each input will go up as the input resistance for that input goes down

Which of the following is true for an inverting summing amplifier built using a single opamp?

a. The gain for each input depends only on the value of the resistor connected to that input

b. None of these

c. The gain for each input can be varied independently by changing the resistor connected in feedback

d. The gain for each input will go up as the input resistance for that input goes up

**e. The gain for each input can be varied without changing the gain for any other input**

Which of the following is true for an opamp connected as an active filter?

a.Replacing both the input and feedback resistors in an inverting amp with capacitors will increase both the low and high frequency gains

b.None of these

c.Replacing the feedback resistor in an inverting amp with a capacitor will increase the high frequency gain

**d.The ideal opamp assumptions will still be valid as long as the loop gain is high enough**

e.Replacing the input resistor in an inverting amp with a capacitor will increase the low frequency gain

Which of the following is true for an opamp connected as an active filter?

a.The ideal opamp assumptions will still be valid as long as the loop gain is high enough

b.Replacing the input resistor in an inverting amp with a capacitor will increase the high frequency gain

c.Replacing the feedback resistor in an inverting amp with a capacitor will increase the low frequency gain

d.Replacing both the input and feedback resistors in an inverting amp with capacitors will NOT increase both the low and high frequency gains

**e.All of these**

Which of the following is one of the ideal opamp assumptions?

a.Ideal opamps have infinite output resistance

b.Ideal opamps have zero input resistance

c.None of these

d.Ideal opamps have zero gain for differential-mode input signals

**e.Ideal opamps have zero gain for common-mode input signals**

Which of the following is one of the ideal opamp assumptions?

a. Ideal opamps have zero gain for common-mode input signals

b. Ideal opamps have infinite gain for differential-mode input signals

c. Ideal opamps have zero output resistance

d. Ideal opamps have infinite input resistance

**e. All of these**

Above the -3dB frequency of an integrated circuit opamp, the open-loop voltage gain will :

a. Decrease with decreasing frequency

b. Change by 20dB if the frequency changes by a octave

c. None of these

d. Be equal to the frequency of the signal divided by the unity gain frequency

**e. Change by 6dB if the frequency changes by an octave**

Above the -3dB frequency of an integrated circuit opamp, the open-loop voltage gain will :

a.Change by 6dB if the frequency changes by an decade

**b.Be equal to the unity gain frequency divided by the frequency of the signal**

c.Change by 20dB if the frequency changes by a octave

d.All of these

e.Decrease with decreasing frequency

Above the -3dB frequency of an integrated circuit opamp, the open-loop voltage gain will :

a.Be equal to the frequency of the signal divided by the unity gain frequency

b.Change by 20dB if the frequency changes by a octave

**c.Decrease with increasing frequency**

d.None of these

e.Change by 6dB if the frequency changes by an decade

Above the -3dB frequency of an integrated circuit opamp, the open-loop voltage gain will :

a.Change by 20dB if the frequency changes by a decade

b.Decrease with increasing frequency

**c.All of these**

d.Be equal to the unity gain frequency divided by the frequency of the signal

e.Change by 6dB if the frequency changes by an octave

The gain for a transconductance amplifier has units of V/V

**Answer: False**

* For a DC coupled amplifier with a single high frequency pole, the phase of the gain approaches -90 degrees at frequencies well above the upper corner frequency.

**Answer: True**

* For an amplifier with a single-time constant high pass response, the magnitude of the gain increases at +6dB/octave as the frequency is decreased below the corner frequency.

**Answer: False**

* For an amplifier with a single-time constant high pass response, the magnitude of the gain decreases at -20dB/decade as the frequency is decreased below the corner frequency.

**Answer: TRUE**

* A current amplifier needs a low input resistance and a low output resistance.

**Answer: False**

* A voltage amplifier needs a high input resistance and a low output resistance

**Answer: True**

* The differential input resistance for a Difference amplifier is equal to twice the value of the input resistance seen by either the + or - input signals.

**Answer: True**

* An ideal opamp has a slew rate of 1000 V/us.

**Answer: True**

* Opamp differentiators are very sensitive to high frequency noise.

**Answer: True**

* An ideal opamp has infinite differential-mode voltage gain.

**Answer: True**

* An ideal opamp has a zero common-mode rejection ratio.

**Answer: False**

* If an amplifier uses a voltage input and a voltage output, then it is :

1. A current amplifier
2. None of these
3. A transresistance amplifier
4. A transconductance amplifier
5. **A voltage amplifier**

* For an amplifier with a single high frequency pole, which of the following is true?

1. None of these
2. **At this pole frequency, the magnitude of the gain will be -3dB below the midband value**
3. Above this pole frequency, the magnitude of the gain will increase at +20dB/decade as frequency increases
4. Above this pole frequency, the phase of the gain will increase at +45 degrees/decade as frequency increases
5. At this pole frequency, the phase of the gain will be +45 degrees above the midband value

For an amplifier with a single high frequency pole, which of the following is true?

a.None of these

b.At this pole frequency, the magnitude of the gain will be +3dB above the midband value

c.At this pole frequency, the phase of the gain will be +45 degrees above the midband value

**d.Above this pole frequency, the magnitude of the gain will roll off at -20dB/decade as frequency increases**

e.Above this pole frequency, the phase of the gain will increase at +45 degrees/decade as frequency increases

If an amplifier needs a Thevenin’s equivalent circuit to model it’s output, then it is :

a.Either a current amplifier or a transresistance amplifier

b.Either a current amplifier or a transconductance amplifier

c.Either a voltage amplifier or a transconductance amplifier

d.None of these

**e.Either a voltage amplifier or a transresistance amplifier**

Non-ideal effects in real integrated circuit operational amplifiers can cause :

**a.All of these**

b.The difference in voltage between the + and – inputs to increase as the signal frequency increases

c.The difference in voltage between the + and – inputs to be greater than zero

d.The input currents into the + and – inputs to be greater than zero

e.The output voltage to be greater than zero when the voltage between the + and – inputs is zero

If an instrumentation amplifier has a connection between the resistors in the first stage and ground, then it will suffer from which of the following disadvantages?

a.The two signal paths in the first stage will be less symmetric

b.Varying the gain of the first stage will require changing two resistors instead of one

**c.All of these**

d.The two amplifiers in first stage will be more difficult to match accurately

e.In the first stage the common-mode gain will be just as large as the differential-mode gain

If an instrumentation amplifier has a connection between the resistors in the first stage and ground, then it will suffer from which of the following disadvantages?

**a. The two amplifiers in first stage will be more difficult to match accurately**

b. In the first stage the common-mode gain will be smaller than the differential-mode gain

c. The two signal paths in the first stage will be very symmetric

d. All of these

e. Varying the gain of the first stage will require changing the value of a resistor

Which of the following is NOT true for an inverting summing amplifier built using a single opamp?

a.The gain for each input will go up as the input resistance for that input goes down

**b.The gain for each input depends only on the value of the resistor connected to that input**

c.The gain for each input can be varied without changing the gain for any other input

d.The gain for all inputs can be varied by changing the resistor connected in feedback

e.None of these

Transresistance amplifiers use a current input signal and a voltage output signal.

**Answer: True**

The phase shift from a pole asymptotically approaches -90 degrees at frequencies well above the pole frequency, and reaches -90 degrees 3 decades above the pole frequency.

**Answer: False**

The phase shift from a pole asymptotically approaches 0 degrees at frequencies well below the pole frequency, but never completely reaches 0 degrees.

**Answer: True**

The phase shift from a pole is -45 degrees/decade as the frequency is increased from one decade below the corner frequency to one decade above the corner frequency.

**Anser: True**

A voltage amplifier needs a high input resistance and a high output resistance.

**Answer: False**

If an amplifier needs a high input resistance and a high output resistance, then it is a transconductance amplifier.

**Answer: True**

An ideal opamp has a bandwidth of 1 GHz.

**Answer: False**

An ideal opamp has an infinite bandwidth.

**Answer: True**

The gain of a single-pole active filter (one which uses a single RC time constant) rolls off as frequency as varied at a rate of -6 dB per decade.

**Answer: False**

The differential input resistance for a Difference amplifier is equal to the same value as the input resistance seen by either the + or - input signals.

**Answer: False**

The output voltage of an integrated circuit opamp will clip if the desired output voltage divided by the load resistance exceeds the maximum output current that the opamp can supply.

**Answer: True**

The gain for a transconductance amplifier has units of :

a.Volts per Volt

b.Volts per Amp

c.None of these

d.Amps per Amp

**e.Amps per Volt**

The gain for a transconductance amplifier has units of A/V.

**Answer: True**

If an amplifier uses a current input and a current output, then it is :

a.A transconductance amplifier

**b.A current amplifier**

c.A transresistance amplifier

d.None of these

e.A voltage amplifier

For an amplifier with a single low frequency pole, which of the following is true?

a. Below this pole frequency, the magnitude of the gain will increase at +20dB/decade as frequency increases

b. At this pole frequency, the phase of the gain will be +45 degrees above the midband value

**c. All of these**

d. Below this pole frequency, the phase of the gain will decrease at -45 degrees/decade as frequency increases

e. At this pole frequency, the magnitude of the gain will be -3dB below the midband value

For an amplifier with a single low frequency pole, which of the following is true?

a. All of these

b. Below this pole frequency, the phase of the gain will increase at +45 degrees/decade as frequency increases

c. At this pole frequency, the phase of the gain will be -45 degrees below the midband value

d. Below this pole frequency, the magnitude of the gain will roll off at -20dB/decade as frequency increases

**e. At this pole frequency, the magnitude of the gain will be -3dB below the midband value**

Which of the following is true for a DC coupled amplifier with a single high frequency pole?

**a. At this pole frequency, the magnitude of the gain will be -3dB below the midband value**

b. None of these

c. Below this pole frequency, the magnitude of the gain will roll off at -20dB/decade as frequency decreases

d. Above this pole frequency, the magnitude of the gain will be approximately constant

e. At this pole frequency, the phase of the gain will be +45 degrees above the midband value

Which of the following is true for a DC coupled amplifier with a single high frequency pole?

a. At this pole frequency, the magnitude of the gain will be +3dB above the midband value

b. Above this pole frequency, the magnitude of the gain will be approximately constant

c. None of these

**d. Above this pole frequency, the magnitude of the gain will roll off at -20dB/decade as frequency increases**

e. At this pole frequency, the phase of the gain will be +45 degrees above the midband value

Which of the following is true for a DC coupled amplifier with a single high frequency pole?

a.At this pole frequency, the phase of the gain will be +45 degrees above the midband value

b.Above this pole frequency, the magnitude of the gain will be approximately constant

c.Below this pole frequency, the magnitude of the gain will roll off at -20dB/decade as frequency decreases

d.At this pole frequency, the magnitude of the gain will be +3dB above the midband value

**e.None of these**

In order to minimize signal loss, a current amplifier needs :

a.**A low input resistance and a high output resistance**

b.A low input resistance and a low output resistance

c.A high input resistance and a high output resistance

d.None of these

e.A high input resistance and a low output resistance

In an instrumentation amplifier, if the connection between the resistors in the first stage and ground is removed then which of the following will improve?

a.The differential-mode gain

b.The output resistance

c.The input resistance

**d.The common-mode gain**

e.All of these

In an instrumentation amplifier, if the connection between the resistors in the first stage and ground is removed then which of the following will improve?

**a. The common-mode rejection ratio**

b. The output resistance

c. The input resistance

d. The bandwidth

e. All of these

Which of the following is NOT true for an ideal opamp?

a.The output voltage will change just as fast as the input changes

b.None of these

**c.The output voltage only changes slightly as the load resistance changes**

d.The current into the + and - inputs is zero

e.The voltage between the + and - inputs is zero

Which of the following is NOT true for actual integrated circuit opamps?

a.They are almost always used to build amplifiers employing negative feedback

**b.Their open-loop gain decreases as frequency decreases**

c.None of these

d.They depend on the ratio of resistors to set accurate closed-loop gain values

e.They trade away extra open-loop gain to achieve more accurate closed-loop gain values

If an amplifier uses a voltage input signal and a voltage output signal, then it is a voltage amplifier

**True**

For an amplifier with a single-time constant high pass response, the phase of the gain approaches -90 degrees at frequencies well below the corner frequency.

**False**

For an amplifier with a single-time constant high pass response, the phase of the gain approaches +90 degrees at frequencies well below the corner frequency

**True**

The model for a current amplifier uses a Norton’s equivalent circuit at it’s output.

**True**

The model for a voltage amplifier uses a Norton’s equivalent circuit at it’s output.

**FALSE**

The model for a voltage amplifier uses a Thevenin’s equivalent circuit at it’s output.

**Answer: TRUE**

If an amplifier needs a high input resistance and a low output resistance, then it is a voltage amplifier.

**True**

Ideal opamp integrators without an extra resistor in parallel with the capacitor have infinite gain at very high frequencies.

**False**

The CMRR for an opamp typically depends on how close the devices inside the opamp are to their ideal values.

**False**

How well a difference amplifier rejects the common-mode input depends on how accurate the values of the resistors used are compared to their ideal values.

**False**

The closed-loop gain of an inverting amplifier built using resistors to provide negative feedback around an integrated circuit opamp is exactly equal to minus one times the ratio of the resistors used.

**False**

The closed-loop gain of a non-inverting amplifier built using resistors to provide negative feedback around an opamp is equal to the ratio of the resistors used.

**False**

The closed-loop gain of a non-inverting amplifier built using resistors to provide negative feedback around an integrated circuit opamp is slightly less than one plus the ratio of the resistors used.

**TRUE**

The gain for a voltage amplifier has units of :

a.Volts per Amp

b.None of these

**c.Volts per Volt**

d.Amps per Amp

e.Amps per Volt

A voltage amplifier has :

a.A current input and a voltage output

b.A voltage input and a current output

**c.A voltage input and a voltage output**

d.None of these

e.A current input and a current output

An ideal opamp has an infinite slew rate.

**True**

Which of the following is true for an ideal opamp?

**a.All of these**

b.The output voltage doesn’t change at all as the load resistance changes

c.The voltage between the + and - inputs is zero

d.The output voltage will change just as fast as the input changes

e.The current into the + and - inputs is zero

Which of the following is true regarding the effect of a single pole on an amplifier’s transfer function?

**a.All of these**

b.The phase of the transfer function decreases by -45 degrees/decade from one decade below the pole frequency to one decade above it

c.The magnitude of the transfer function decreases by -6dB/octave as frequency is increased above the pole frequency

d.The magnitude of the transfer function decreases by -20dB/decade as frequency is increased above the pole frequency

e.The most phase shift that is possible from a single pole is -90 degrees

For an AC coupled amplifier with a single high frequency pole, the phase of the gain approaches -90 degrees at frequencies well above the upper corner frequency.

**Answer: True**

If an amplifier needs a high input resistance and a low output resistance, then it is a transresistance amplifier.

**Answer: False**

If an amplifier needs a low input resistance and a low output resistance, then it is a transresistance amplifier.

**Answer: True**

If an instrumentation amplifier has a connection between the resistors in the first stage and ground, then it will have a much higher common-mode gain than it would if this connection to ground is removed.

**Answer: True**

Ideally, the common-mode gain of a difference amplifier is zero so the CMRR is infinite.

**Answer: True**

Ideally, the common-mode gain of a difference amplifier is zero so the CMRR is also zero.

**Answer: FALSE**

The output voltage of an ideal opamp never clips, no matter how big the output gets.

**Answer: True**

The output voltage of an integrated circuit opamp will clip if the desired output voltage divided by the load resistance exceeds the maximum output current that the opamp can supply.

**Answer: True**

The positive input terminal of an opamp connected in an inverting amplifier configuration is referred to as a “virtual ground” because negative feedback forces the signal voltage on this node to be very close to zero.

**Answer: False**

In practical difference amplifiers, the CMRR can be as high as 120dB.

**Answer: TRUE**

Ideal opamp differentiators without an extra resistor in series with the capacitor have infinite gain at DC.

**Answer: FALSE**

The ideal opamp assumption that there is zero current into the + and – inputs is based on

the fact that actual operational amplifiers are designed to have very high input resistance.

**Answer: TRUE**

The gain of an integrated circuit opamp multiplied by it’s bandwidth is constant anywhere on the amplifier’s frequency response plot below the -3dB frequency and above the unity gain frequency.

**Answer: FALSE**

The output voltage of an integrated circuit opamp will clip if the input voltage multiplied by the closed-loop amplifier gain exceeds the power supply voltage.

**Answer: TRUE**

For an amplifier with a single-time constant high pass response, the magnitude of the gain decreases at -6dB/octave as the frequency is decreased below the corner frequency.

**Answer: True**

Errors in the output voltage of an actual integrated circuit operational amplifier can be caused by :

1. Low bandwidth for high frequency signals
2. Low slew rate for signals which change quickly
3. Low open-loop voltage gain
4. Non-zero offset voltages or currents
5. **All of these**

**A transresistance amplifier needs a low input resistance and a high output resistance.**

**Answer: False**

**If an amplifier needs a high input resistance and a high output resistance, then it is a current amplifier.**

**Answer: False**

**The ideal opamp assumption that there is zero volts between the + and – inputs is based on the fact that actual operational amplifiers are designed to have a very high voltage gain.**

**Answer: True**

**Clipping of an opamp’s output voltage can be caused by :**

a.Decreasing the closed-loop amplifier gain used

b.Increasing the power supply voltages used

c.None of these

**d.Increasing the amplitude of the input signal used**

e.Increasing the load resistance used

Opamp integrators with an extra resistor in parallel with the capacitor are usually avoided since small DC voltages will cause the output voltage to ramp all the way to VDD or VSS over time.

**Answer: T/F**

If an opamp is connected as an inverting summing amplifier, the voltage gain for one input does not depend on the voltage gain for any other input.

**Answer: T/F**

The input offset voltage of an integrated circuit opamp is caused by mismatches between the transistors inside the opamp.

**Answer: T/F**

Ideal opamp integrators without an extra resistor in parallel with the capacitor have infinite gain at DC.

**Answer: T/F**

The model for a transresistance amplifier uses a Thevenin’s equivalent circuit at it’s output.

**True**

The Gain-Bandwidth Product of an integrated circuit opamp is equal to the -3dB frequency of the opamp multiplied by the opamp’s voltage gain at low frequencies.

**TRUE**

An amplifier which needs a low input resistance and a high output resistance is :

A transresistance amplifier

b.None of these

**c.A current amplifier**

d.A transconductance amplifier

e.A voltage amplifier

Current amplifiers use a current input signal and a current output signal.

**TRUE**

If an amplifier needs a low input resistance and a high output resistance, then it is a current amplifier.

**TRUE**

The CMRR for an amplifier is defined as the ratio of the differential-mode gain to the common-mode gain.

**TRUE**

An ideal opamp has infinite input resistance.

**TRUE**

In order to minimize signal loss, a voltage amplifier needs :

1. None of these
2. A low input resistance and a low output resistance
3. A high input resistance and a high output resistance
4. **A high input resistance and a low output resistance**
5. A low input resistance and a high output resistance

Transconductance amplifiers use a voltage input signal and a current output signal.

**TRUE**

For an AC coupled amplifier with a single low frequency pole, the magnitude of the gain increases at +6dB/octave as the frequency is decreased below the lower corner frequency.

**FALSE**

For a DC coupled amplifier with a single high frequency pole, the magnitude of the gain increases at +6dB/octave as the frequency is increased above the corner frequency.

**FALSE**

It is usually easy to minimize errors due to the input offset current of an opamp by adding a resistor in the + input terminal, but this still leaves a small error due to the input bias current.

**FALSE**

If the input voltage of an integrated circuit opamp changes too quickly, then the output voltage of the opamp may not be able to keep up and only ramp up linearly at the opamp’s slew rate.

**TRUE**

Instrumentation amplifiers provide a much higher input resistance and CMRR than a simple Difference amplifier, but require additional opamps to accomplish this.

**TRUE**

An ideal opamp has zero output resistance.

**TRUE**