L1: Q1

Do you have your clicker and know how to operate it?

A: Yes

B: No

L1: Q2

What is the most likely way a physicist will die at work?

A: Toxic chemicals

B: Explosions

C: Electrocution

D: Disgruntled graduate student

L1: Q3

What will kill you?

A: Current

B: Voltage

C: Power

L1: Q4

- 10 -100 mA can kill you!

- You will generally work with 15 V max.
- (Internal resistance ~ 500 Ω, Skin resistance ~100k Ω)

Is 15 V safe if you have dry hands?

A: Yes

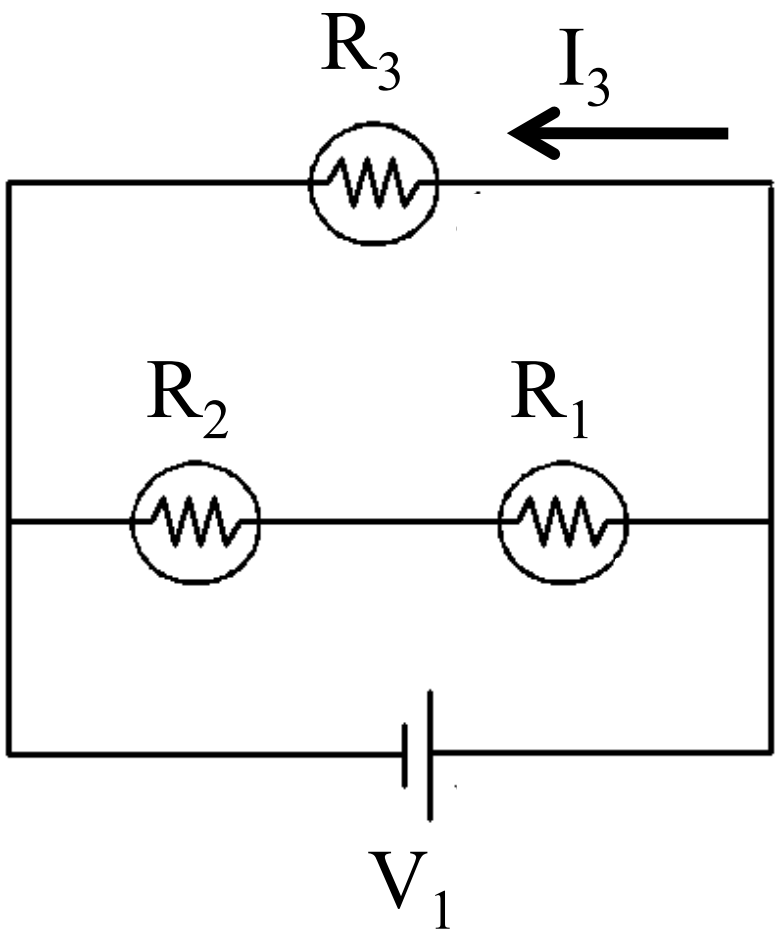
B: No

L2:Q1

$R_1 = 2\ \Omega$
$R_2 = 1\ \Omega$
$R_3 = 5\ \Omega$
$V_1 = 10\ V$

What is I_3?

A) 2 A
B) 3.33 A
C) 5 A
D) 5.33 A
E) 10 A



L2:Q2

What is V_{out}/V_{in}?

A) $\frac{R_1}{R_1 + R_2}$

B) $\frac{R_2}{R_1 + R_2}$

C) $\frac{R_1 + R_2}{R_2}$

D) $\frac{R_2}{R_1}$

E) $\frac{R_1}{R_2}$

L2:Q3

What is Z_{eq}?

A) $\frac{1}{R}+\frac{1}{j\omega L}$ B) $\left(\frac{1}{R}+\frac{1}{j\omega L}\right)^{-1}$ C) $R+j\omega L$

D) $R+\frac{1}{j\omega L}$ E) $\left(R+\frac{1}{j\omega L}\right)^{-1}$

L2:Q4

Is it possible to measure the current generated by the power supply using the scope?

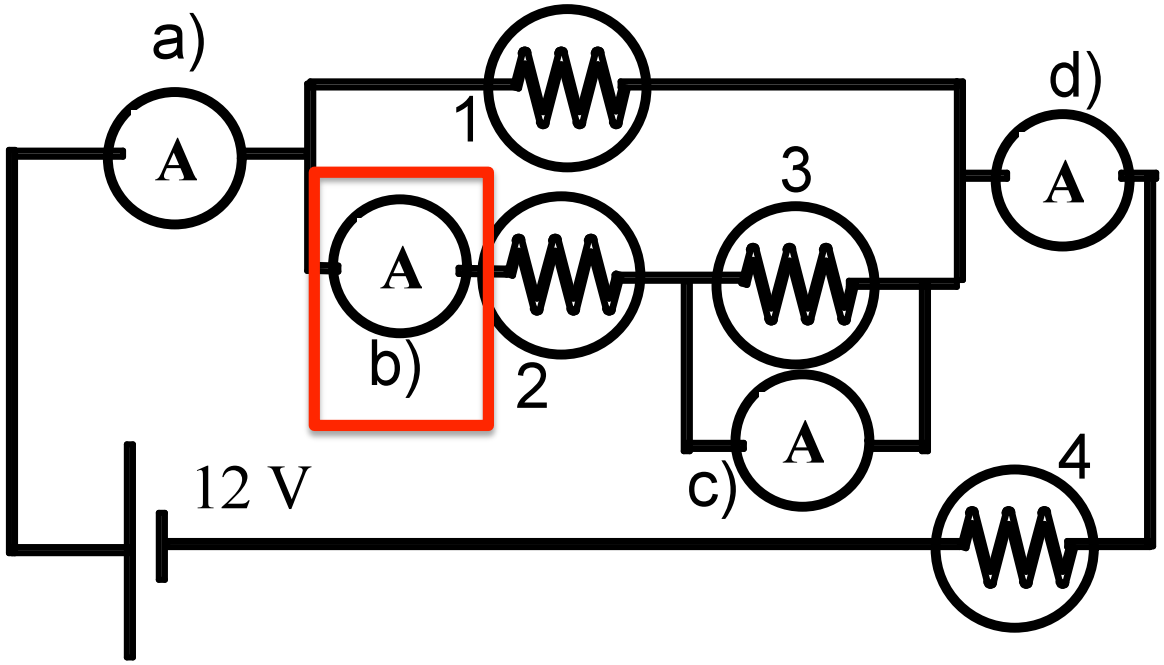
A) No, it only measures voltage

B) Yes, just turn the knob on the scope from "V" to "I"

C) Yes, put a resistor in the circuit and measure the voltage across it.

L2:Q5

To measure the current thru resistor 3, how should the ammeter be attached (assume you only attach one at a time)?



e) MORE than one of these choices is ok.

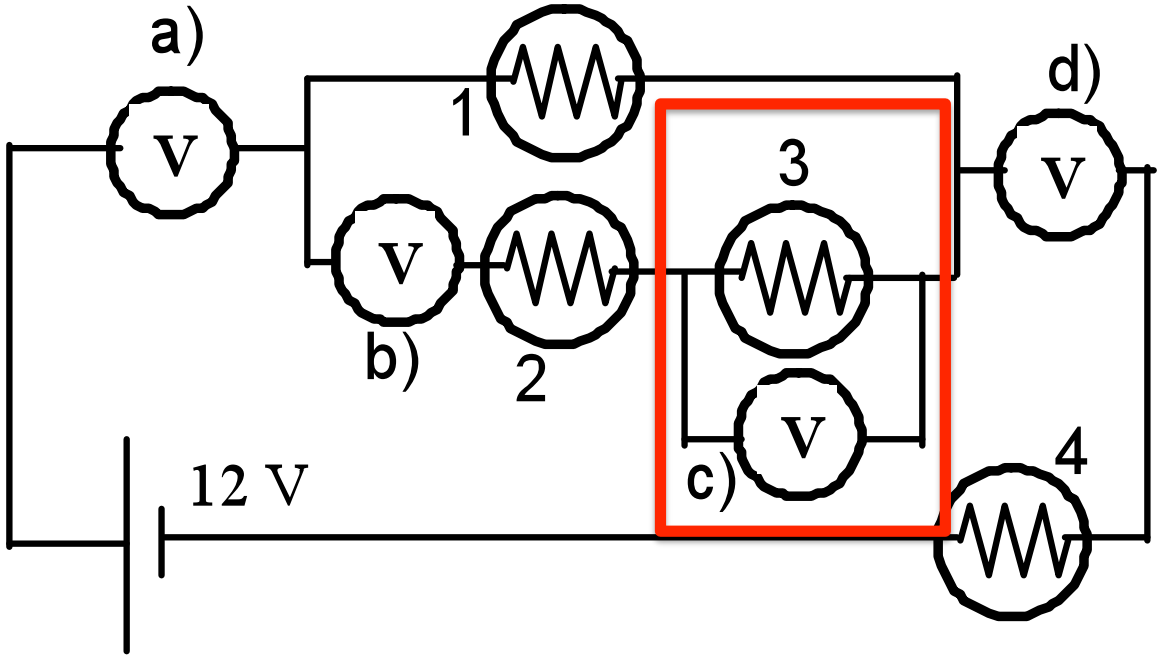
L2:Q6

An ideal ammeter should have

A) Zero resistance
B) Infinite resistance
C) Shiny red color

L2:Q7

To measure the voltage across resistor 3, how should the voltmeter be attached (assume you only attach one at a time)?



e) MORE than one of these choices is ok.

L2:Q8

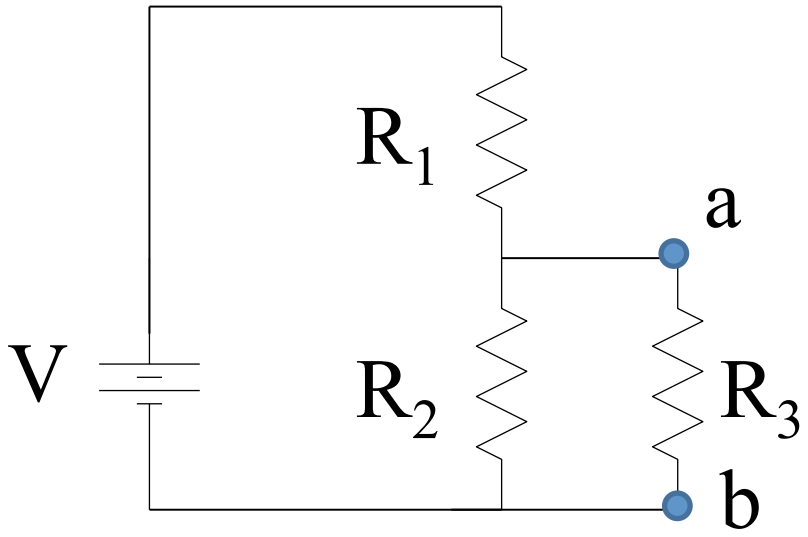
An ideal voltmeter should have

A) Zero resistance
B) Infinite resistance
C) Shiny red color

C1

What is V_{Th}?

A) V
B) V $R_2/(R_1+R_2)$
C) V $R_1/(R_1+R_2)$
D) V (R_1+R_2)
E) 0



C2

What is R_{Th}?

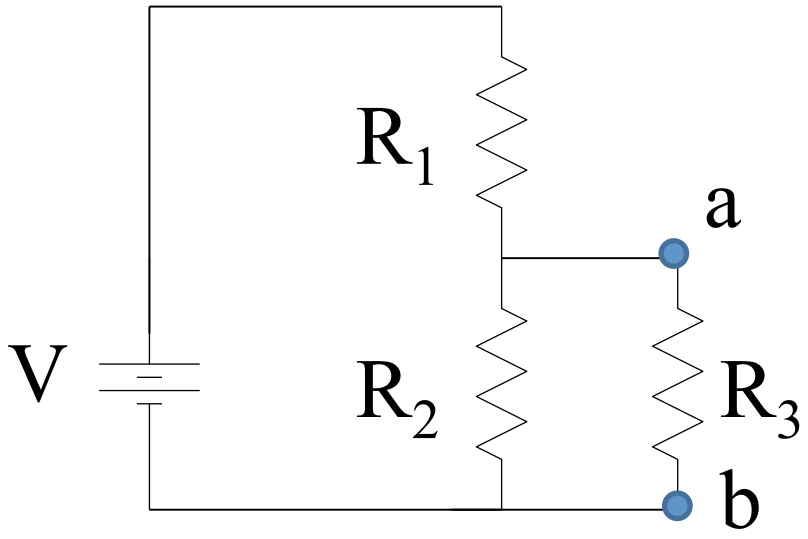
A) 0

B) $R_1R_2/(R_1+R_2)$

C) R_1

D) R_2

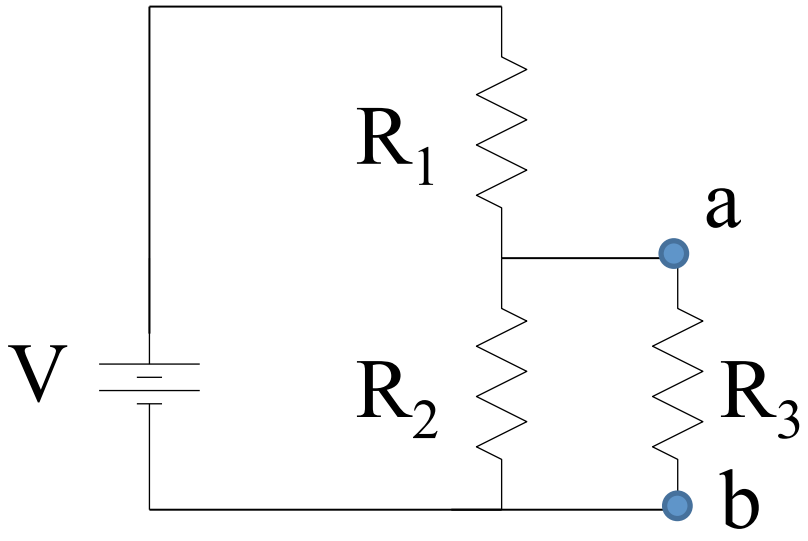
E) R_1+R_2



C3

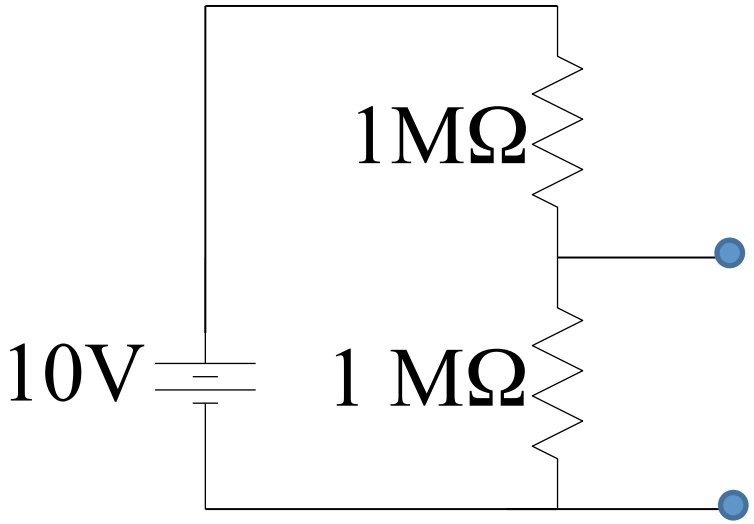
What is I_N?

A) V/R_1
B) V/R_2
C) V/R_3
D) $V\ /(R_2/(R_1+R_2))$
E) $V\ /(R_1+R_2)$



C4

The input impedance of most scopes is 1 MΩ. What voltage does the scope measure across the lower 1 MΩ resistor?



A) 0 V
B) 2.5 V
C) 3.3 V
D) 5 V
E) 7.5 V

D1

Using only the Wheatstone bridge can you accurately determine the value of resistor R_x?

A) Yes, it is easy to do.
B) Yes, but only if you are very careful
C) No

D2

What is I_0 (I at t = 0)?

A) 0

B) q/c

C) V/R

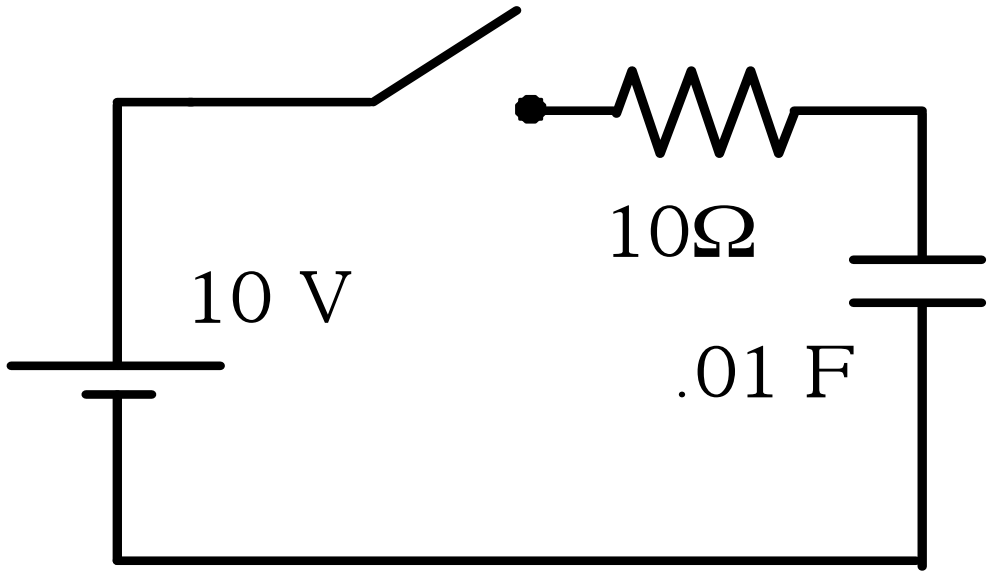
D) 1/(RC)

E) Near infinite

D3

What is the voltage across the capacitor 100 ms after the switch is closed?

A)Zero
B) 3.7 V
C) 5 V
D) 6.3 V
E) 10 V



D4

Which circuit has a larger value of RC ?

A)A

B) B

C) They are the same.

D) Impossible to tell from given information.

E1

For a low pass filter, what frequency is the power out half of the power in?

A) $\omega = RC$

B) $\omega = 1/RC$

X) $\omega = 2\ RC$

Δ) $\omega = 2\ \pi/RC$

E) $\omega = 2\ \pi\ RC$

E2

What is the 3dB frequency for a high pass filter?

A) $\omega = RC$

B) $\omega = 1/RC$

X) $\omega = 2\ RC$

Δ) $\omega = 2\ \pi/RC$

E) $\omega = 2\ \pi\ RC$

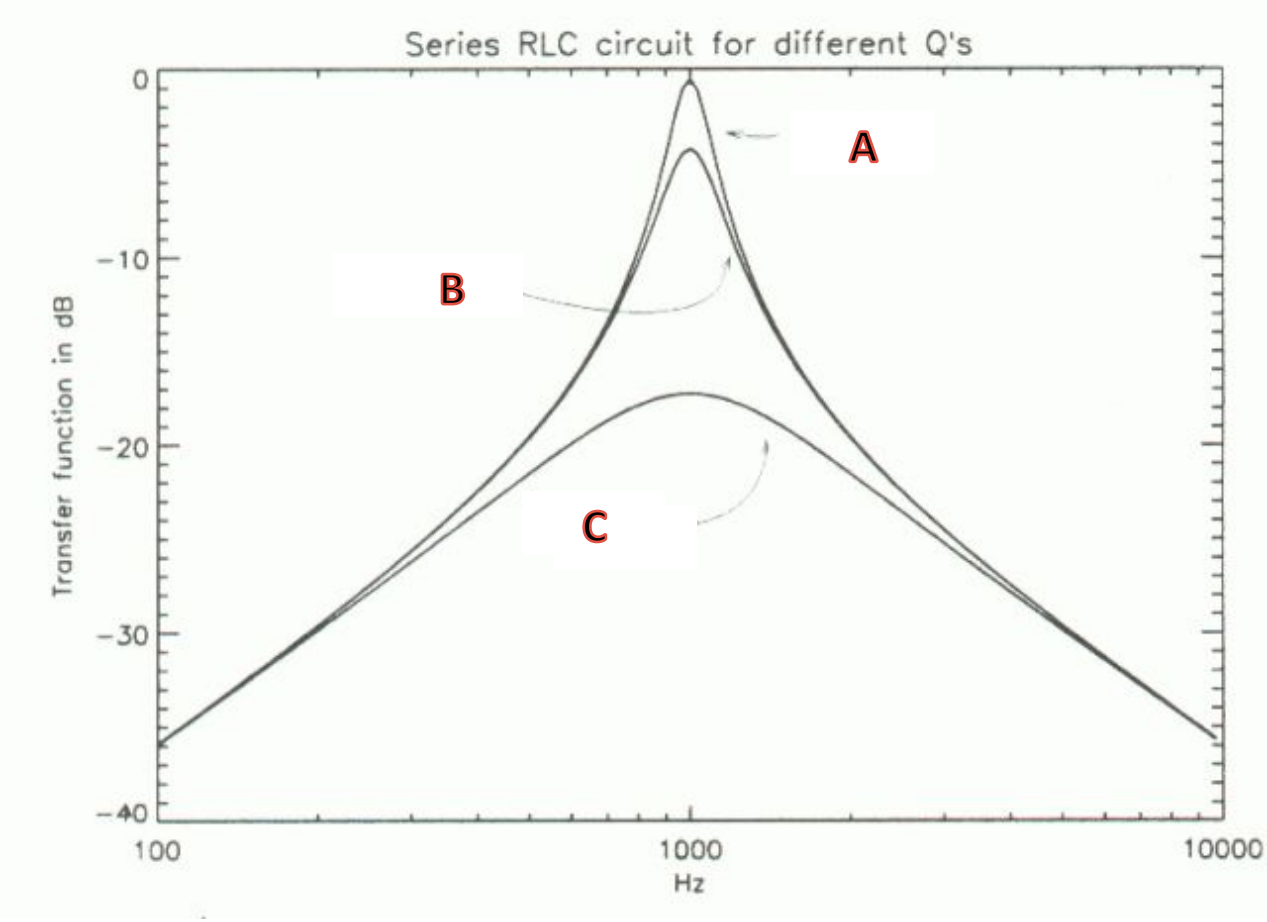
E3

For a high pass filter, what is the phase of T for frequencies much greater that the 3dB frequency?

A) -90^0
B) -45^0
C) 0^0
D) 45^0
E) 90^0

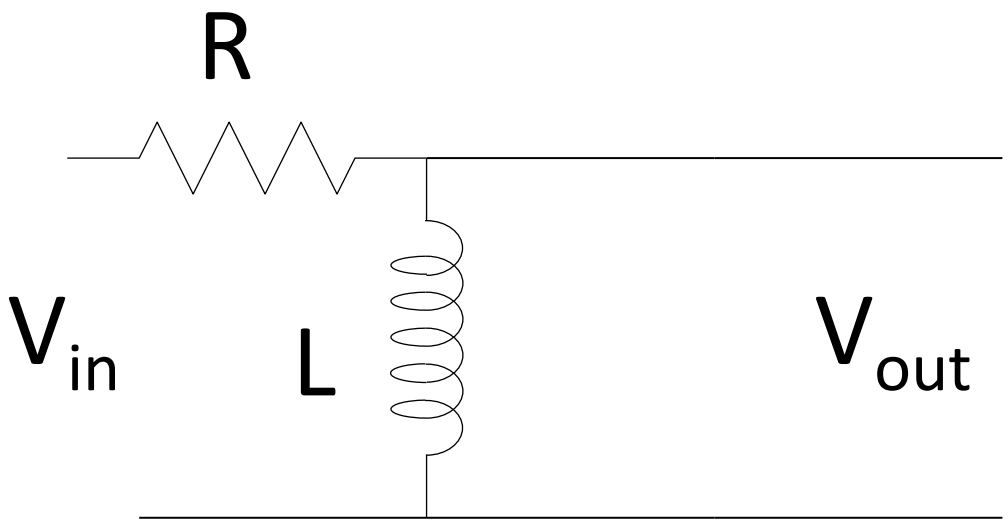
E4 Which curve represents the largest Q?

A) Can not determine without knowing L C R values
B) A
C) B
D) C



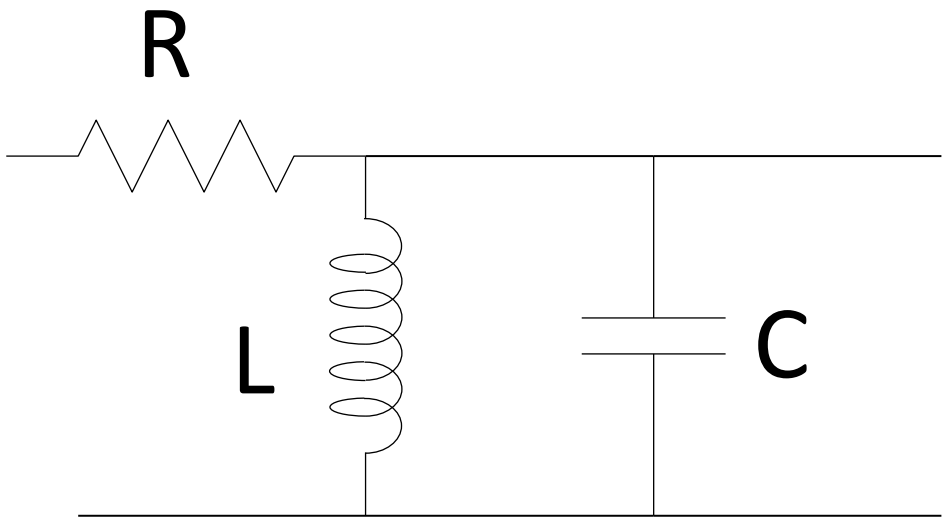
F2 What is the 3dB frequency of the LR high-pass circuit?

A) Sqrt(R/L)
B) R/L
C) Sqrt(LR)
D) LR
E) 1/Sqrt(L/R)



F3 What is the resonant frequency for a parallel LCR circuit?

A) L/R
B) LC
C) Sqrt(LC)
D) 1/Sqrt(LC)
E) 1/Sqrt(L/C)



G0 I measure a resistor in two ways. The measurements are 0.4% different. Do these measurements agree?

A) Yes
B) No
C) Can not determine

G1 Are these two measurements of resistance consistent with each other?

R1= 1.015 kΩ

R 2 = 1.020 kΩ

A) Yes

B) No

C) Can not determine

G2 Are these two measurements of resistance consistent?

$R1 = 1.015 \pm 0.010\ k\Omega$

$R\ 2 = 1.020 \pm 0.020\ k\Omega$

A) Yes

B) No

C) Can not determine

G3 Are these two measurements of resistance consistent?

$R1 = 1.015 \pm 0.001\ k\Omega$

$R\ 2 = 1.020 \pm 0.002\ k\Omega$

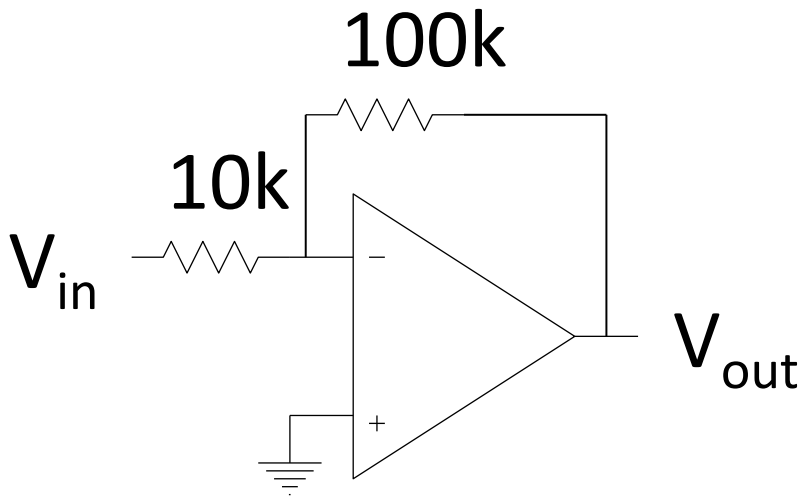
A) Yes

B) No

C) Can not determine

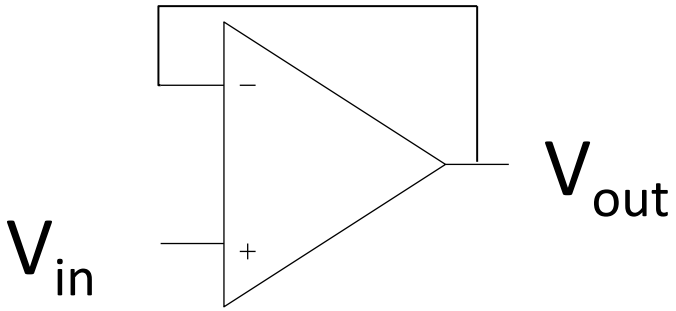
G4 If V_{in} = 1V, what is V_{out}?

A) 0 V
B) 1 V
C) -1V
D) 10 V
E) -10 V



G5 What is V_{out}/V_{in}?

A) 0
B) 1
C) -1
D) $10^5 \sim \infty$



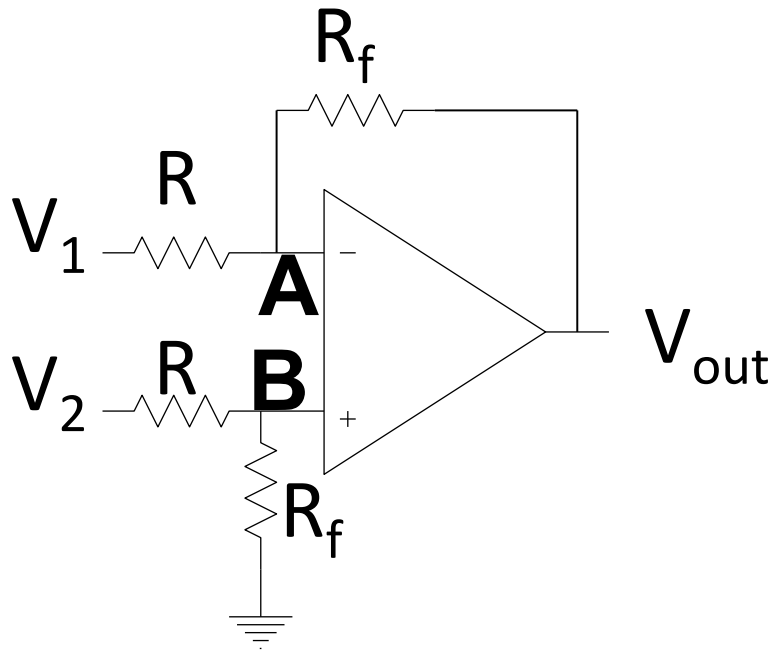
H1 What is the voltage at the non-inverting input, V_B?

A) $V_B = \frac{R}{R_f} V_2$

B) $V_B = \frac{R_f}{R} V_2$

C) $V_B = \frac{R}{R_f + R} V_2$

D) $V_B = \frac{R_f}{R_f + R} V_2$

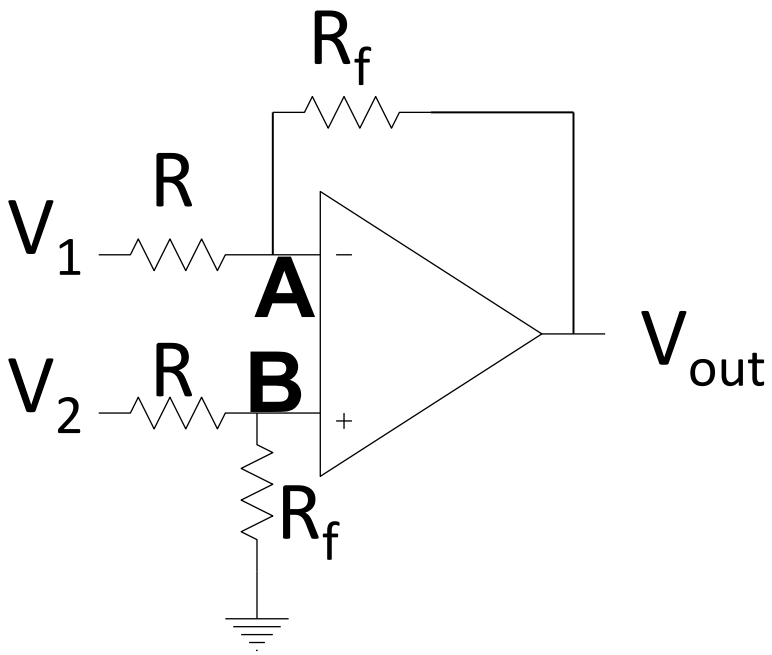


H2 What is the voltage at the inverting input, V_A?

A) $V_A = \dfrac{V_1 R_f + V_{out} R}{R}$

B) $V_A = \dfrac{V_1 R_f + V_{out} R}{R_f}$

C) $V_A = \dfrac{V_1 R_f + V_{out} R}{R + R_f}$

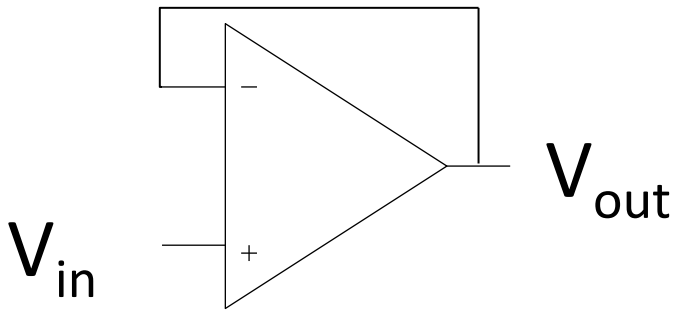


D) $V_A = \dfrac{R_f}{R_f + R} V_1$

E) $V_A = \dfrac{R}{R_f + R} V_1$

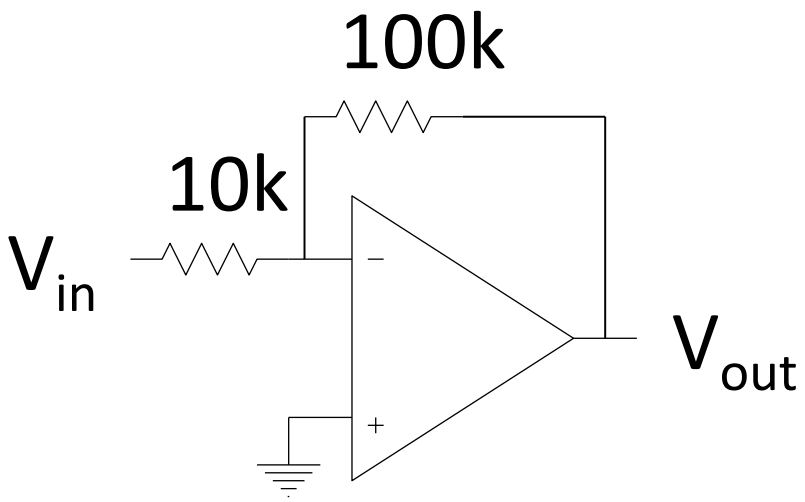
H4 The open loop gain of this op-amp is 10^5 and the bandwidth is 10 Hz. What is the bandwidth of a voltage follower made with this op-amp?

A) 10 kHz
B) 100 kHz
C) 1 MHz
D) 10 MHz
E) Can not be determined



H3 The unity gain frequency of this op-amp is 5 MHz. What is the 3 db frequency of this circuit?

A) 50 kHz
B) 500 kHz
C) 5 MHz
D) 50 MHz
E) Can not be determined

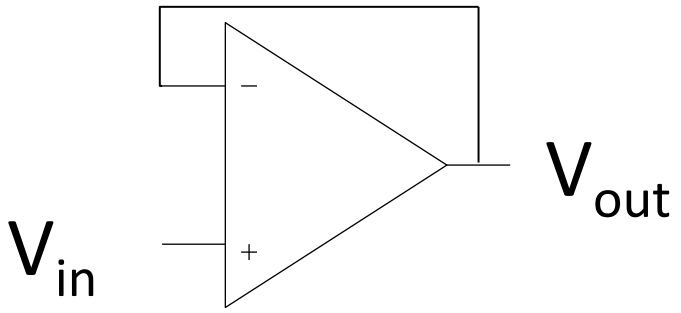


I1 The open loop gain of an op-amp is 10^5 and the open loop bandwidth is 10 Hz. What is the unity gain frequency?

A) 10 kHz
B) 100 kHz
C) 1 MHz
D) 10 MHz
E) Can not be determined

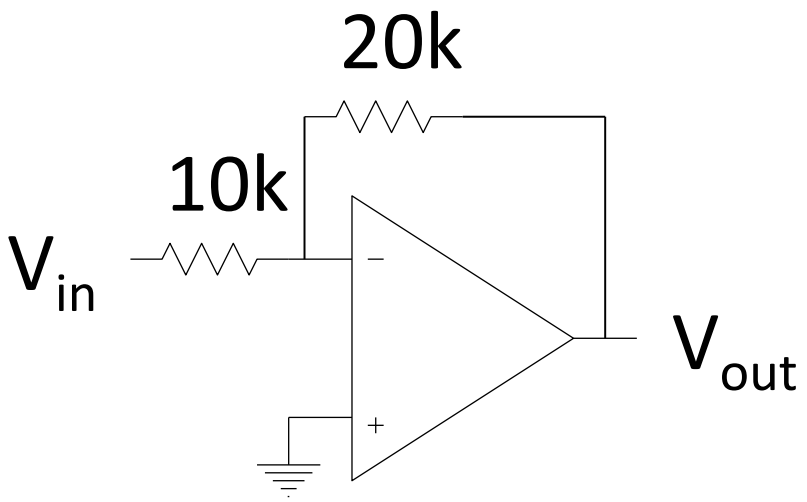
I2 The open loop gain of this op-amp is 10^5 and the open loop bandwidth is 10 Hz. What is the bandwidth of a voltage follower made with this op-amp?

A) 10 kHz
B) 100 kHz
C) 1 MHz
D) 10 MHz
E) Can not be determined



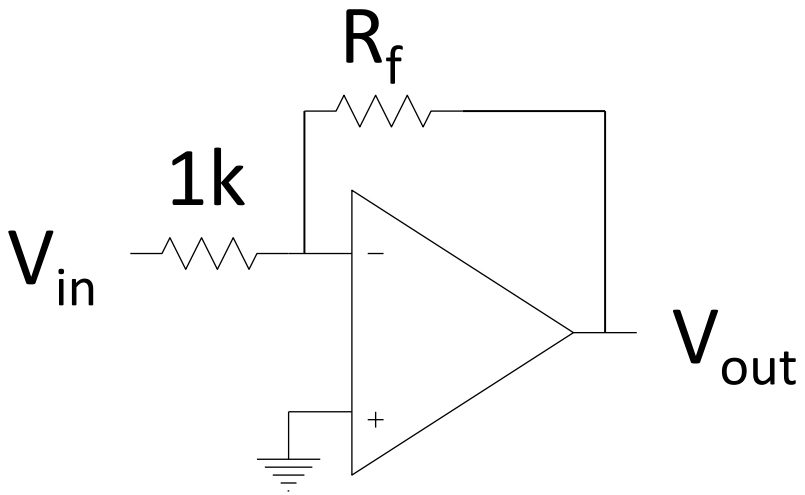
I3 The unity gain frequency of this op-amp is 2 MHz. What is the 3 db frequency of this circuit?

A) 100 kHz
B) 500 kHz
C) 1 MHz
D) 2 MHz
E) Can not be determined



I4 I want to have a circuit with a bandwidth of at least 500 kHz and the largest possible gain. What feedback resistor should I choose ?

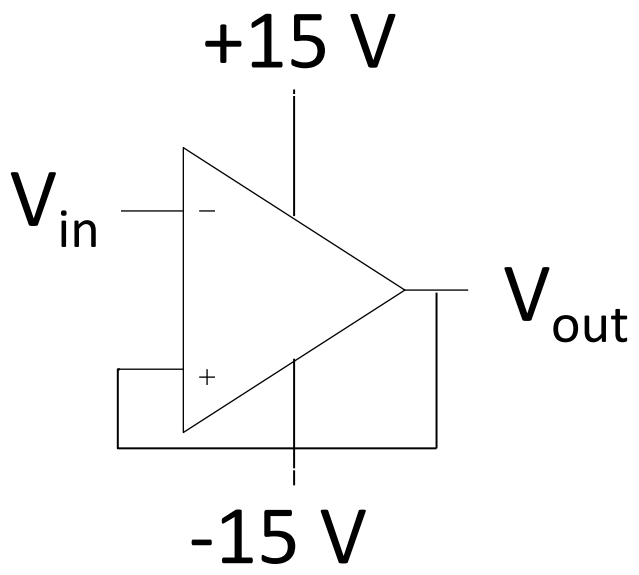
A) 1 kΩ
B) 2.5 kΩ
C) 5 kΩ
D) 10 kΩ
E) Can not be determined



$F_t = 2.5$ MHz

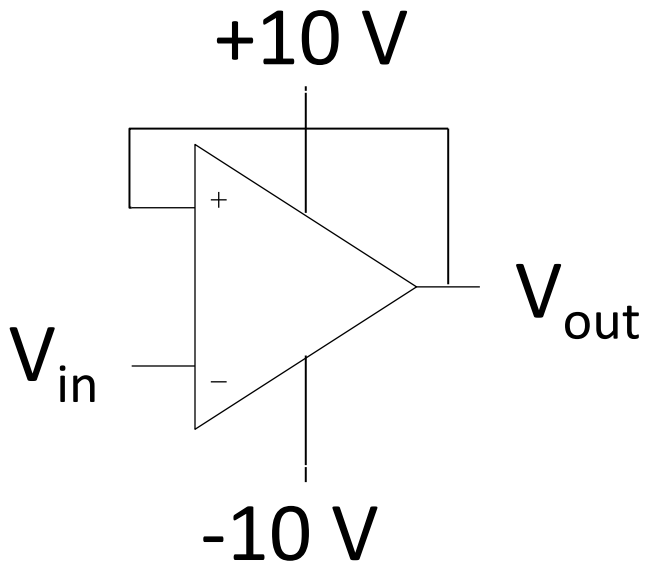
I5 If V_{in} is 1 V what is V_{out}?

A) 0V
B) 1 V
C) -1 V
D) ~15 V
E) ~ -15 V



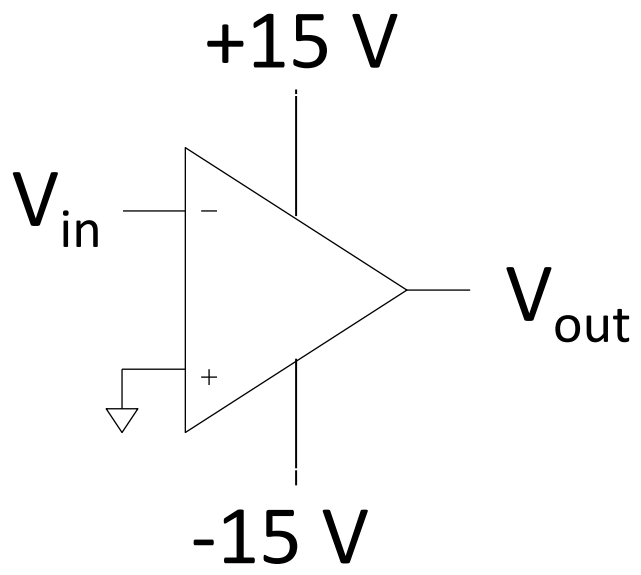
J1 If V_{in} is -50 mV what is V_{out}?

A) 0V
B) 50 mV
C) -50 mV
D) 10 V
E) -10 V



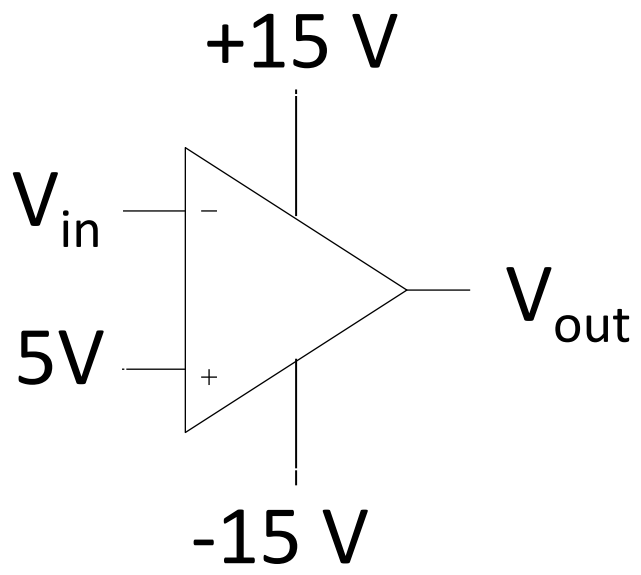
J2 If V_{in} is 1 V what is V_{out}?

A) 0V
B) 1 V
C) -1 V
D) 15 V
E) -15 V



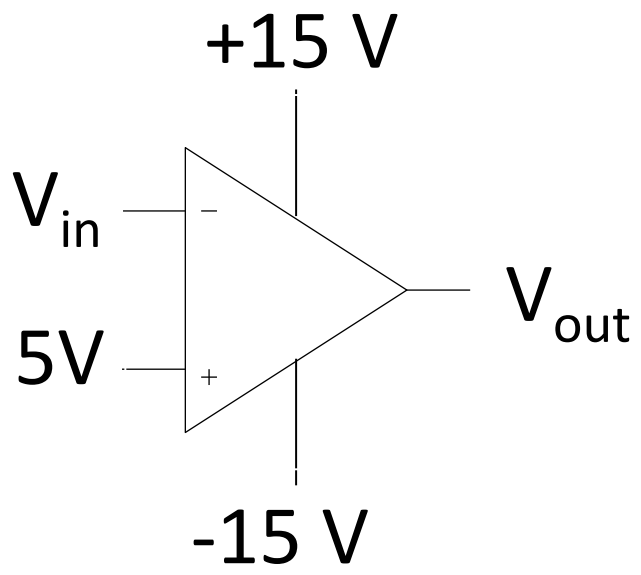
J3 If V_{in} is 1 V what is V_{out}?

A) 0V
B) 1 V
C) -1 V
D) 15 V
E) -15 V



J4 If V_{in} is 8 V what is V_{out}?

A) 0V
B) 1 V
C) -1 V
D) 15 V
E) -15 V



J5 Is an op-amp (LF 356) a good choice to create a comparator for 1kHz digital switching?

A) Yes
B) No

Why or why not?

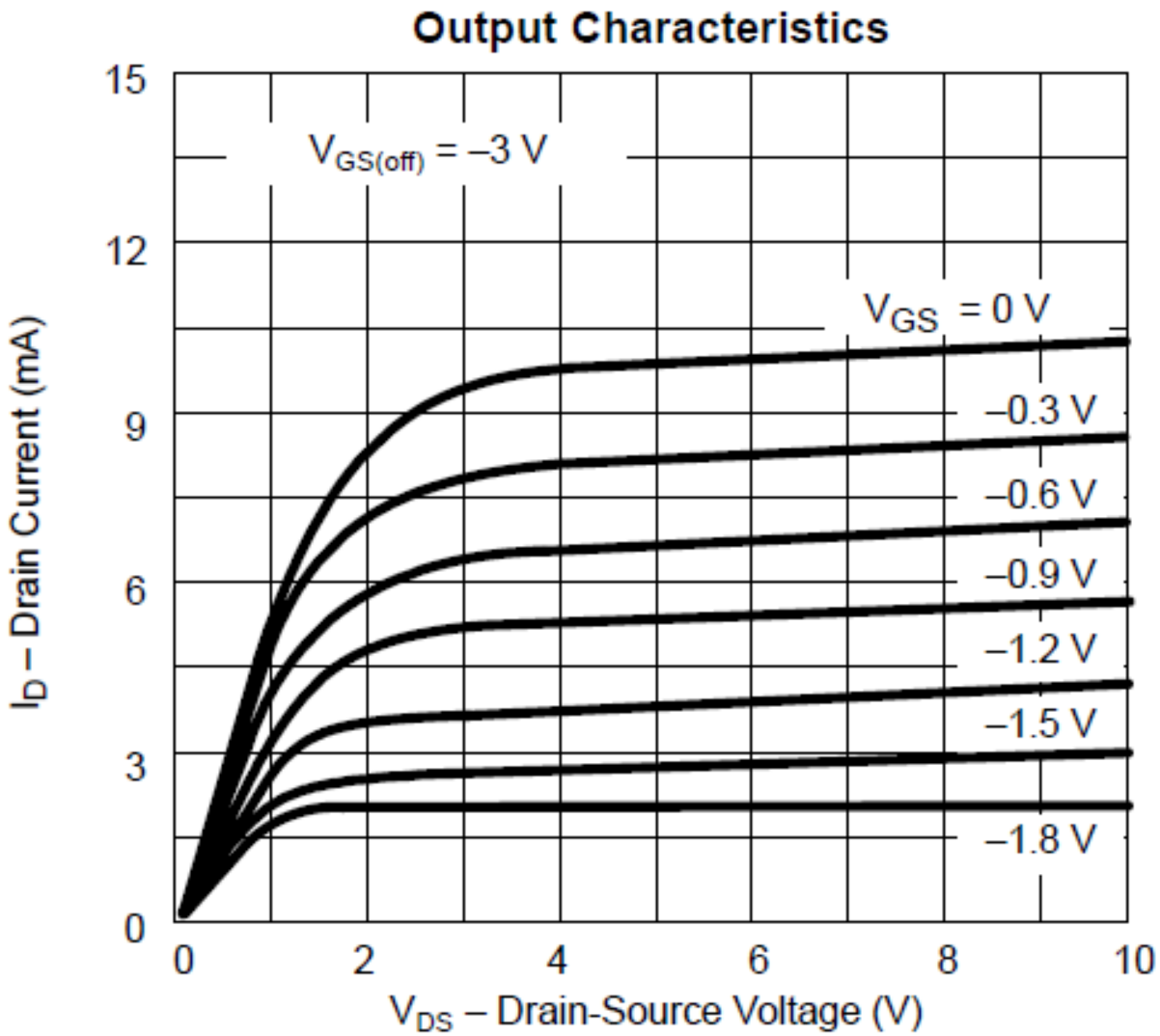
K1

Which detector is going to collect more light?

A) A detector with a radius of 5 cm placed 50 cm from the light source
B) A detector with a radius of 2 cm placed 25 cm from the light source
C) They will collect the same amount of light

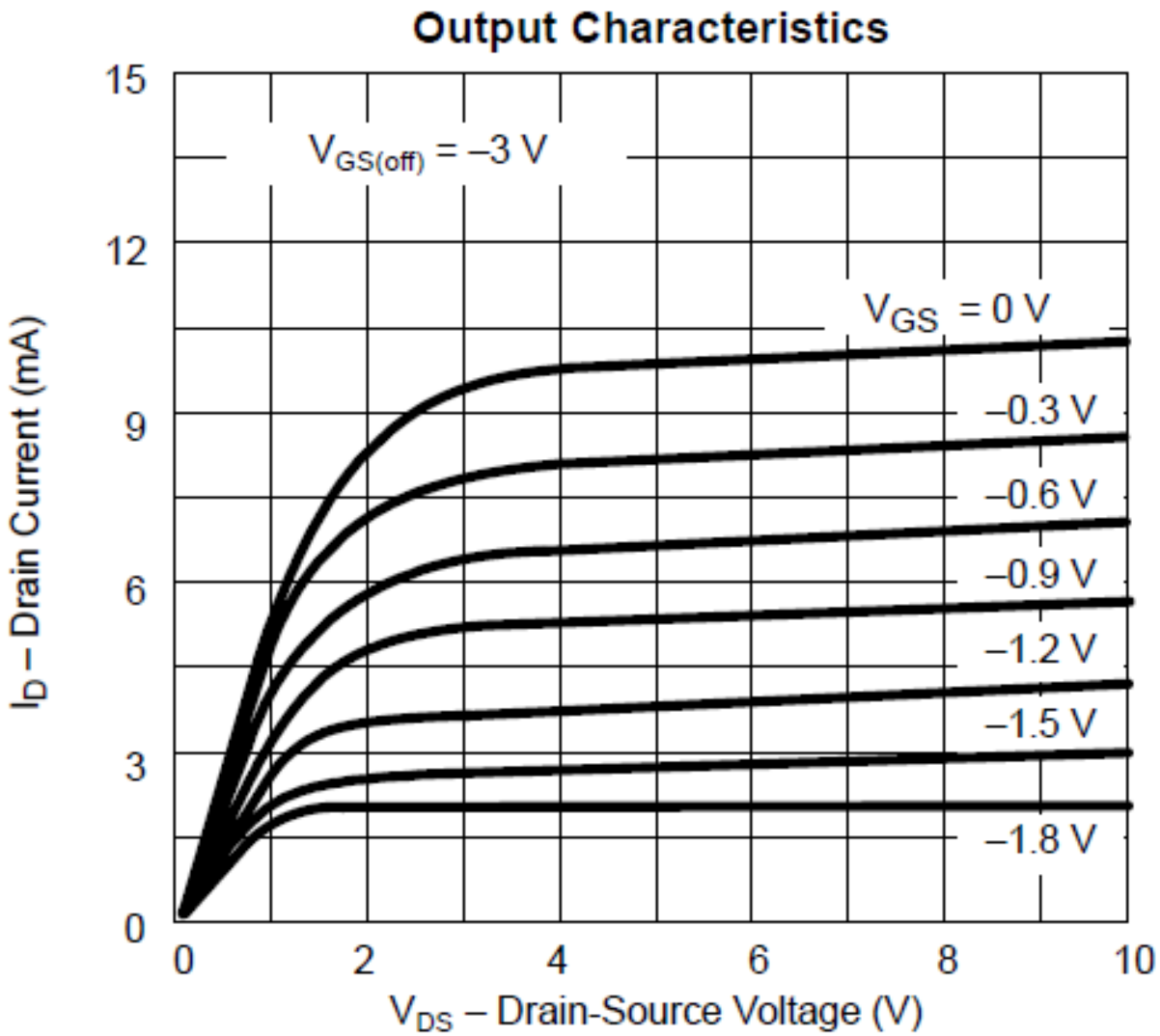
M1 What is the transconductance for the JFET in the saturated region (V_{DS} > 3V) for V_{GS} biased at 0V?

A)1 mS
B) 2 mS
C) 5 mS
D)10 mS
E)15 mS



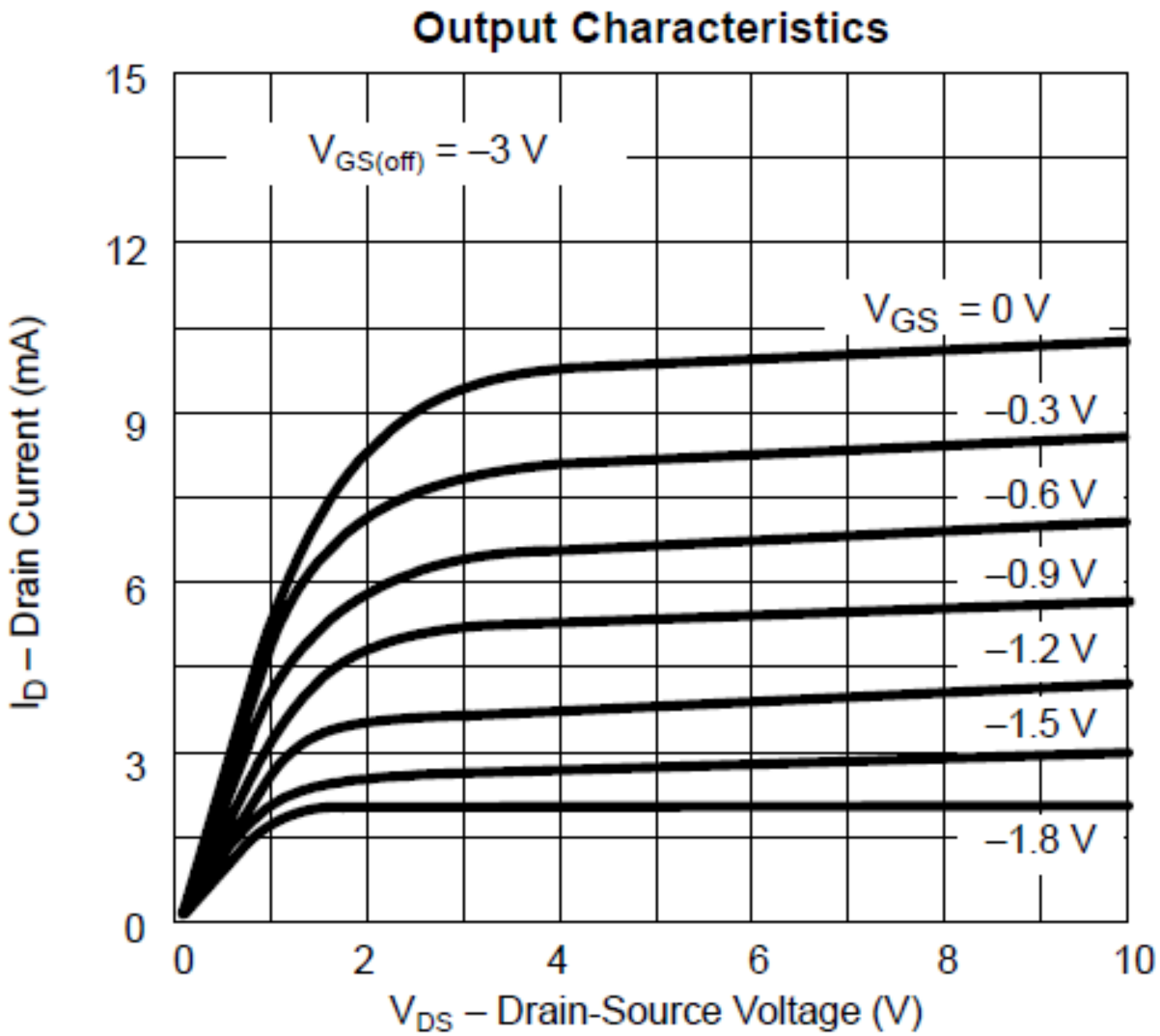
M2 What is I_{DSS} for this JFET?

A)3 mA
B) 5 mA
C) 7.5 mA
D)10.5 mA
E)12 mA



M3 What is V_{out} with the gate grounded?

A) 0 V
B) 1 V
C) 5 V
D) 9 V
E)10 V



M4 What is gain with V_{GS} biased at 0 V?

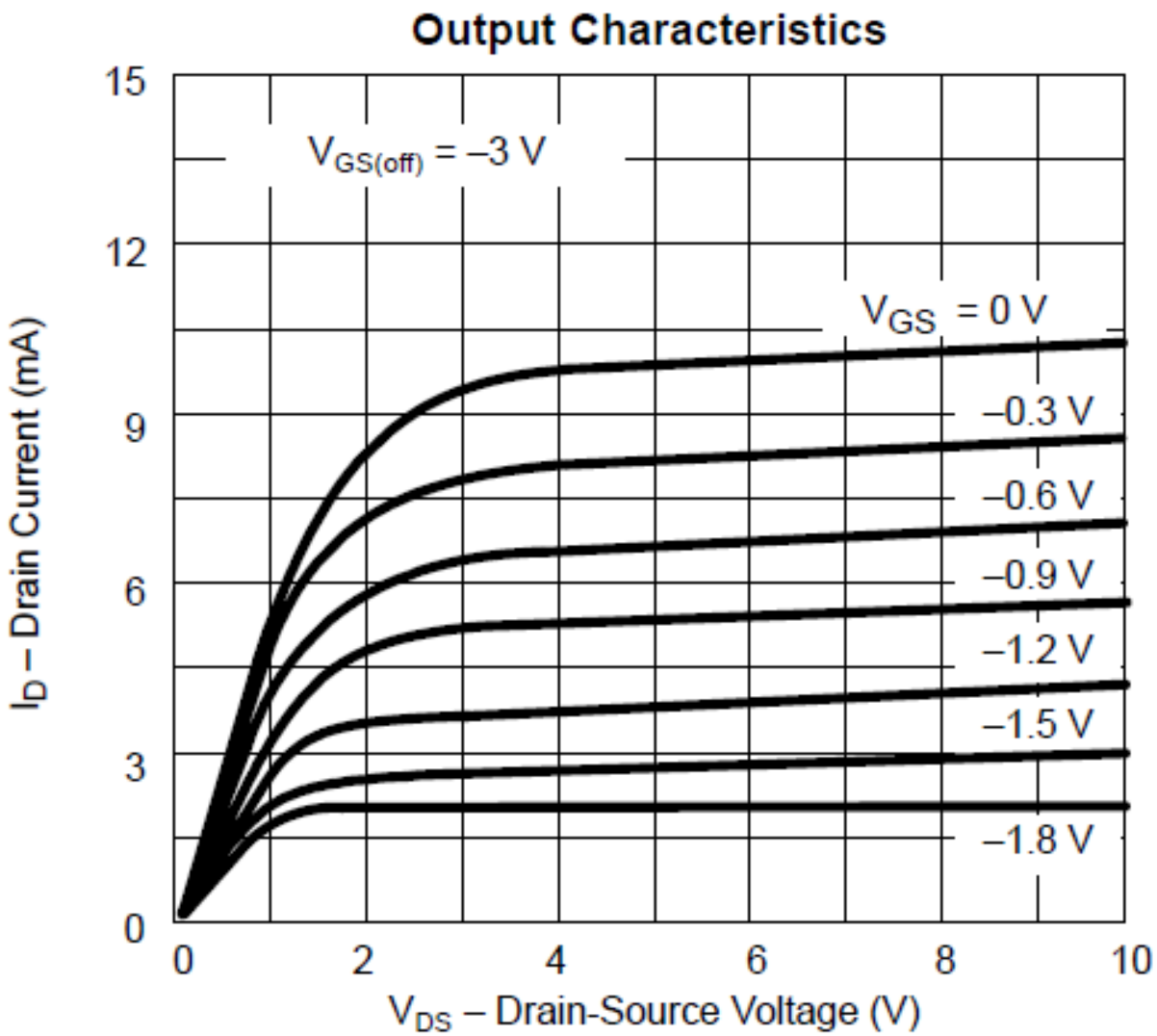
A) 0

B) 0.5

C) 1

D) 5

E)10



M6 Which circuit will have more Johnson noise?

A) top

B) bottom

C) they are the same