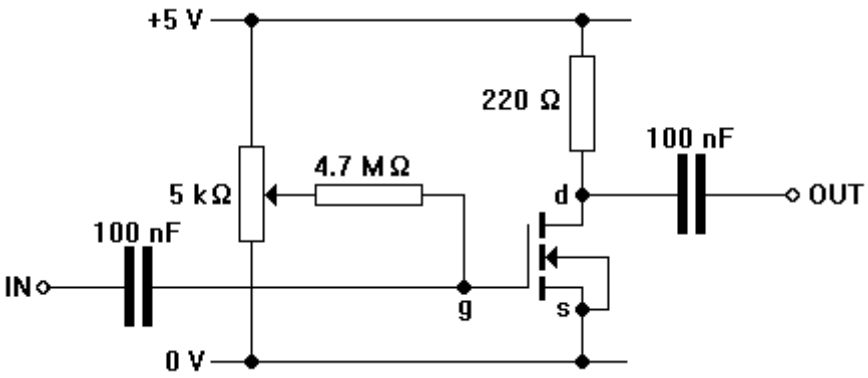
A MOSFET amplifier

1 Assemble the amplifier circuit shown below. Use a 2N7000 MOSFET.



2 Use a double-beam oscilloscope to monitor the voltages at the wiper and the drain. If all is well, the voltage at the drain should fall as the voltage at the wiper (and gate) rises.

3 Set the wiper to 0 V and slowly increase it until the drain starts to fall below +5 V. Note the value of the wiper voltage. Then continue to increase the wiper/gate voltage until the drain hits 0 V and the MOSFET saturates. Note the new gate voltage.

4 Use the data from step 3 to estimate a value for the voltage gain of the circuit. Don't forget the sign.

5 Adjust the potentiometer so that the drain sits at +2.5 V. This should give the amplifier optimum bias.

6 Use a signal generator to feed a 1 kHz sine wave with a peak value of 100 mV into the amplifier. Trigger the oscilloscope on the signal at the output. Sketch waveforms of the signals at IN and OUT. Don't forget to show the scales of the voltage and time axes.

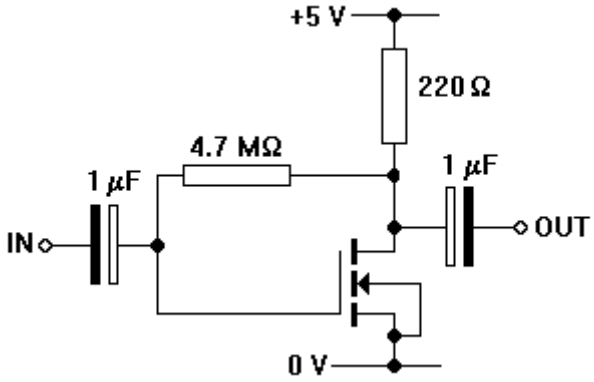
7 Use the peak values of the input and output waveforms to calculate a value for the voltage gain. How does it compare with your value calculated in step 4?

8 Investigate the effect on the voltage gain of changing the drain resistor R_d. Use the values shown in the table. You will need to adjust the bias each time. Make sure that the signal is small enough so that the amplifier is not saturated!

drain resistor	voltage gain
100	
220	
470	

9 The voltage gain G should be given by the formula $G = -g_m R_d$. What value does the data suggest for the transconductance g_m of your MOSFET?

10 Remove the potentiometer. Use the 4.7 M resistor to provide bias from the drain, as shown below.



11 Measure the voltage gain of your new amplifier.

12 Note what happens now to the voltage gain and the bias if you replace the MOSFET with others.