1. In the circuit shown, the rails are ±5V; the emitter of Q1 is at −5V (not ground).

R1=100K and R2=600Ω.

Figure out the voltage at point A with respect to ground, and the voltage at point B with respect to ground. Use DC current gain $H_{fe}=100$. For this transistor $V_{ce} = 0.2$ volts, when it is saturated. Write your answers on the circuit.

2. Design (do not build) a circuit to run a 1200W heater when one phototransistor is illuminated more than another phototransistor. (You will need to use an opamp.)

You are given a heater (make up a symbol for it) that has a resistance of 12Ω, so that it conducts 10 amps when 120V is across it. In addition to your ±5 volt power supply, you have a power supply that provides 120 volts DC at up to 15 amps. In addition to small PNP and NPN transistors such as we have been using in class, you can use PNP or NPN "power transistors" which can handle up to 30 amps and up to 200 volts. The DC current gain ($H_{fe}$) of these transistors is at least 50.

Draw your circuit, choose specific resistor values where needed, and indicate these values on the circuit diagram right by the components (not in a separate list).
3. Design & build a circuit to illuminate an incandescent lamp in response to the rotation of a potentiometer.

Lamp voltage and pot rotation do not have to be proportionate. An OK outcome is one that can vary the brightness of the lamp continuously over its whole range (off to bright; perhaps 1-4volts, or even a greater range). A better outcome is that the lamp’s brightness or voltage range uses most or all of the rotation range of the pot. And the best outcome is if the voltage across the lamp and the pot’s rotation are actually proportionate or nearly so. (Note that at low voltages the lamp may not visibly glow; that’s OK.)

You will need to use transistors; use of an opamp is optional. You can in fact achieve any of the outcomes above with or without an opamp.

Pick a good monitor point on your circuit and connect it to your scope so you can show how the lamp voltage varies with pot rotation. Use another scope channel to monitor pot rotation.

Diagram and build your circuit and raise your hand when you are ready to demonstrate it, and your scope, in operation.