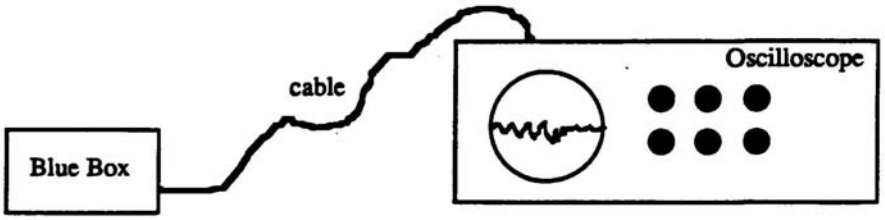
G. Kovacs' QUALS QUESTION JAN 1994 Circuits

The student was asked to sit down in front of an oscilloscope displaying a signal coming from a blue plastic box in front of it. A brief, but carefully-prepared set of instructions was read, instructing the student that they were to focus on the blue box, that playing with the oscilloscope controls was allowed but would only waste time (they were preset correctly) and that without "smashing, disassembling or setting fire to" the blue box, they should tell me as much as possible about its contents.



Time was allowed for the student to study the situation and if they had not touched the box within a couple of minutes, they were prompted to do so. Along the way, they were asked to describe the waveform seen on the oscilloscope when the box was not being moved (noise) and whether or not they could tell if the circuit within the blue box was active or passive based only on the signal displayed (the approach to answering the latter question was more important than the answer -> active).

Once the student had played with the device, they were asked to try to describe its contents and, if needed, were given hints to describe the quantity the box might be measuring (it contained an accelerometer). The student's approach to the problem was most important.

Once the student had established that it was an accelerometer of some type, they were asked to determine its sensitivity in volts per "g" (unit of gravity). Various solutions were possible, such as observing that the sensor had a DC response, so turning it upside down causes a variation of a known acceleration, etc., etc.

The student was then asked to estimate the noise level and give some examples of uses of accelerometers "in the real world."

Finally, the student was asked to think about a "generic" device to measure acceleration and explain what basic elements it would require (i.e. a mass to be accelerated, a restoring force of some kind and a transducer to measure the force or position and convert it into an electrical signal.