

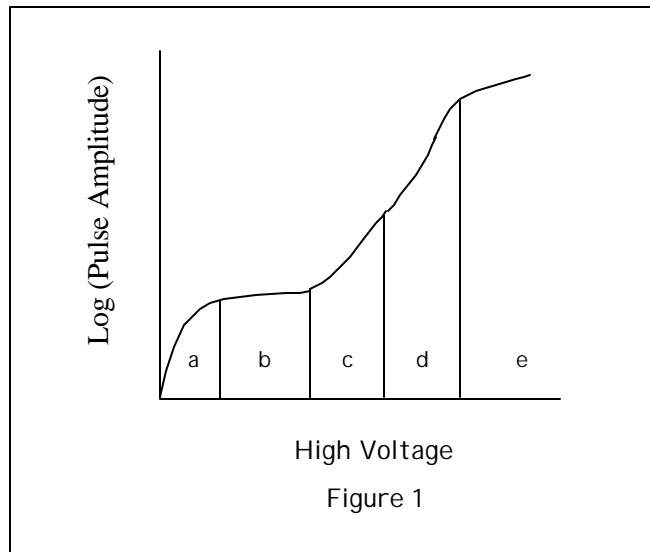
### QUESTION 5

You are assigned the task of training a new technician in the principles of operation of gas-filled radiation detectors.

#### STATE ALL ASSUMPTIONS

#### POINTS

- 20 A. For a gas-filled radiation detector, the general relationship between the amplitude of the output pulse and the applied high voltage is shown in Figure 1, below:



**Identify** each of the labeled regions and briefly explain the mechanisms involved in each case.

- 30 B. You use a mixed alpha plus beta source to calibrate a thin window gas-flow proportional counter.

**Given:** Calibration measurements yield the following data:

$$MDA(dpm) = \frac{2.71}{e t} + \frac{4.65}{e} \sqrt{b/t}$$

- Alpha absolute detection efficiency: 0.40 cpm/dpm
- Beta absolute detection efficiency: 0.45 cpm/dpm
- Beta efficiency is zero in the alpha plateau region
- Count rate vs. applied high voltage:

A sample and detector background were counted, yielding the following information:

High Voltage	Counting Time (min)	Background (Counts)	Sample (Counts)
700	10	0	100
1500	10	10	600

1. Calculate both the alpha activity and the beta activity in the sample, in dpm. **Show all calculations.**
2. Calculate the beta MDA in dpm, for the above sample.

