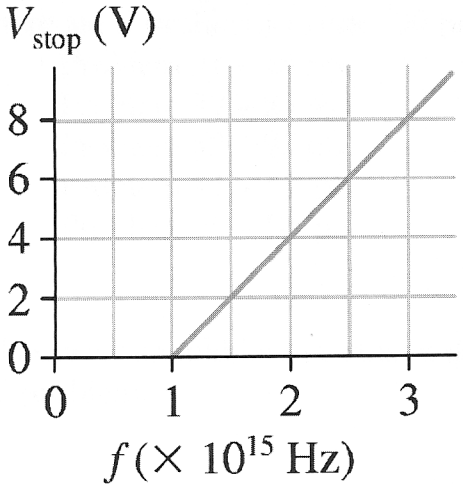
NAME / Section #:	Exam III Problem #5 Phys270
SOLUTION / _____	

5. [10 pts] The graph below was measured in a photoelectric-effect experiment.



(a) [5 pts] What is the work function (in eV) of the cathode?

Let the work function be E_0

The energy of an electron after absorbing a photon = $E = hf$

∴ The stopping potential is related to the electron energy in the following ways:

$$eV_{stop} = hf - E_0 \quad \text{------ (1)}$$

$$\therefore E_0 = hf \quad \text{when } V_{stop} = 0$$

from the graph $E_0 = h \times 10^{15}\ Hz = 6.62 \times 10^{-19}\ J = \frac{6.62 \times 10^{-19}}{1.6 \times 10^{-19}}\ eV = 4.14\ eV$ (Ans)

(b) [5 pts] What experimental value of Planck's constant is obtained from these data?

From relation (1)

$$eV_{stop} = hf - E_0$$

Since E_0 (work function) is a constant for the cathode we have

$$e\frac{\Delta V_{stop}}{\Delta f} = h$$

$$\therefore h = e \times (\text{slope of } V_{stop} \text{ vs. } f \text{ plot})$$

$$= e \times \frac{4\ V}{10^{15}\ s^{-1}} = 4 \times 10^{-15}\ eV\text{-}s = 6.4 \times 10^{-34}\ J\text{-}s \quad \text{(Ans)}$$