MODERN PHYSICS DAY 2: PHOTOELECTRIC INVESTIGATION

CED 15.5 · Skills 3.A/2.D · FRQ: Experimental Design · supervised-simulation lab: determine h from stopping-voltage data

RETRIEVE

Complete the energy account and circle the variable that should be on the horizontal axis of a linear graph.

$$KE_{max} = \_\_\_\_\_ - \phi$$

A. intensity **B. frequency f** **C. wavelength λ** **D. current**

INVESTIGATION QUESTION

How can stopping-voltage measurements determine Planck constant h and the metal work function ϕ?

Controls: one metal, one collection geometry, intensity high enough for a stable current. **Independent variable:** frequency. **Dependent variable:** stopping voltage.

NOTES / REASONING

COLLECT A LAB RECORD

1. Select one metal and record it.
2. Locate the threshold, then choose at least five well-separated frequencies above it.
3. For each frequency, adjust the stopping voltage until the photocurrent reaches zero.
4. Record the chosen values; do not copy a partner group's frequencies.

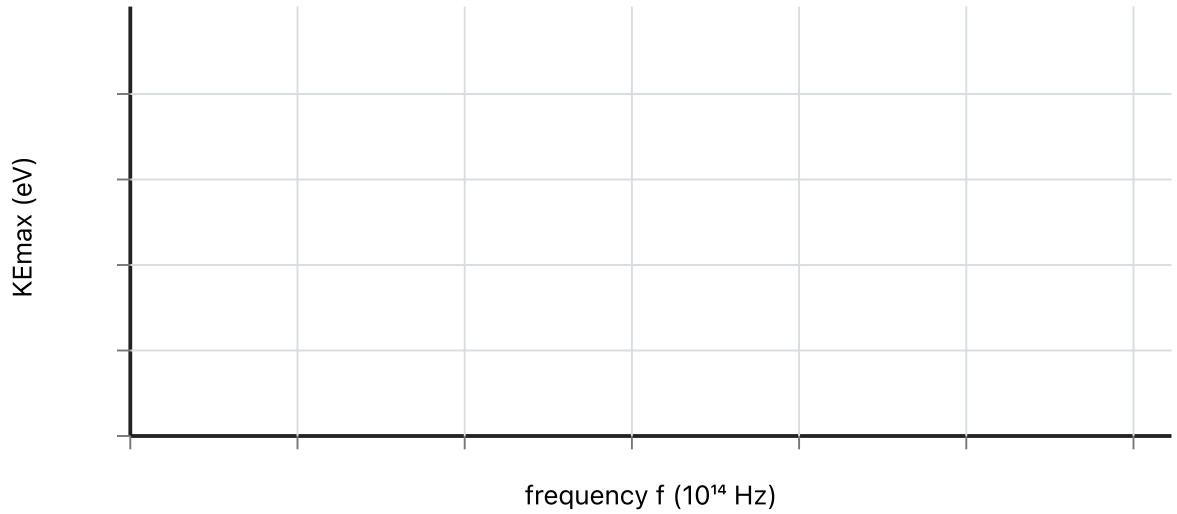
Metal: _____ intensity setting: _____

Trial	frequency f (10^{14} Hz)	stopping voltage V_s (V)	$KE_{max} = eV_s$ (eV)
1			
2			
3			
4			
5			
6			

Record quality: keep all chosen trials, include units, and note any point you repeat.

GRAPH AND FIT

KEMAX VERSUS FREQUENCY



1. Choose and label scales that use most of the grid. Plot each measured point.

2. Draw one best-fit line. Mark two well-separated points on the line for the slope calculation; do not default to two raw data points.

EXTRACT THE PHYSICS

1. Calculate the slope with units. Compare it with the accepted $h = 4.14 \times 10^{-15}\,\text{eV} \cdot \text{s}$.

2. Use the vertical intercept to determine ϕ, then use $f_0 = \phi/h$ to find the threshold frequency.

3. Explain why a KE_{max}-versus-λ graph is curved rather than linear.

4. Identify one uncertainty in setting V_s and one method for reducing its effect.