

Electron configurations, PES and periodic trends

AP Chemistry · Lab answers

Model answers use the sample table. Wavelengths seen by eye are approximate, so small differences from your readings are expected.

Level: AP Chemistry · **Curriculum:** AP Chem Unit 1

Question 1 Photon energy in eV

Li 1240/671 = 1.85 eV; Na 1240/589 = 2.11 eV; K 1240/766 = 1.62 eV; Ca 1240/622 = 1.99 eV; Ba 1240/524 = 2.37 eV. **Energies: 1.85, 2.11, 1.62, 1.99, 2.37 eV.**

Question 2 Photon energy in joules

$E = (6.626 \times 10^{-34} \times 2.998 \times 10^8) / (589 \times 10^{-9}) = 3.37 \times 10^{-19} \text{ J}$, which equals 2.11 eV.

Question 3 Order of energies

K (1.62), Li (1.85), Ca (1.99), Na (2.11), Ba (2.37 eV) from lowest to highest.

Question 4 Origin of the light

The flame promotes an electron to a higher energy level. When it falls back, the energy difference ΔE leaves as a photon of wavelength $\lambda = hc/\Delta E$. Only certain ΔE exist, so **only certain wavelengths are emitted**.

Question 5 Trend in group 1

The valence electron is in a different shell in each atom, and the spacings between the energy levels differ because Z_{eff} , shielding and distance differ. So **the photon energies differ**.

Question 6 Reliability

Sodium's strong yellow light can hide weaker colours. Use fresh, clean splints and a new rinse for each test so that **residue from the previous solution is not carried over**.

Question 7 Improvement

Record the flame spectrum with a digital spectrometer or a camera with a diffraction

grating, and read the peak positions on a calibrated scale. **A calibrated instrument removes the observer's colour judgement.**