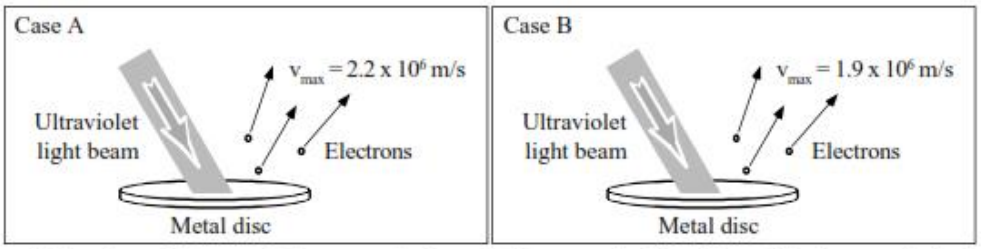
AP Physics 2 – Modern Physics

F1-CT02: Ultraviolet Light on Metal Discs—Work Function

A beam of ultraviolet light shines on a metal disc, causing electrons to be emitted from the disc. The two cases are identical, except that the metals are different and the emitted electrons have a higher maximum speed in Case A than in Case B.



Is the work function of the metal (i) *greater in Case A*, (ii) *greater in Case B*, or (iii) *the same in both cases*? _____

Explain your reasoning.

F1-SCT04: Photoelectric Effect Investigations—More Electrons

In two experiments, electromagnetic waves are used to eject electrons from a metal. The electromagnetic waves have a longer wavelength in experiment A than in experiment B. More electrons were ejected from metal B than from metal A. Three students are discussing the experiments:

Arturo: *"Since more electrons were ejected from metal B, that means the intensity of the light used in that investigation was higher."*

Bonifacio: *"I don't think we can say that for sure. Since the wavelength used in B was shorter, those waves would have more energy, and they could eject more electrons even though the intensity of the wave was lower."*

Carla: *"I think that all we can conclude is that the work function for metal B is smaller than the work function of metal A, and that is why more electrons were ejected from B."*

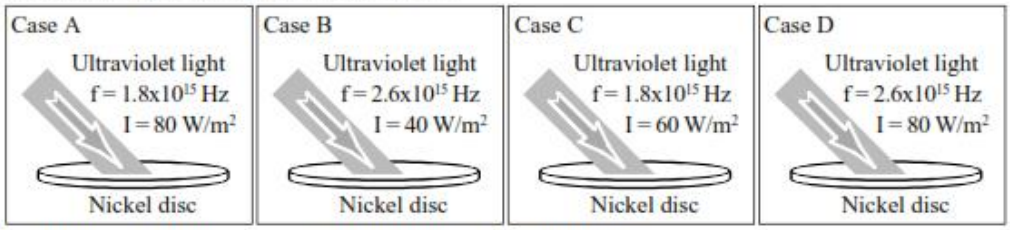
With which, if any, of these students do you agree?

Arturo _____ Bonifacio _____ Carla _____ None of them _____

Explain your reasoning.

F1-RT05: Ultraviolet Light Incident on Nickel—Number of Ejected Electrons

A nickel disc emits electrons when it is illuminated with a beam of ultraviolet light. The frequency of the light and the intensity of the light beam are given for each case.



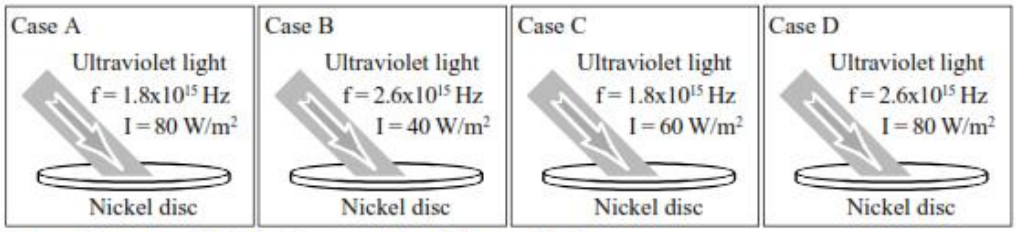
Rank the number of electrons ejected from the nickel per unit time.

				OR			
1 Greatest	2	3	4 Least		All the same	All zero	Cannot determine

Explain your reasoning.

F1-RT06: Ultraviolet Light Incident on Nickel—Ejected Electron Speed

A nickel disc emits electrons when it is illuminated with a beam of ultraviolet light. The frequency of the light and the intensity of the light beam are given for each case.



Rank the maximum speed of the electrons ejected from nickel.

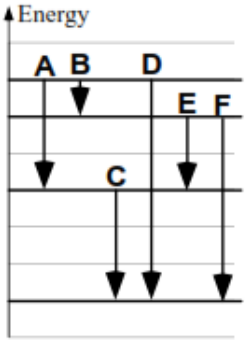
☐ ☐ ☐ ☐ OR ☐ ☐ ☐

1 Greatest 2 3 4 Least | All the same | All zero | Cannot determine

Explain your reasoning.

F2-RT11: Energy Level Transitions—Emission Frequency

Shown are four energy levels for an atom along with six possible transitions between pairs of energy levels. Adjacent horizontal lines (light gray or dark) are separated by the same energy difference.



Rank the frequency of the emitted photons for the labeled transitions.

☐ ☐ ☐ ☐ ☐ ☐ OR ☐ ☐ ☐

1 Greatest 2 3 4 5 6 Least | All the same | All zero | Cannot determine

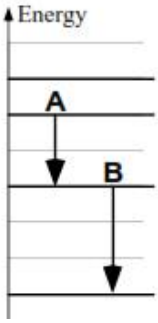
Explain your reasoning.

F2-WWT13: Energy Level Diagram—Wavelength

A student comparing two transitions on an energy level diagram contends:

"The wavelength of light emitted in transition A will be shorter than the wavelength of light emitted in transition B, because transition A starts from a higher energy level."

What, if anything, is wrong with this student's contention? If something is wrong, identify the problem and explain how to correct it. If the student is correct, explain the physics supporting his/her statement.



F1-CT09: Two Moving Protons—deBroglie Wavelength

Two protons are moving through a vacuum. Proton A has a speed of 4×10^4 m/s, and proton B has a speed of 9×10^5 m/s.

Will the deBroglie wavelength for proton A be (a) *greater than*, (b) *less than*, or (c) *equal to* the deBroglie wavelength of proton B? _____

Explain your reasoning.

F3-CT14: Carbon Isotopes— Protons, Neutrons, and Electrons

A carbon-14 atom has 6 electrons, 6 protons, and 8 neutrons.

(a) Will an atom of carbon-11 have (i) *more electrons*, (ii) *fewer electrons*, (iii) or *the same number of electrons* as an atom of carbon-14? _____

Explain your reasoning.

(b) Will an atom of carbon-11 have (i) *more protons*, (ii) *fewer protons*, or (iii) *the same number of protons* as an atom of carbon-14? _____

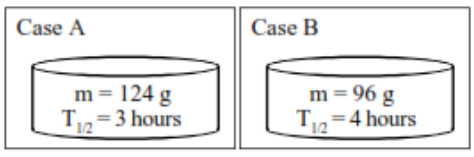
Explain your reasoning.

(c) Will an atom of carbon-11 have (i) *more neutrons*, (ii) *fewer neutrons*, or (iii) *the same number of neutrons* as an atom of carbon-14? _____

Explain your reasoning.

F3-CT15: Two Radioactive Samples—Mass Remaining

The masses of samples of radioactive elements are measured and then measured again 12 hours later. The initial mass for two samples of different elements are given, along with the half-life of each element.



After 12 hours, will the mass of the sample in Case A be (i) *greater than*, (ii) *less than*, or (iii) *equal to* the mass of the sample in Case B? _____

Explain your reasoning.