What is the difference between visible light and electromagnetic radiation?

A. Electromagnetic radiation contains both an oscillating electric field and an oscillating magnetic field; visible light only contains one of the two.
B. Visible light is only one form of electromagnetic radiation; all visible light is electromagnetic radiation, but not all electromagnetic radiation is visible light.
C. Electromagnetic radiation is only found at higher energies than visible light.
D. Electromagnetic radiation is only one form of visible light; all electromagnetic radiation is visible light, but not all visible light is characterized as electromagnetic radiation.

The temperature of stars may be gauged by their colour, e.g. blue-white stars are hotter than red stars. How is this observation consistent with Planck's assumption?

A. Planck proposed that matter is allowed to emit energy across a continuous spectrum analogous to the spectrum of visible light.
B. Planck proposed that all types of matter would emit the same frequencies of visible light when at the same temperatures.
C. As temperature increases, so does the average energy of the emitted radiation. Blue-white light is at the longer wavelength (lower energy) end of the visible spectrum while red light is at the shorter wavelength (higher energy) end of the visible spectrum.
D. As temperature increases, so does the average energy of the emitted radiation. Blue-white light is at the shorter wavelength (higher energy) end of the visible spectrum while red light is at the longer wavelength (lower energy) end of the visible spectrum.

Human skin is penetrated by X-rays but not by visible light. Which travels faster, X-rays or visible light?

A. Both visible light and X-rays travel at the same speed, about 300,000 kilometres per second.
B. Additional energy information is needed to compare the speeds.
C. X-rays travel faster.
D. Visible light travels faster.

Suppose that yellow light can be used to eject electrons from a certain metal surface. What would happen if ultraviolet light was used instead?

A. No electrons would be ejected.
B. Electrons would be ejected, and they would have the same kinetic energy as those ejected by yellow light.
C. Electrons would be ejected, and they would have greater kinetic energy than those ejected by yellow light.
D. Electrons would be ejected, and they would have lower kinetic energy than those ejected by yellow light.

Speculate as to how Bohr's model might explain the fact that hydrogen gas emits a line spectrum rather than a continuous spectrum.

A. Hydrogen's one-electron system only has four possible energies of emission and absorption.
B. Photons of only certain allowed frequencies can be absorbed or emitted as the electron changes energy state.
C. Hydrogen's spectroscopic behavior is different than other elements since it's a one-electron system allowing only certain portions of the continuous spectrum to be visible.
D. Photons of a continuous frequency spectrum can be absorbed or emitted but only certain regions have enough intensity to be detectable.

As the electron in a hydrogen atom jumps from the $n = 3$ orbit to the $n = 7$ orbit, does it absorb energy or emit energy?

A. It neither emits nor absorbs energy.
B. It both emits and absorbs energy simultaneously.
C. It emits energy.
D. It absorbs energy.

A baseball pitcher throws a fastball at 150 km/h. Does that moving baseball generate matter waves? If so, can we observe them?

A. No matter waves are produced.
B. No, because the mass of the baseball is too large.
C. Yes; but too small to allow any way of observing them.
D. Yes; and they can be observed.

What is the principal reason that the uncertainty principle seems very important when discussing electrons and other subatomic particles, but seems rather unimportant in our macroscopic world?

A. The size and mass of a subatomic particle is very small relative to the macroscopic world.
B. The uncertainty principle is very important in the macroscopic world.
C. The uncertainty principle only applies to charged particles and most macroscopic world objects are neutral.
D. The uncertainty principle only applies to subatomic particles.

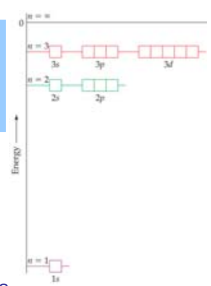
Is there a difference between stating, "The electron is located at a particular point in space" and "There is a high probability that the electron is located at a particular point in space"?

A. No. The statements mean the same thing.
B. Yes, there is a difference. The first statement says the electron's position is known exactly, which violates the uncertainty principle. The second statement expresses some uncertainty of position.

What is the difference between an *orbit* (Bohr model) and an *orbital* (quantum mechanical model)?

A. An orbital is composed of some integral number of orbits.
B. An orbit is a well-defined circular path around the nucleus while an orbital is a wave function that gives the probability of finding the electron at any point in space.
C. An orbit is a well-defined circular path around the nucleus while an orbital is the object (electron) that is moving around the nucleus.
D. There is no difference between the definitions of the terms "orbit" and "orbital." They simply were proposed by different scientists.

Why is the difference between the $n = 1$ and $n = 2$ levels so much greater than the energy difference between the $n = 2$ and $n = 3$ levels?



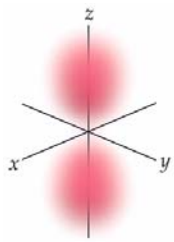
A. because $-1/(2)^2$ and $-1/(1)^2$ are of much greater difference than $-1/(3)^2$ and $-1/(2)^2$ in Bohr's equation that describes the hydrogen atom.
B. because the Rydberg constant in Bohr's equation is higher for $n = 1$ to $n = 2$ transitions.
C. because the energy difference between the 1st and 2nd energy level of hydrogen is smaller than the energy difference between the 2nd and 3rd energy level.
D. because the electron in the hydrogen atom never occupies energy levels of higher than $n = 1$.

How many maxima would you expect to find in the radial probability function for the 4*s* orbital of the hydrogen atom? How many nodes would you expect in the 4*s* radial probability function?

A. three maxima and three nodes
B. three maxima and four nodes
C. four maxima and three nodes
D. four maxima and four nodes

What does the change in colour of the orbital represent in the picture below?

A. The variations in pink color do not represent any significant physical feature.
B. The lighter pink regions represent more positively charged areas of the *p*-orbital.
C. The probability of finding an electron in the interior of a *p*-orbital lobe is less than it is on the edges.
D. The probability of finding an electron in the interior of a *p*-orbital lobe is greater than it is on the edges.

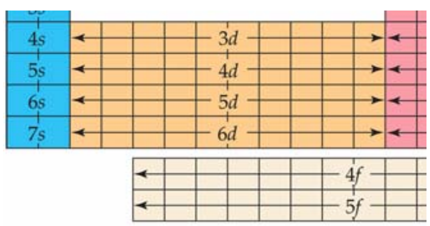


For a many-electron atom, can we predict unambiguously whether the 4*s* orbital is lower or higher in energy than the 3*d* orbitals?

A. Yes
B. No

Based on the structure of the periodic table, which becomes occupied first, the 6*s* orbital or the 5*d* orbitals?

A. the 5*d* orbital
B. the 6*s* orbital



The elements Ni, Pd and Pt are all in the same group. By examining the electron configurations for these elements, what can you conclude about the relative energies of the *nd* and (*n* + 1)*s* orbitals for this group?

A. All three elements have the same relative energies for their *nd* and (*n* + 1)*s* orbitals.
B. Nothing can be concluded, because the three elements each have different valence electron configurations.
C. The *nd* orbitals are of lower energy than (*n* + 1)*s* orbitals for all three elements.
D. The *nd* orbitals are of higher energy than (*n* + 1)*s* orbitals for all three elements.