homework#4

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Started: September 22, 2009 2:13 PM

Questions: 29

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1. HW4 (Q1) (Points: 1)

As usual, select one problem for which you had the wrong answer. In the text box below:

i) identify the question number you are correcting
ii) state (copy) your original wrong answer,
iii) explain where your original reasoning was incorrect, the correct reasoning for the problem, and how it leads to the right answer.
If you got all the answers correct!!! Great ... then state which was your favorite / most useful homework problem and why.

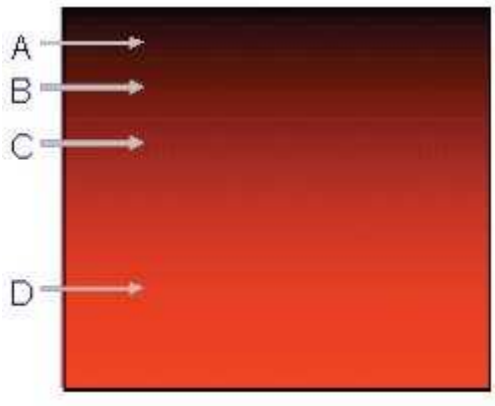
New Insert equation

Save Answer

2. HW4 (Q2) (Points: 1)

Red laser light and a variable filter are used to create the image above on the detector of a digital camera (brighter red corresponds to higher intensity). For the marked places:

What can you say about the probability that the next photon being detected will be found at location A,B,C,D:



1. The next photon is equally probably to be found at each of these locations.
2. We cannot say anything about the probability of where the next photon will be detected.
3. The probability that the next photon will be found at A is higher than at B, which is higher than

at C, which is higher than at D.

4. The probability that the next photon will be found at D is higher than at C, which is higher than at B, which is higher than at A.

Save Answer

3. HW4 (Q3) (Points: 1)

Rank the absolute value of the magnitude of the electromagnetic wave at these points:

1. We cannot say anything about the magnitude of the electromagnetic wave at these points
2. Magnitude of electromagnetic wave at A>B>C>D
3. Magnitude of electromagnetic wave at A=B=C=D
4. Magnitude of electromagnetic wave at D>C>B>A

Save Answer

4. HW4 (Q4) (Points: 1)

Increasing the intensity of the laser, means (check all that apply):

1. increasing the energy of each photon
2. decreasing the energy of each photon
3. increasing the number of photons
4. decreasing the number of photons
5. increasing the amplitude of the electromagnetic wave
6. decreasing the amplitude of the electromagnetic wave
7. increasing the total energy in the laser beam
8. decreasing the total energy in the laser beam
9. increasing the wavelength of the light
10. decreasing the wavelength of the light

Save Answer

5. HW4 (Q5) (Points: 1)

Increasing the wavelength of the laser, means (check all that apply):

1. increasing the amplitude of the electromagnetic wave
2. decreasing the amplitude of the electromagnetic wave
3. increasing the number of photons
4. decreasing the number of photons
5. increasing the energy of each photon
6. decreasing the energy of each photon

Save Answer

6. HW4 (Q6) (Points: 1)

The spatial extent (or size) of each photon right after they pass through the variable laser filter but before they get detected on the digital camera match the whole detector area of the camera.

1. True
2. False

Save Answer

7. HW4 (Q7) (Points: 1)

The spatial extent (or size) of each photon right after they pass through the variable laser filter but before they get detected on the digital camera are much smaller than the detector area of the camera.

1. True
2. False

Save Answer

8. HW4 (Q8) (Points: 1)

Rutherford discovered the basic structure of an atom by firing in alpha-particles (Helium nuclei which have 2 protons and 2 neutrons). Given Rutherford's findings about the structure of the atom, if you bombarded an atom with a spray of alpha particles, what fraction would you estimate to be scattered at very large/ glancing angles? (We are looking for an estimate, not a complicated calculation, but you should think about
the geometry of the situation such as the size of the nucleus Vs the size of the atom)
(A note on entering the answer. If you find for instance
that 1/100 particles will scatter at steep angles, enter 1E-2 with ONE significant figure)
1.

Save Answer

9. HW4 (Q9) (Points: 1)

For this problem, you will be investigating the Discharge Lamps Simulation.
Begin by exploring the 1-atom panel and the Configurable Atom. (A few non-obvious simulation controls: You can select the # of empty electronic energy levels in the configurable atom and adjust their location. And you can move the atom about in
the discharge tube.) Consider the following True/False statements:

If the spacing between two electronic energy levels in atom A is smaller than in atom B, then the wavelength of the light emitted by atom B will be longer.

1. True
2. False

Save Answer

10. HW4 (Q10) (Points: 1)

If the spacing between two electronic energy levels in atom A is smaller than in atom B, then fewer photons will be emitted by atom B.

1. True
2. False

Save Answer

11. HW4 (Q11) (Points: 1)

Photons are emitted as electrons in the atom jump up in energy

1. True

2. False

Save Answer

12. HW4 (Q12) (Points: 1)

The colors emitted by an atom does not depend on how much kinetic energy the free electron has when it hits the atom

1. True
2. False

Save Answer

13. HW4 (Q13) (Points: 1)

The colors emitted depends on the number of free electrons passing through the lamp.

1. True
2. False

Save Answer

14. HW4 (Q14) (Points: 1)

When a free electron hits an atom in this sim, the atom can be excited to an energy level higher than the KE of the electron

1. True
2. False

Save Answer

15. HW4 (Q15) (Points: 1)

The kinetic energy of the free electron at the point of collision increases as the voltage of the battery increases.

1. True
2. False

Save Answer

16. HW4 (Q16) (Points: 1)

The kinetic energy of the free electron at the point of collision is higher if the atom is further from the source of electrons

1. True
2. False

Save Answer

17. HW4 (Q17) (Points: 1)

The only way to emit IR photons is if there are empty electronic energy levels really close to the ground state (lowest energy level).

1. True
2. False

Save Answer

18. HW4 (Q18) (Points: 1)

When atomic electrons are excited to a higher level, they ultimately return to their lowest energy level.

1. True
2. False

Save Answer

19. HW4 (Q19) (Points: 1)

The electrons that are excited to a higher energy level return to the ground state because of the attractive electric force from the positively charged nucleus.

1. True
2. False

Save Answer

20. HW4 (Q20) (Points: 1)

How many possible colors can an atom with 5 electronic energy levels (Ground state through level 4) emit?
1.

Save Answer

21. HW4 (Q21) (Points: 2)

(essay) In some discharge lamps, the work function of the metal cathode is overcome by heating the electrons so they have enough thermal energy to get out. The voltage difference across the plates then give these electrons a certain amount of electrostatic potential energy. As always, energy must be conserved. Track and explain the transfers and conversions between different forms of energy that occur in a discharge lamp that make it work to produce light. Be sure to include the main physics ideas about how atoms behave which are needed to make sense of what's going on.

Remember, we're looking for 4 elements in long answers (grading rubric on long essay questions)

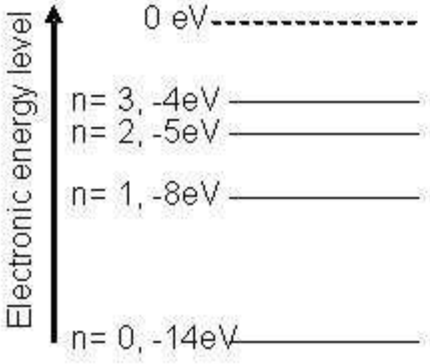
New Insert equation

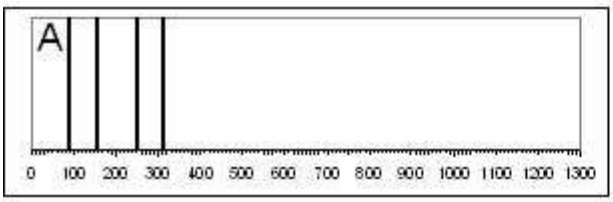
Save Answer

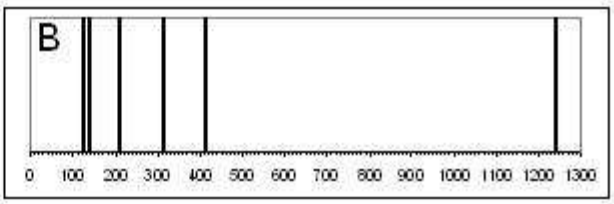
22. HW4 (Q22) (Points: 1)

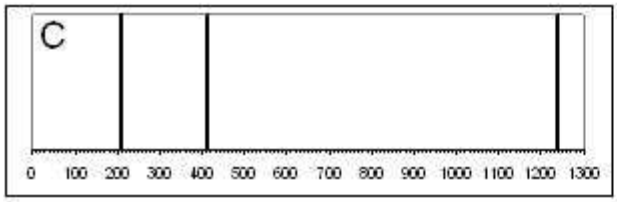
Atomic spectra are really useful because they tell us what energies electrons are allowed to have within atoms.

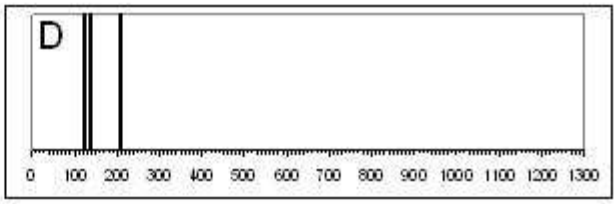
Which of the atomic spectra below includes all the emission lines you might expected from the above electronic energy level diagram?

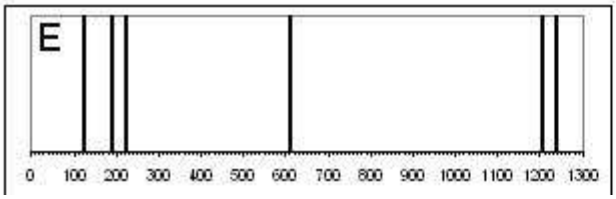


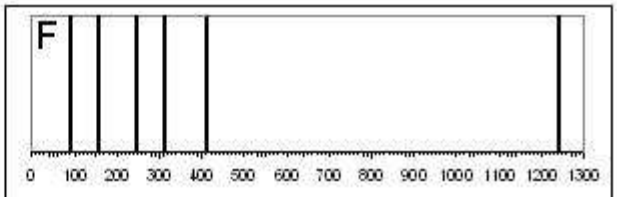












1. A
2. B
3. C
4. D
5. E
6. F

Save Answer

23. HW4 (Q23) (Points: 1)

What is the ionization energy (the amount of energy needed to liberate a ground state electron) of this atom (in eV)?

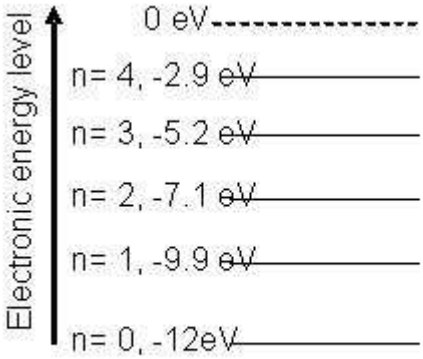
1.

Save Answer

24. HW4 (Q24) (Points: 3)

You are experimenting with new designs for discharge lights to substitute for a neon sign. The gas you have chosen for your design has the following electronic energy level diagram.

What transitions are possible in this gas? List all transitions AND the colors they correspond to.



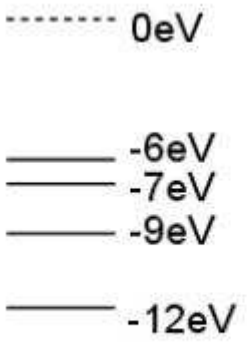
New Insert equation

Save Answer

25. HW4 (Q25) (Points: 1)

The following represents the electron energy levels diagram of an atom that you want to detect in the lab. You are considering two different methods of detection. The first uses a flame where you detect the emission spectrum of the atom. The second uses absorption spectroscopy, where you pass a white light (all colors from far UV through far IR) through a gas of the atoms and see what energies of light will you expect to detect.

At what energy level is the electron when the atom is in its ground state (for example, just write "-7", or "-6", etc)?



1.

Save Answer

26. HW4 (Q26) (Points: 1)

In the case of the absorption detector, what colors will you expect to see the sample absorb? (Think hard about this one!) (check all that apply)

- 1. 1 eV
- 2. 2 eV
- 3. 3 eV
- 4. 4 eV
- 5. 5 eV
- 6. 6 eV
- 7. 7 eV
- 8. 9 eV
- 9. 12 eV

Save Answer

27. HW4 (Q27) (Points: 1)

In the case of the flame, what energies of light will you expect to detect from the sample? (check all that apply)

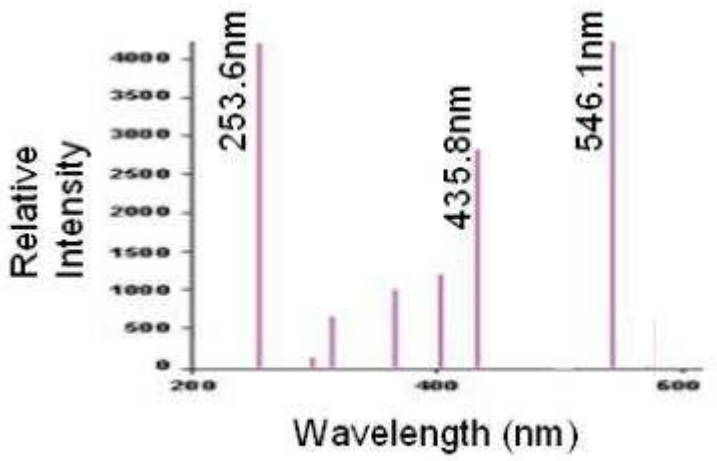
- 1. 1 eV
- 2. 2 eV
- 3. 3 eV
- 4. 4 eV
- 5. 5 eV
- 6. 6 eV
- 7. 7 eV
- 8. 9 eV
- 9. 12 eV

Save Answer

28. HW4 (Q28) (Points: 2)

You have a sample of a piece of unknown material. You want to know what the sample is, so you burn it in a flame and observe the emission with a spectrometer. You see the
following strong lines and conclude that you are looking at mercury:

(essay) You notice that the intensity of the lines are different. What can you conclude about what's happening in the atoms in the flame from this observation?



New Insert equation

Save Answer

29. HW4 (Q29) (Points: 0)

How long did it take you to complete this HW?

1. <1 hr
2. 1hr
3. 2 hr
4. 3 hr
5. 4 hr
6. 5 hr
7. 6 hr
8. >6hr

Save Answer

Finish **Save All** **Help**