Quiz E21.1

Atomic physics

1. What is the explanation of the large angle scatterings in the Rutherford scattering experiment?

A The alpha particles experienced the effect of the strong nuclear force.
B The alpha particles got very close to the nucleus and were repelled by the electric force.
C The alpha particles bounced off the high density gold foil.
D The alpha particles suffered multiple collisions with the gold atoms

2. Which is **not** a conclusion of the Rutherford scattering experiment?

A Most of the volume in an atom is empty space.
B Most of the mass of an atom is concentrated in a tiny nucleus.
C The nucleus contains the positive charge of the atom.
D The nucleus contains neutrons.

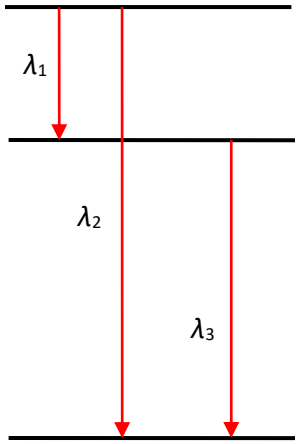
3. How many transitions leading to photon emission are there when five energy levels are involved?

A 5 **B** 8 **C** 10 **D** 12

4. What is evidence for the existence of energy levels?

A The fact that gases emit light when exposed to a high electric field.
B Atoms are electrically neutral.
C The mass of the electrons in an atom is negligible compared to the mass of the nucleus.
D The discrete wavelengths in emission and absorption spectra.

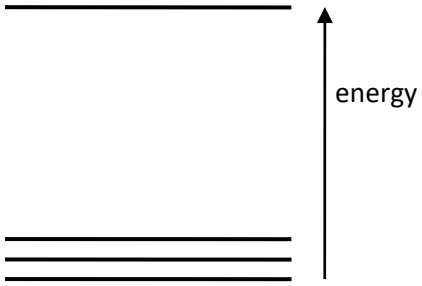
5. The photon wavelengths in the transitions below are indicated.



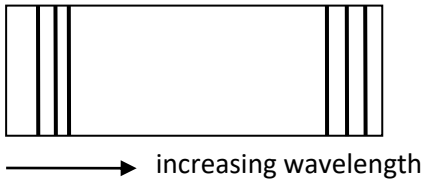
What is the correct relation between the three wavelengths?

A $\lambda_2 = \lambda_1 + \lambda_3$ **B** $\frac{1}{\lambda_2} = \frac{1}{\lambda_1} + \frac{1}{\lambda_3}$ **C** $\lambda_2 = \frac{\lambda_1 + \lambda_3}{2}$ **D** $\lambda_2 > \lambda_3 > \lambda_1$

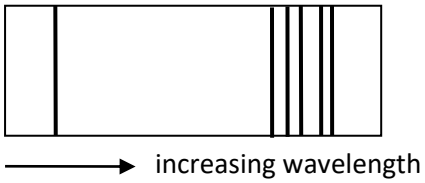
6. Four energy levels of an atom are shown.



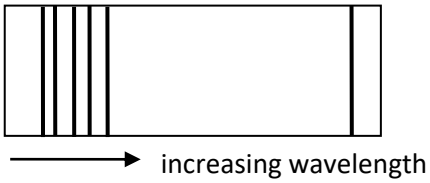
What is a possible emission spectrum of this atom?



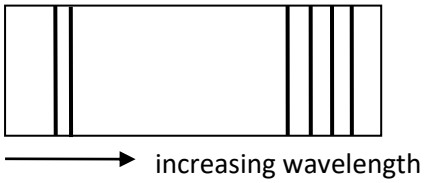
A



B



C

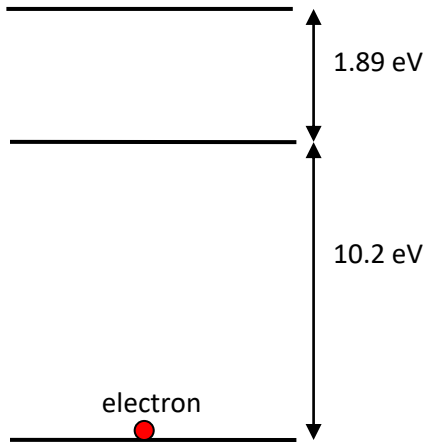


D

7. White light passes through a gas that is kept at low pressure. The transmitted light is analyzed and found to contain dark lines at certain wavelengths. What is the explanation of this observation?

A The fact that gases emit light when exposed to a high electric field.
B Atoms are electrically neutral.
C The mass of the electrons in an atom is negligible compared to the mass of the nucleus.
D Some photons are absorbed by electrons and make transitions to higher energy states.

8. The diagram shows the three lowest energy states of hydrogen and an electron in the ground state. Energy differences between levels are shown.



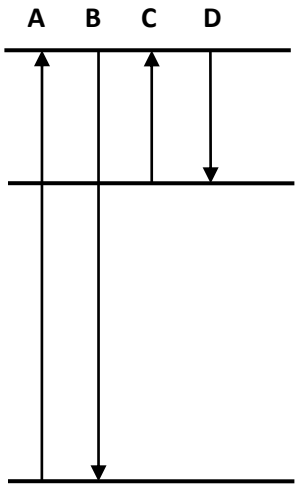
A photon of energy 11 eV is incident on this atom. What is a possible outcome for the electron and the photon?

	Electron	Photon
A	Electron moves to the next level	Scatters with energy 0.8 eV
B	Electron moves to the next level	Is absorbed by atom
C	Electron stays in ground state	Scatters with energy 11 eV
D	Electron stays in ground state	Is absorbed by atom

9. What is an estimate of the wavelength of a photon emitted in a transition between two levels separated in energy by 0.2 eV?

A 60 mm **B** 6 mm **C** 60 μm **D** 6 μm

10. Which transition corresponds to the absorption of a photon of the least wavelength?



Quiz E21.1 Answers	
1	B
2	D
3	C
4	D
5	B
6	A
7	D
8	C
9	D
10	A