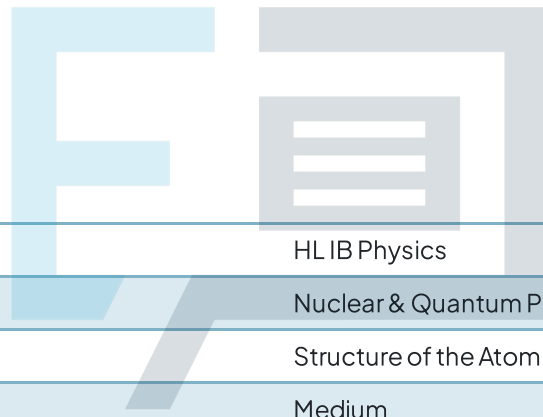




Structure of the Atom

Question Paper



Course	HL IB Physics
Section	Nuclear & Quantum Physics
Topic	Structure of the Atom
Difficulty	Medium

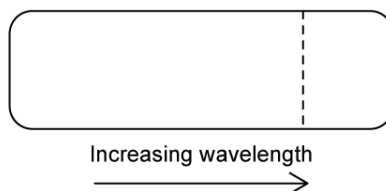
Exam Papers Practice

To be used by all students preparing for HL IB Physics
Students of other boards may also find this useful

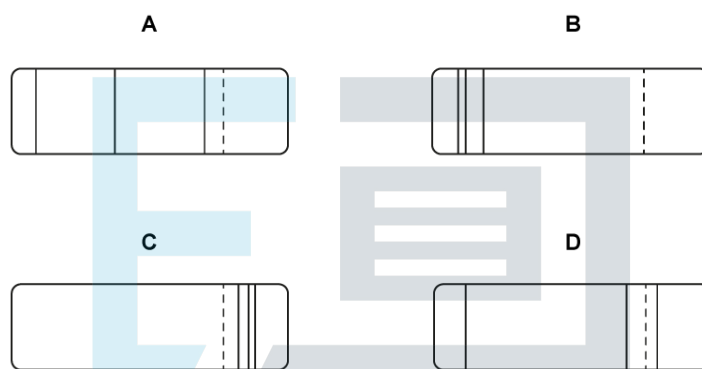
Question 1

According to the Bohr model for hydrogen, visible light is emitted when electrons make transitions from excited states down to the state with $n = 2$.

The dotted line in the diagram represents such a transition, from $n = 3$ to $n = 2$, in the spectrum of hydrogen.



Which of the following diagrams could represent the visible light emission spectrum of hydrogen?



[1 mark]

Question 2

Two elements are compared where the nucleus of the first element, N_1 has radius r and nucleon number Z , and the nucleus of the second element N_2 has radius $3r$ and nucleon number $\frac{5}{3} Z$. What is the ratio of $\frac{\text{density } N_1}{\text{density } N_2}$?

- A. $\frac{1}{5}$
- B. $\frac{4}{9}$
- C. 1
- D. $\frac{5}{2}$

[1 mark]

Question 3

The Physicists Geiger and Marsden bombarded a thin gold foil with alpha particles. They observed that

- I.
most alpha particles passed through without deflection
- II.
a very small number of alpha particles were deflected by a large angle

Select the row which explains these effects.

	I.	II.
A.	most α -particles miss the gold atoms	a small number of α -particles are deflected by the gold atoms
B.	the nucleus of the gold atom is very small so that most α -particles do not interact with it	the ratio of deflected particles is small because it reflects the ratio of the size of the nucleus compared to the atom
C.	the charge on the nucleus is insufficient to deflect the α -particle	the ratio of deflected particles is small because it reflects the ratio of the size of the nucleus compared to the atom
D.	α -particles are high energy and able to pass through the nucleus	the charges on the α -particle and the nucleus are such that large angle deflection cannot occur

[1 mark]

Question 4

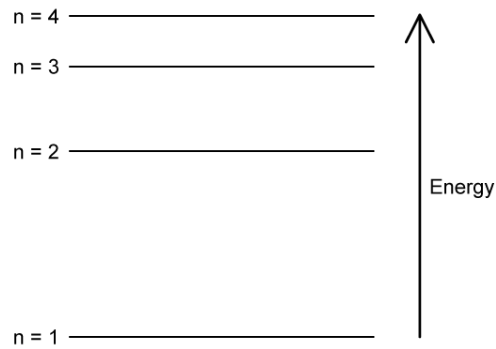
The best estimate of the radii of nuclei is determined from experiments involving

- A. The scattering of charged particles.
- B. The emission of photoelectrons due to UV light incident on a metal surface.
- C. Diffraction of high energy electron beams.
- D. Ionisation due to alpha-particle radiation.

[1 mark]

Question 5

The energy levels of an atom are shown in the diagram below.



Which transition will emit the photon with the shortest wavelength?

- A. $n = 4$ to $n = 1$
- B. $n = 2$ to $n = 1$
- C. $n = 2$ to $n = 1$
- D. $n = 4$ to $n = 3$

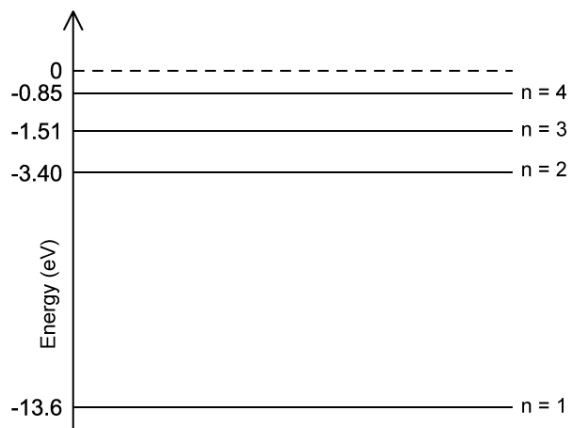


[1 mark]

Exam Papers Practice

Question 6

Hydrogen atoms feature energy levels as shown below.



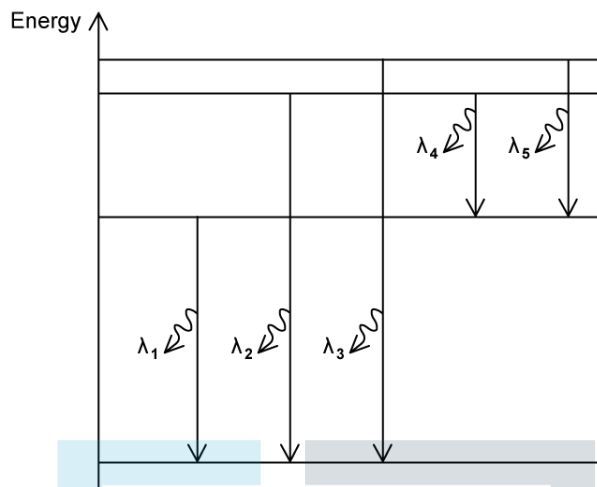
Which photon energy will **not** cause an electron to be excited or ionised in a ground state hydrogen atom?

- A. 10.2 eV
- B. 12.29 eV
- C. 12.75 eV
- D. 15.0 eV

[1 mark]

Question 7

The following is an energy level diagram for an atom. Electron transitions give rise to emission of spectrum wavelengths $\lambda_1, \lambda_2, \lambda_3, \lambda_4, \lambda_5$.



With reference to the diagram, which of the following statements is **correct**?

- A. $E_3 > E_2 > E_5 > E_1 > E_4$
- B. $f_4 > f_5 > f_1 > f_2 > f_3$
- C. $\lambda_3 > \lambda_2 > \lambda_1 > \lambda_5 > \lambda_4$
- D. $\lambda_4 > \lambda_5 > \lambda_1 > \lambda_2 > \lambda_3$

[1 mark]