TEST

JEE Mains PYQS Atoms (Physics Master Academy)

QUESTIONS

SECTIONS

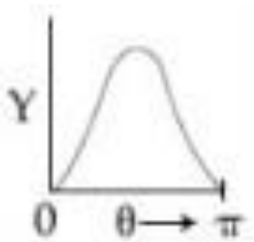
1. Section A - 25 Questions

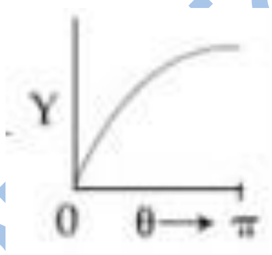
Section 1 : Section A - 25 Questions

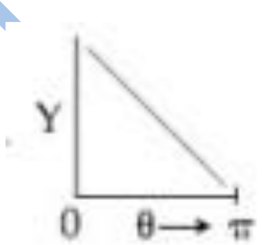
SECTION INSTRUCTIONS

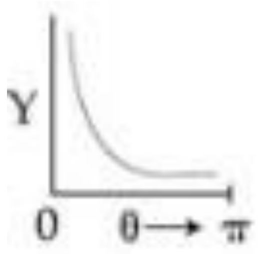
This section contains 25 MCQs. +4 ofr every correct answer, -1 for every incorrect answer.

1 The graph which depicts the results of Rutherford gold foil experiment with α particles is: [θ: scattering angel, Y: Number of scattered α-particles detected (Plots are schematic and not to scale)]

○ 

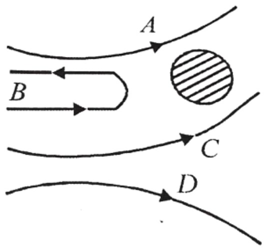
○ 

○ 



Correct: +4 · Incorrect: -1

2 In the Rutherford experiment, α-particles are scattered form a nucleus as shown. Out of four paths, which path is not possible?



- D
- B
- C
- A

Correct: +4 · Incorrect: -1

3 An alpha nucleus of energy ½ mv^2 bombards a heavy nuclear target of charge Ze. Then the distance of closest approach for the alpha nucleus will be proportional to

- v^2
- 1/m
- $1/v^2$
- 1/Ze

Correct: +4 · Incorrect: -1

4 A free electron o f2.6eV energy collides with a H^+ ion, This results in the formation of a hydrogen atom in the krst excited state and a photon is released. Find the frequency of the emitted photon. ($h = 6.6\times10^{-34}$Js)

- 1.45×10^{16}MHz
- 0.19×10^{15}MHz

- ◯ 1.45×10^{9}MHz
- ◯ 9.0×10^{27}MHz

Correct: +4 · Incorrect: -1

5 X different wavelength s may be observed in the spectrum from a hydrogen sample if the atoms are excited to states with principal quantum number n -= 6? The value of X is

- ◯ 5
- ◯ 10
- ◯ 15
- ◯ 20

Correct: +4 · Incorrect: -1

6 A particle hydrogen like ion emits radiation of frequency 2.92×10^{15}Hz when ti makes transition from n = 3 to n = 1. The frequency in Hz of radiation emitted in transition from n =2 to n = 1 will be

- ◯ 0.44×10^{15}
- ◯ 6.57×10^{15}
- ◯ 4.38×10^{15}
- ◯ 2.46×10^{15}

Correct: +4 · Incorrect: -1

7 In Bohr's atomic model, the electron is assumed to revolve in a circular orbit of radius $0.5\mathring{A}$. IF the speed of electron in 2.2×10^{6}m/s, then the current associated with the electron will be __ $\times10^{-2}$mA. (take π = 22/7)

- ◯ 100
- ◯ 105
- ◯ 112
- ◯ 115

Correct: +4 · Incorrect: -1

8 Imagine that the electron in a hydrogen atom is replaced by a muon (μ). The mass of muon particle is 207 times that of an electron and charge is equal to the charge of an electron. The ionization potential of this hydrogen atom will be

○ 331.2eV

○ 2815.2eV

○ 13.6eV

○ 27.2eV

Correct: +4 · Incorrect: -1

9 If λ_1 and λ_2 are the wavelengths of the third member of Lyman and krst member of Paschen series respectively, then the value of $\lambda_1 : \lambda_2$ is

○ 1:3

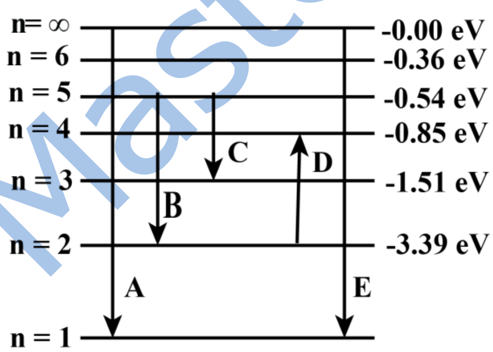
○ 7:108

○ 7:135

○ 1:9

Correct: +4 · Incorrect: -1

10 In the kgure, the energy levels of hydrogen atoms have been shown along with some transitions marked A, B, C, D and E. The transitions A, B and C respectively represent



○ The ionization potential of hydrogen, second member of Balmer series and third member of Paschen series

○ The krst member of Lyman series, third member of Balmer series and second member of Paschen series

○ The series limit of Lyman series, third member of Balmer series and second member of Paschen series

○ The series limit of Lyman series, second member of Balmer series and second member of Paschen series

Correct: +4 · Incorrect: -1

11 According to Bohr atom model, in which or the following transitions will the frequency be maximum?

○ n = 4 to n = 3

- n = 2 to n = 1
- n = 5 to n = 4
- n = 3 to n = 2

Correct: +4 · Incorrect: -1

12 A particle of mass 200 MeV/c^2 collides with a hydrogen atom at rest. Soon after the collision the particle comes to rest, and the atoms recoils and goes to its krst excited state. The initial kinetic energy of the particle (in eV) is N/4. The value of N is___(given the mass of the hydrogen to be 1 GeV/c^2)

- 49
- 50
- 51
- 52

Correct: +4 · Incorrect: -1

13 In the line spectra of hydrogen atom, difference between the largest and the shortest wavelengths of the Lyman series is 304$\mathring{A}$. The corresponding difference for the Paschen series in
$\mathring{A}$
is ___

- 10550
- 10553.14
- 10552.68
- 10551.86

Correct: +4 · Incorrect: -1

14 The energy required to ionize a hydrogen like ion in its ground state is 9 Rydbergs. What is the wavelength of the radiation emitted when the electron in this ion jumps from the second excited state to the ground state?

- 24.2nm
- 11.4nm
- 35.8nm
- 8.6nm

Correct: +4 · Incorrect: -1

15 The time period of revolution of electron in its ground state orbit in a hydrogen atom is 1.6×10^{-16}s. The frequency of revolution of the electron in its krst excited state (in s^{-1}) is

- ○ 1.6×10^{14}
- ○ 7.8×10^{14}
- ○ 6.2×10^{15}
- ○ 5.6×10^{12}

Correct: +4 · Incorrect: -1

16 An excited He^{+} ion emits two photons in succession with wavelengths 108.5 nm and 30.4nm in making a transition to ground state. The quantum number n corresponding to its initial excited state is (for photon of wavelength >>, energy E =

$$\frac{1240\,eV}{\lambda(¿nm)}$$

- ○ n = 4
- ○ n = 5
- ○ n = 7
- ○ n = 6

Correct: +4 · Incorrect: -1

17 The electron in a hydrogen atom krst jumps from the third excited state to the second state and subsequently to the krst excited state. The ratio of the respective wavelengths λ_1/λ_2 of the photons emitted in this process is

- ○ 20/7
- ○ 27/5
- ○ 7/5
- ○ 9/7

Correct: +4 · Incorrect: -1

18 Consider an electron in a hydrogen atom, revolving in its second excited state (having radius 4.65$\mathring{A}$). The de-Broglie wavelength of this electron is

- ○ 3.5$\mathring{A}$
- ○ 6.6$\mathring{A}$

○ 12.9$\mathring{A}$

○ 9.7$\mathring{A}$

Correct: +4 · Incorrect: -1

19 Taking the wavelength of krst Balmer line in hydrogen spectrum (n = 3 to n = 2) as 660nm, the wavelength of the 2^{nd} Balmer line (n = 4 to n = 2) will be

○ 889.2nm

○ 488.9nm

○ 642.7nm

○ 388.9nm

Correct: +4 · Incorrect: -1

20 A He^+ ion in its krst excited state. TIs ionization energy is

○ 48.36eV

○ 54.40eV

○ 13.60eV

○ 6.04eV

Correct: +4 · Incorrect: -1

21 Radiation coming from transitions n = 2 to n = 1 of hydrogen atoms fall on He^+ ions in n =- 1 and n = 2 states. The possible transition of helium ions as they absorb energy from the radiation is

○ n = 2 $\rightarrow$ n = 3

○ n = 1 $\rightarrow$ n = 4

○ n = 2 $\rightarrow$ n = 5

○ n = 2 $\rightarrow$ n = 4

Correct: +4 · Incorrect: -1

22 In a hydrogen like atom, when an electron jumps from the M shell to L shell, the wavelength of emitted radiation is 1. If an electron jumps from N shell to L shell the wavelength of emitted radiation will be

- $\frac{27}{20}\lambda$
- $\frac{16}{25}\lambda$
- $\frac{25}{16}\lambda$
- $\frac{20}{27}\lambda$

Correct: +4 · Incorrect: -1

23 An electron from various excited state states of hydrogen atom emit radiation to come to the ground state. Let λ_n , λ_g be the de-Broglie wavelength of the electron in the nth state and the ground state respectively. Let
Λ_n
be the wavelength of the emitted proton in the transition from the nth state to the ground state. For large n, (A, B are constants)

- $\Lambda_n = A + \frac{B}{\lambda_n^2}$
- $\Lambda_n = A + B\lambda_n$
- $\Lambda_n^2 = A + B\lambda_n^2$
- $\Lambda_n^2 \approx \lambda$

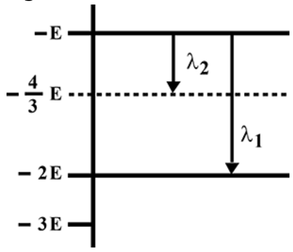
Correct: +4 · Incorrect: -1

24 The energy required t remove the electron from a singly ionized Helium atom is 2.2 times the energy required to remove an electron from Helium atoms. The total energy required to ionize the Helium atom completely is

- 20eV
- 79eV
- 109eV
- 34eV

Correct: +4 · Incorrect: -1

25 Some energy levels of a molecule are shown in the kgure. The ratio of the wavelengths $r = \lambda_1/\lambda_2$ is given by



- ◯ r = 3/4
- ◯ r = 1/3
- ◯ r = 4/3
- ◯ r= 2/3

Correct: +4 · Incorrect: -1

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ANSWERS

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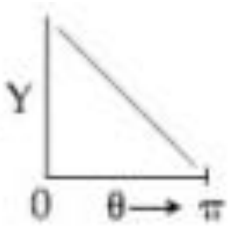
1 

2 C

3 1/m

4 1.45×10^{9}MHz

5 15

6 2.46×10^{15}

7 112

8 2815.2eV

9 7:135

10 The series limit of Lyman series, third member of Balmer series and second member of Paschen series

11 n = 2 to n = 1

12 51

13 10553.14

14 11.4nm

15 7.8×10^{14}

16 n = 5

17 20/7

18 $9.7 \mathring{A}$

19 488.9nm

20 13.60eV

21 $n = 2 \rightarrow n = 4$

22 $\frac{20}{27}\lambda$

23 $\Lambda_n = A + \frac{B}{\lambda_n^2}$

24 79eV

25 r = 1/3

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