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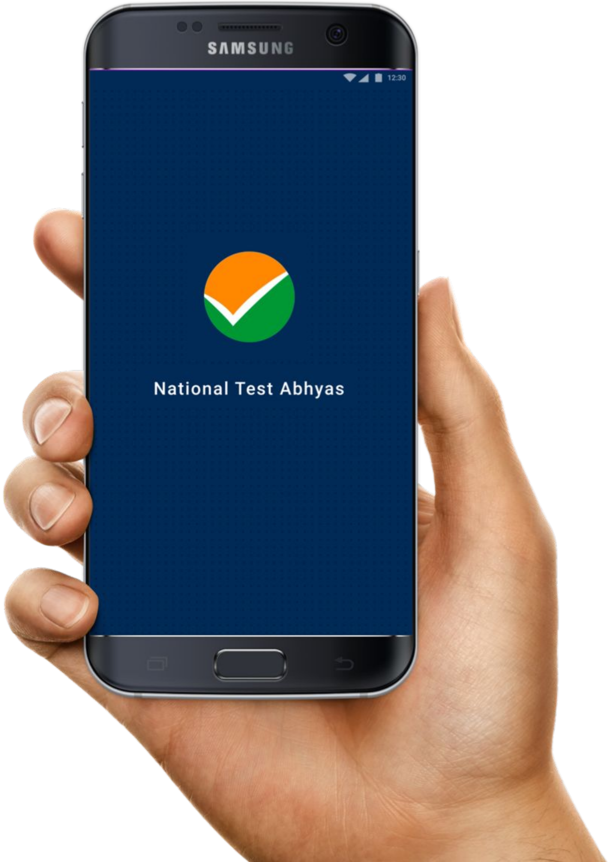


Modern Physics

A particle A of mass m and initial velocity v collides with a particle B of mass $\frac{m}{2}$ which is at rest. The collision is head on, and elastic. The ratio of the de-Broglie wavelengths λ_A to λ_B after the collision is:

A $\frac{\lambda_A}{\lambda_B} = \frac{1}{2}$

B $\frac{\lambda_A}{\lambda_B} = \frac{1}{3}$

C $\frac{\lambda_A}{\lambda_B} = 2$

D $\frac{\lambda_A}{\lambda_B} = \frac{2}{3}$

Two radioactive materials X_1 and X_2 have decay constants 10λ and λ respectively. If initially they have the same number of nuclei, then the ratio of the number of nuclei of X_1 to that of X_2 will be $1/e$ after time

A $\frac{1}{10\lambda}$

B $\frac{1}{11\lambda}$

C $\frac{11}{10\lambda}$

D $\frac{1}{9\lambda}$

The binding energy per nucleon of deuteron (^2_1H) and helium nucleus (^4_2He) is 1.1 MeV and 7 MeV respectively. If two deuteron nuclei react to form a single helium nucleus, then the energy released is

A 13.9 MeV

B 26.9 MeV

C 23.6 MeV

D 19.2 MeV

A radioactive nucleus (initial mass number A and atomic number Z) emits $3\ \alpha$ – particles and 2 positrons. The ratio of the number of neutrons to that of protons in the final nucleus will be

A $\dfrac{A-Z-8}{Z-4}$

B $\dfrac{A-Z-4}{Z-8}$

C $\dfrac{A-Z-12}{Z-4}$

D $\dfrac{A-Z-4}{Z-2}$

If the radius of the $^{27}_{13}Al$ nucleus is estimated to be 3.6 Fermi, then the radius of $^{125}_{52}Te$ nucleus be nearly :

A 6 Fermi

B 8 Fermi

C 4 Fermi

D 5 Fermi

What should be the velocity of an electron so that its momentum becomes equal to that of a photon of wavelength 5200 Å?

A 700 ms^{-1}

B 1000 ms^{-1}

C 1400 ms^{-1}

D 2800 ms^{-1}

The particle A is converted into C via the following reaction.

$$A \rightarrow B + {}_2\mathrm{He}^4$$

$$B \rightarrow C + 2e^-$$

Then

A A and C are isobars

B A and C are isotopes

C A and B are isobars

D A and B are isotopes

The surface of the metal is illuminated with the light of 400 nm. The kinetic energy of the ejected photoelectrons was found to be 1.68 eV, the work function of the metal is

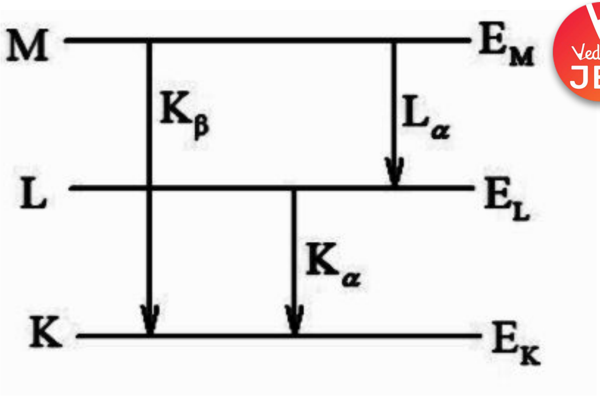
A 1.51 eV

B 1.42 eV

C 3.0 eV

D 1.68 eV

Let λ_α, λ_β and λ'_α denote the wavelengths of the X-rays of the K_α, K_β and L_α lines in the characteristic X-rays for a metal. Then,



A $\dfrac{1}{\lambda_\beta} = \dfrac{1}{\lambda_\alpha} + \dfrac{1}{\lambda'_\alpha}$

B $\dfrac{1}{\lambda'_\alpha} = \dfrac{1}{\lambda_\beta} + \dfrac{1}{\lambda_\alpha}$

C $\dfrac{1}{\lambda_\alpha} = \dfrac{1}{\lambda_\beta} + \dfrac{1}{\lambda'_\alpha}$

D $\lambda_\alpha = \lambda_\beta + \lambda'_\alpha$

If λ is the wavelength of hydrogen atom from the transition n =3 to n=1, then what is the wavelength for doubly ionised lithium ion for same transition?

A $\frac{\lambda}{3}$

$$\frac{1}{\lambda} = RZ^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

B 3λ

C $\frac{\lambda}{9}$

D 9λ

If stopping potentials corresponding to wavelength $4000\ \mathring{A}$ and $4500\ \mathring{A}$ are $1.3\ V$ and $0.9\ V$, respectively, then the work function of the metal is

A 0.3 eV

B 1.3 eV

C 2.3 eV

D 5 eV

80 kg of a radioactive material reduces to 10 kg in 1 h. The decay constant of the material is

A $5.80 \times 10^{-4}\ s^{-1}$

B $1.16 \times 10^{-3}\ s^{-1}$

C $2.32 \times 10^{-3}\ s^{-1}$

D $4.64 \times 10^{-3}\ s^{-1}$

The half-life of a radioactive isotope X is 50 years. It decays to another element Y which is stable. The two elements X and Y were found to be in the ratio of 1 : 16 in a sample of a given rock. The age of the rock was estimated to be

A 150 years

B 200 years

C 250 years

D 100 years

The angular momentum of an electron in Bohr's hydrogen atom whose energy is - 3.4 eV, is

A $\frac{5h}{2\pi}$

B $\frac{h}{2\pi}$

C $\frac{h}{\pi}$

D $\frac{2h}{3\pi}$

A radioactive sample S_1 having the activity A_1 has twice the number of nuclei as another sample S_2 of activity A_2. If $A_2 = 2A_1$, then the ratio of half-life of S_1 to the half-life of S_2 is

A 4

B 2

C 0.25

D 0.75

When radiation is incident on a photoelectron emitter, the stopping potential is found to be $9\ \text{V}$. If e/m for the electron is $1.8 \times 10^{11}\ \text{C Kg}^{-1}$, the maximum velocity the ejected electron is

A $6 \times 10^5\ \text{ms}^{-1}$

B $8 \times 10^5\ \text{ms}^{-1}$

C $1.8 \times 10^6\ \text{ms}^{-1}$

D $1.8 \times 10^5\ \text{ms}^{-1}$

A photocell is illuminated by a small bright source placed $1\ \mathrm{m}$ away. When the same source of light is placed $(1/2)\ \mathrm{m}$ away, the number of electrons emitted by photocathode would

A Decrease by a factor of 2

B Increase by a factor of 2

C Decrease by a factor of 4

D Increase by a factor of 4

A radioactive material decays by simultaneous emission of two particles with half-lives 1620 yr and 810 yr respectively. The time in year after which one-fourth of the material remains, is

A 4860 yr

B 3240 yr

C 2340 yr

D 1080 yr

Monochromatic light of frequency 6.0×10^{14} Hz is produced by a laser. The power emitted is 2×10^{-3} W. The number of photons emitted, on an average, by the source per second is $n \times 10^{15}$ where n is an integer. Find the value of n?

In an experiment on photoelectric emission from a metallic surface, the wavelength of incident light is 2×10^{-7} m and stopping potential is 2.5 V. The threshold frequency of the metal (in Hz) approximately is (charge on electron $e = 1.6 \times 10^{-19}$ C, Planck's constant $h = 6.6 \times 10^{-34}$ J s)

A 12×10^{15}

B 9×10^{15}

C 9×10^{14}

D 12×10^{13}

Homework Question

How to utilize remaining 30 days??

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