The magnitude of De broglie wavelength (λ) of electron (e), proton (p), neutron (n) and α - particle (α) all having the same kinetic energy of 1MeV, in the increasing order will follow the sequence :

(1) $\lambda_e, \lambda_p, \lambda_n, \lambda_\alpha$ (2) $\lambda_e, \lambda_n, \lambda_p, \lambda_\alpha$

(3) $\lambda_\alpha, \lambda_n, \lambda_p, \lambda_e$ (4) $\lambda_p, \lambda_e, \lambda_\alpha, \lambda_n$

Deutron → ^2_1H (+e)

Proton → ^1_1H (+e)

$\lambda = \frac{h}{p}$.

e^-, p, n, α (+2e)

(-e) (+e)

^4_2He → $\boxed{n+p}$ → $\boxed{p}$

$m_e < m_p < m_n < m_\alpha$

$\lambda = \frac{h}{\sqrt{2mK}}$

$\lambda \propto \frac{1}{\sqrt{m}}$

The ratio of wavelength of deutron and proton accelerated through the same potential difference will be -

$\lambda_p = \frac{h}{\sqrt{2mK}}$

$K_p = K_d$

$p \rightarrow m$

$d \rightarrow 2m$

$\lambda_d = \frac{h}{\sqrt{4mK}}$

$\frac{\lambda_d}{\lambda_p} = \sqrt{\frac{2}{4}} = 1/\sqrt{2}$

(1) $\frac{1}{\sqrt{2}}$ ✓

(2) $\sqrt{\frac{2}{1}}$

(3) $\frac{1}{2}$

(4) $\frac{2}{1}$

In davisson-Germer experiment, the filament emits :-

(1) Photons

(2) Protons

(3) X - rays

(4) Electrons

In the Davisson and Germer experiment, the velocity of electrons emitted from the electron gun can be increased by :

(1) increasing the potential difference between the anode and filament

(2) increasing the filament current

(3) decreasing the filament current

(4) decreasing the potential difference between the anode and filament

Light of wavelength 500 nm is incident on a metal with work function 2.28 eV. The de Broglie wavelength of the emitted electron is :-

(1) $\leq 2.8 \times 10^{-12}$ m

(2) $< 2.8 \times 10^{-10}$ m

(3) $< 2.8 \times 10^{-9}$ m

(4) $\geq 2.8 \times 10^{-9}$ m

$h\nu = \frac{124\cancel{00}}{50\cancel{00}} = \frac{12.4}{5}$

$K_{max} = h\nu - \phi$

$= 2.48\,eV$

2.28

$K_{max} \rightarrow \boxed{0.2\,eV}$

$\lambda = \frac{12.27\,\mathring{A}}{\sqrt{V}}$

$\boxed{\lambda = \frac{12.27\,\mathring{A}}{\sqrt{0.2}}}$

λ_{max} ?

λ_{min}

$\lambda \geq \frac{h}{\sqrt{2mK}}$

$\lambda \geq \frac{h}{\sqrt{2m \times 0.2\,eV}}$

ABLES KOTA

ABLES KOTA

An electron is accelerated through a potential difference of 10,000 V. Its de Broglie wavelength is, (nearly): ($m_e = 9 \times 10^{-31}$ kg)

(1) 12.2×10^{-13} m ✓(2) 12.2×10^{-12} m

(3) 12.2×10^{-14} m (4) 12.2 nm

$$\lambda = \frac{12.27\,\mathring{A}}{\sqrt{10^4}}$$

$$= 12.27 \times 10^{-12}$$

ABLES KOTA

The de-Broglie wavelength of a neutron in thermal equilibrium with heavy water at a temperature T (Kelvin) and mass m, is :-

(1) $\frac{h}{\sqrt{3mkT}}$ ✓

(2) $\frac{2h}{\sqrt{3mkT}}$

(3) $\frac{2h}{\sqrt{mkT}}$

(4) $\frac{h}{\sqrt{mkT}}$

$E_k = \frac{f}{2} kT$

$f = 3$

$E_k = \frac{3}{2} kT$

$\lambda = \frac{h}{\sqrt{2mE_k}}$

$= \frac{h}{\sqrt{3mkT}}$

The de-Broglie wavelength of a neutron in thermal equilibrium with heavy water at a temperature T (Kelvin) and mass m, is :-

(1) $\frac{h}{\sqrt{3mkT}}$ (2) $\frac{2h}{\sqrt{3mkT}}$

(3) $\frac{2h}{\sqrt{mkT}}$ (4) $\frac{h}{\sqrt{mkT}}$

$E_k = \frac{3}{2}kT$

$2E_k = 3kT$

$2mE_k = 3mkT$

$\downarrow$

$p^2 \Rightarrow p = \sqrt{3mkT}$

$\lambda = h/p$

$$\lambda = \frac{h}{mV_0\left(1+\frac{eE_0}{mV_0}t\right)} =$$

ABLES KOTA

An electron of mass m with an initial velocity $\vec{V} = V_0\hat{i}(V_0 > 0)$ enters an electric field $\vec{E} = -E_0\hat{i}$ (E_0 = constant >0) at t = 0. If λ_0 is its de-Broglie wavelength initially, then its de-Broglie wavelength at time t is :-

(1) $\dfrac{\lambda_0}{\left(1+\dfrac{eE_0}{mV_0}t\right)}$ ✓

(2) $\lambda_0\left(1+\dfrac{eE_0}{mV_0}t\right)$

(3) $\lambda_0 t$

(4) λ_0

$$\lambda_0 = \frac{h}{mV_0}$$

$$V = V_0 + \left(\frac{eE_0}{m}\right)t$$

$$\lambda = \frac{h}{mV}$$

$$= \frac{h}{m\left(V_0+\left(\frac{eE_0}{m}\right)t\right)}$$

$$= \frac{h}{mV_0\left(1+\frac{eE_0}{mV_0}t\right)}$$

A proton and an α–particle are accelerated from rest to the same energy. The de Broglie wavelengths λ_p and λ_α are in the ratio,

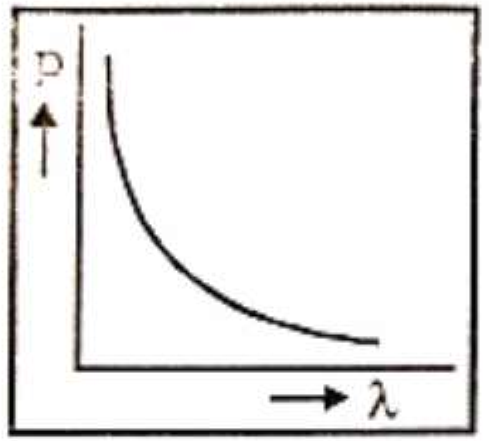
(1) 2 : 1 (2) 1 : 1

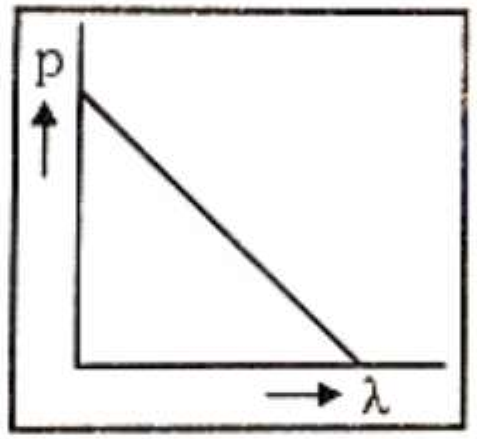
(3) $\sqrt{2} : 1$ (4) 4 : 1

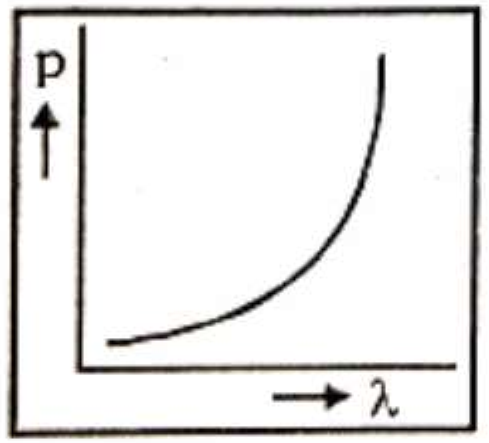
$\lambda \propto 1/\sqrt{m}$

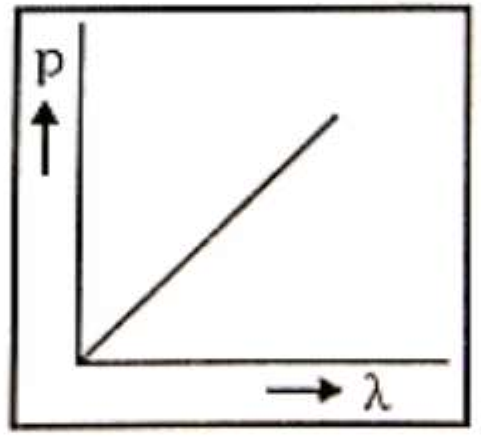
$m_\alpha = 4 m_p$

Which of the following figures represent the variation of particle momentum and the associated de-Broglie wavelength ?

(1) 

(2) 

(3) 

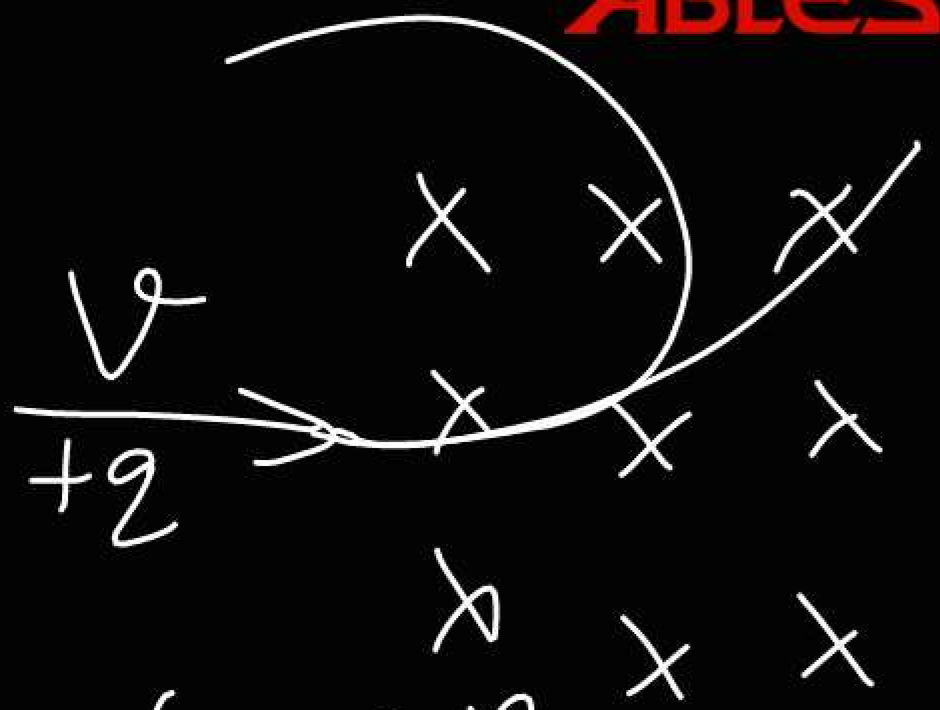
(4) 

An α-particle moves in a circular path of radius 0.83 cm in the presence of a magnetic field of 0.25 Wb/m^2. The de Broglie wavelength associated with the particle will be :

(1) 10Å (2) 0.1Å (3) 1Å (4) 0.01Å

An α-particle moves in a circular path of radius 0.83 cm in the presence of a magnetic field of 0.25 Wb/m^2. The de Broglie wavelength associated with the particle will be :

(1) 10Å (2) 0.1Å (3) 1Å (4) 0.01Å



$$\vec{F} = q(\vec{v} \times \vec{B})$$

B

$$\lambda = \frac{h}{qBr}$$

$$= \frac{6.62\times10^{-34}}{2\times1.6\times10^{-19}\times25\times0.83\times10^{-2}}$$

$$\frac{mv}{r} = qB$$

$$\boxed{mv = qBr}$$

$$\boxed{p = qBr}$$

$$\frac{mv^2}{r} = qvB$$

$$\boxed{r = \frac{mv}{qB}}$$

Determination of e/m by Thomson

$e \leftarrow$ Milikan's Oil Drop Expt

$\frac{e}{m_e} = \frac{E^2}{2B^2V}$

$eV = \frac{1}{2} m_e \times \left(\frac{E}{B}\right)^2$

if both $\vec{E}$ & $\vec{B}$ are ON.

$\boxed{eE = evB}$

$eV = \frac{1}{2} m_e v^2$

$\boxed{v = E/B}$

$\boxed{c = E_0/B_0}$