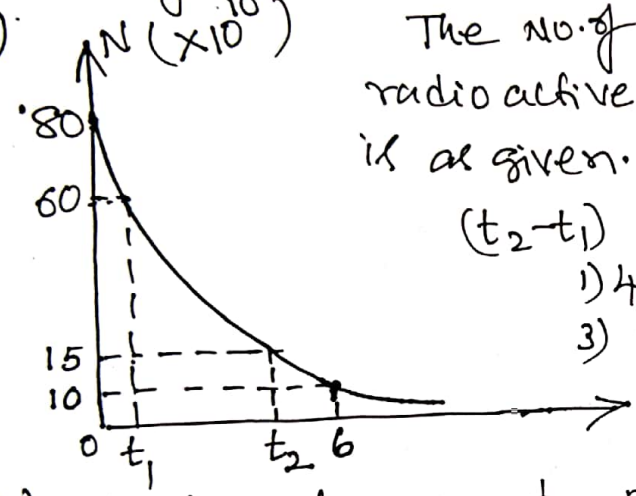
JEE-ADVANCED - TEST ① - 2020.

TOPIC ~~Atomic & Nuclei~~ Nuclear physics.

I. only one option correct.

1) 

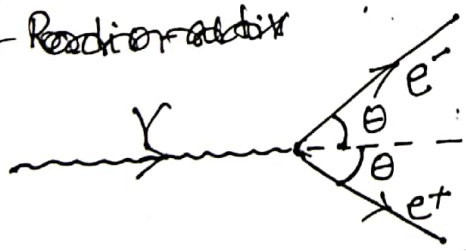
The No. of active nuclei in a radioactive sample ~~is~~ V/s time is as given. Then the value of $(t_2 - t_1)$ is

1) 4 days 2) $2\ln 2$ days
3) 1.5 days 4) $3\ln 2$ days.

2) Starting at 10 A.M the probability of a particular radioactive nucleus to be present without undergoing upto 11 A.M is P, in a sample. Now starting at 11 AM the probability of that particular nucleus to be decayed by 1 P.M is

1) $(1-P)$ 2) $(1-2P)$ 3) $(1-P/2)$ 4) $(1-P/4)$

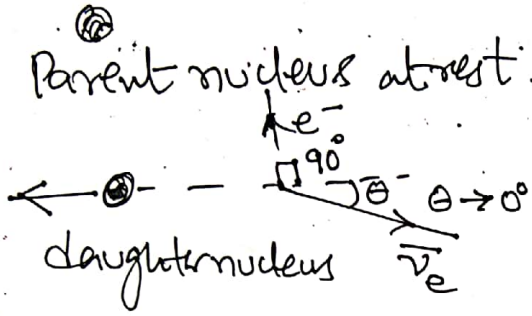
3) ~~A Radioactivity~~



A photon of energy 2.02 MeV produce electron, positron pair (each of mass 0.51 MeV/c^2) as shown, Then

1) e^- and e^+ both have same momentum and energy
2) e^- and e^+ both have same energy but different momenta
3) e^- and e^+ both have same momenta but different energies
4) e^- and e^+ both have diffent momenta and energies.

4)



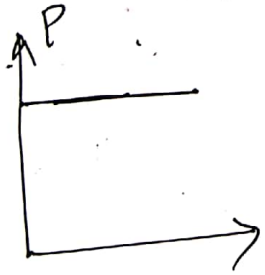
In the above decay

~~maximum energy~~

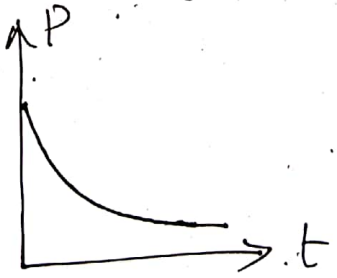
1) electron carries maximum energy
2) antineutrino carries maximum energy
3) daughter nucleus carries maximum energy
4) electron and antineutrino may carry same energy.

5) In a Radio active sample, the variation of Probability of disintegration (P) of a particular nucleus with time 't' is shown correctly in (Assuming it stays undecayed till last)

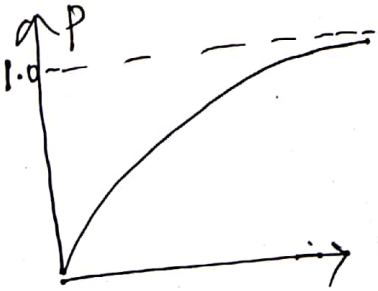
1)



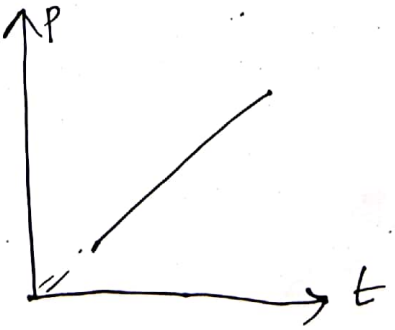
2)



3)



4)



II one (or) more than one option/options correct.

(1) A Radio active nuclide has half life 2 days. Then select correct statement.

1) In the sample the probability that a particular nucleus remain undecayed in the next 4 days is 1/4.

2) The probability that a particular nucleus which has survived first 2 days will decay in next two days is 1/2

3) The probability that a particular nucleus which has survived first 2 days will decay in next two days is 3/4.

4) If sample has only 20 nuclei, in 2 days 10 nuclei will decay.

(2) select wrong statement/statements.

1) ${}_1^3H$ is unstable and after emitting β^- & $\bar{\nu}$ converts into ${}_2^3He$

2) ${}_1^3H$ is unstable and after emitting β^- & ν converts into ${}_2^3He$.

3) ${}_2^3He$ is unstable and after emitting β^+ & ν converts into ${}_1^3H$

4) ${}_2^3He$ is unstable and after emitting β^+ & $\bar{\nu}$ converts into ${}_1^3H$.

(3). Radiations from two radio-active samples A (α-emitter) and B (neutrino emitter). Then select correct statements

1) Though α-Particles have same K.E a few of them have lesser K.E than that of others.

2) Some positrons with energy spectrum are observed

3) If neutrinos are due to K-electron capture they show no energy spectrum.

4) α-particles show energy spectrum.

(4) Select wrong statement/statements.

(1) If Proton number is more than neutron number such a nucleus is always unstable.

(2) comparing α and β^- of same energy (Assume neutron number $\neq 0$) ionisation and penetration power of α is more than that of β^-

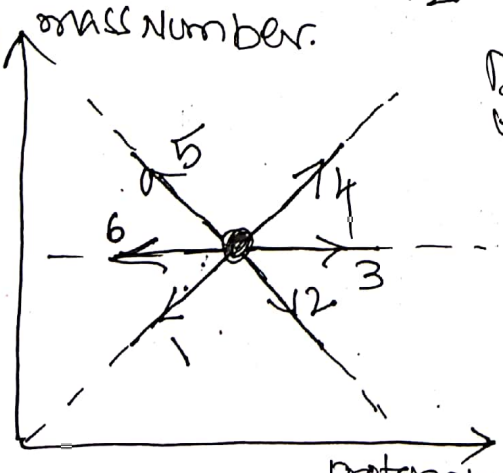
(3) when $^{234}_{92}U$ nucleus decays to $^{230}_{90}Th + ^{4}_{2}He$, thorium nucleus continues to have 92 electrons circling it.

(4) In the decay $^{12}_{5}B \rightarrow ^{12}_{6}C + ^{0}_{-1}e + \bar{\nu}_e$

spins of electron and antineutrino ~~are~~

Can be $+1/2$ and $-1/2$

(5)



Dot indicates parent unstable nucleus. Finally stable daughter nucleus formed. Then impossible transition/transitions.

1) 2 2) 4

3) 6 4) 5

III integer type.

(1). A radio active substance is a mixture of two radio active samples, one having N_0 number of nuclei of disintegration constant $3\lambda_0$, the other has $2N_0$ nuclei and of disintegration constant λ_0. If effective disintegration constant of mixture is $\frac{9\lambda_0}{x}$ find x?

(2) Radio-active nuclei of element $\overset{x}{\text{A}}$ are produced at rate t^3 at any time t. Element x has mean life τ. It is observed that at time t_0 $\frac{dN}{dt}$ is minimum where N is number of nuclei of x at time t. Then number of nuclei of x at time to is $(x t_0^2\tau^2 = t_0^3\tau)$. Find x)

(3). In a mixture two different radio active nuclides A and B of decay constants λ hr^{-1} and 2λ hr^{-1} are present. Initially 75% of total decay comes from B. After time t_0 hr 75% of total decay comes from A. If $\lambda = \ln 3$ find t_0?

IV.

column I	column II
A. Particle emitted by unstable nucleus	P γ
B. Particle with +ve charge	Q α
C. particle with no rest mass	R β^-
D. Particle that can ionise matter.	S ν (neutrino)
	T β^+

correct matching is

1) A → PQRST, B → Q,T C → P D → PQRT

2) A → PQRST B → Q,T C → P D → PQRST

3) A → PQRST B → Q,T C → PS D → PQRT

4) A → PQRST B → Q,T C → PS D → PQRST