Nuclei

Q.No.1: Half – lives of two radioactive elements A and B are 20 minutes and 40 minutes, respectively. Initially the samples have equal number of nuclei. After 80 minutes, the ratio of decayed numbers of A and B nuclei will be : **JEE 2016**

A. 4 : 1

B. 1 : 4

C. 5 : 4

D. 1 : 16

Q.No.2: A radioactive nucleus A with a half life *T*, decays into a nucleus B. At *t* = 0, there is no nucleus B. At sometime *t*, the ratio of the number of B to that of A is 0.3. Then, *t* is given by : **JEE 2017**

A. $t = \frac{T}{\log(1.3)}$

B. $t = \frac{T}{2}\frac{\log 2}{\log 1.3}$

C. $t = T\frac{\log\ 1.3}{\log\ 2}$

D. $t = T\ \log\ (1.3)$

Q.No.3: A sample of radioactive material A, that has an activity of 10 mCi(1 Ci = 3.7×10^{14} decays/s), has twice the number of nuclei as another sample of a different radioactive material B which has an activity of 20 mCi. The correct choices for half-lives of A and B would then be respectively: **JEE 2019**

A. 5 days and 10 days

B. 10 days and 40 days

C. 20 days and 5 days

D. 20 days and 10 days

Q.No.4: At a given instant, say *t* = 0, two radioactive substances A and B have

equal activities. The ratio $\frac{R_B}{R_A}$ of their activities after time t itself decays with time t as e^{-3t}. If the half-life of A is ln2, the half-life of B is : **JEE 2019**

A. $4\ln 2$

B. $\frac{\ln 2}{2}$

C. $\frac{\ln 2}{4}$

D. $2\ln 2$

Q.No.5: Using a nuclear counter the count rate of emitted particles from a radioactive source is measured. At $t = 0$ it was 1600 counts per second and $t = 8$ seconds it was 100 counts per second. The count rate observed, as counts per second, at $t = 6$ seconds is close to: **JEE 2019**

A. 200

B. 150

C. 400

D. 360

Q.No.6: Consider the nuclear fission

$Ne^{20} \rightarrow 2He^4 + C^{12}$

Given that the binding energy/ nucleon of Ne^{20}, He^4 and C^{12} are, respectively, 8.03 MeV, 7.07 MeV and 7.86 MeV, identify the correct statement: **JEE 2019**

A. energy of 12.4 MeV will be supplied

B. 8.3 MeV energy will be released

C. energy of 3.6 MeV will be released

D. energy of 11.9 MeV has to be supplied

Q.No.7: An X-ray tube is operated at 1.24 million volt. The shortest wavelength of the produced photon will be **JEE 2021**

A. 10^{-3} nm

B. 10^{-2} nm

C. 10^{-4} nm

D. 10^{-1} nm

Q.No.8: The de Broglie wavelength of a proton and α-particle are equal. The ratio of their velocities is **JEE 2021**

A. 1 : 4

B. 4 : 3
C. 4 : 1
D. 4 : 2

Q.No.9: According to Bohr atom model, in which of the following transitions will the frequency be maximum? **JEE 2021**

A. n = 3 to n = 2
B. n = 5 to n = 4
C. n = 4 to n = 3
D. n = 2 to n = 1

Q.No.10: Given below are two statements:
Statement I : Two photons having equal linear momenta have equal wavelengths
Statement II : If the wavelength of photon is decreased, then the momentum and energy of a photon will also decrease
In the light of the above statements, choose the correct answer from the options given below **JEE 2021**

A. Statement I is true but Statement II is false
B. Both Statement I and Statement II are false
C. Statement I is false but Statement II is true
D. Both Statement I and Statement II are true