PHYSICS

BOOKS - NEW JYOTHI PHYSICS (TAMIL ENGLISH)

NUCLEI

Solved Problems

1. Given the mass of iron nucleus as 55.85 u and A = 56, find the nuclear density.

$\left(u = 1.67 \times 10^{-27} kg, r = 1.2 \times 10^{-15} m\right)$

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2. Calculate the binding energy per nucleon of ${}_{3}^{7}Li(7u)$, Given mass of a proton = 1.007825 u and mass of neutron = $1.008665u$.

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3. Compute the first three energy levels of doubly ionized lithium. What is the ionisation potential ?

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4. Find the energy eqivalent of one atomic mass unit, first in Joules and then in MeV. Using this express the mass defect of ${}_{8}^{16}O$ in MeV/e^2.

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5. The half life of a radioactive elements is 10 yrs. Calculate the fraction of the sample left after 20 yrs.

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6. The half life of radon is 3.8 days. After how long there will be only one twentieth of radon sample left over?

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7. Counting rate from a radioactive source is 8000 cts per sec. at time t = 0 and after 10 minutes decay is 1000 cts/sce. Calculate (i) half life period, (ii) decay constant and (iii) counting rate after 20 minutes.

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8. Half life of ^{131}I is 8 days. Sample has an activity 6.4 mCi at a certain time. What is the activity 40 days later?

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9. The decay constant (λ) of radium is 0.0356 per year $\left(1.13 \times 10^{-9}\right.$ per sec). How much time is taken to reduce

a. to $(1/10)^{th}$ of the original value?

b. by $(1/10)^{th}$ of the original value?

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10. Half life of ^{226}Ra is 1600 years. How many distintegrations per second occur in 1 gram of ^{226}Ra ?

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11. Half life period of ^{215}At is $100\mu s$. If a sample initially constains 6 mg of the element, calculate its activity, (i) initially, (ii) after $200\mu s$.

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12. The half-life of $^{238}_{92}U$ undergoing α-decay is 4.5×10^9 years. What is the activity of 1g sample of $^{238}_{92}U$?

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13. Tritium has a half-life of 12.5 y undergoing beta decay. What fraction of a sample of pure tritium with remain undecayed after 25 y ?

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Solutions To Exercises From Ncert Text

1. Obtain the binding energy (in MeV) of a nitrogen nucleus $\left({}_{7}^{14}N\right)$, given m $\left({}_{7}^{14}N\right) = 14.00307u$.

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2. Obtain the bindig energy of the nuclie ${}_{26}^{56}Fe$ and ${}_{83}^{209}Bi$ in units of MeV from the following data.

$m\left({}_{26}^{56}Fe\right) = 55.934939u \qquad m\left({}_{83}^{209}Bi\right) = 208.980388u$

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3. A given coin has a mass of 3.0 g. Calculate the nuclear energy that would be required to separate all the neutrons and protons from each other. For simplicity assume that the coin is entirely made of $^{63}_{29}Cu$ atoms (of mass 62.92960 u).

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4. Write nuclear reaction equations for

$i.$ α- decay of $^{226}_{83}Ra$ $ii.$ α- decay of $^{242}_{4}Pu$

$iii.$ β^-- decay of $^{32}_{15}P$ $iv.$ β^- decay of $^{210}_{83}Bi$

$v.$ β^+ -decay of $^{11}_{6}C$ $vi.$ β^+ - decay of $^{97}_{43}Tc$

vii. Electron capture of $^{120}_{54}Xe.$

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5. A radioacitve isotope has a half-life of T years. How long will it take the activity to reduce to (a) 3.125% , (b) 1% of its original value?

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6. The normal activity of living carbon-containing matter is found to be about 15 decays per minute for every gram of carbon. This activity arises from the small proportion of radioactive ${}_{6}^{14}C$ present with the stable carbon isotope ${}_{6}^{12}C$. When the organism is dead, its interaction with the atmosphere (which maintains the above equilibrium activity) cases and its activity begins to drop. From the known half-life (5/30 years) of ${}_{6}^{14}C$, and the measured activity, the age of the specimen can be approximately estimated. This is the principle of ${}_{6}^{14}C$ dating used in archacology. Suppose a specimen from Mohenjodaro

gives as activity of 9 decyas per minute per gram of carbon. Estimate the approximate age of the Indus-Vally civillisation.

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7. Obtain the amount of $^{60}_{27}Co$ necessary to provide a radioactive source of 8.0 mCi strength. The half-life of $^{60}_{27}Co$ is 5.3 years.

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8. The half-life of $^{90}_{38}Sr$ is 28 years. What is the disintegration rate of 15 mg of this isotope?

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9. Obtain approximately the ratio of the nuclear radii of the gold isotope $^{197}_{79}Au$ and the silver isotope $^{107}_{47}Ag$.

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10. Find the Q-value and the kinetic energy of the emitted α-particle in the α-decya of (a) $^{226}_{88}Ra$ and (b) $^{220}_{86}Rn$.

Given $m\left(^{226}_{88}Ra\right) = 226.02540u, \quad m\left(^{222}_{86}Rn\right) = 222.01750u.$

$m\left(^{220}_{86}Rn\right) = 220.01137u, \quad m\left(^{216}_{84}Po\right) = 216.00189u.$

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11. The radionuclide ^{11}C decays according to

$^{11}_{6}C \rightarrow {}^{11}_{5}B + e^{+} + v, T_{1/2} = 20.3$ min

The maximum energy of the emitted positron is 0.960 MeV.

Given the mass values:

$m\left({}_{6}^{11}C\right) = 11.011434u$ and $m\left({}_{6}^{11}B\right) = 11.009305u$. Calculate Q and compare it with the maximum energy of the positron emitted.

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12. The nucleus ${}_{10}^{23}Ne$ decays by β^- emission. Write down the β-decay equation and determine the maximum kinetic energy of the electrons emitted. Given that :

$m\left({}_{10}^{23}Ne\right) = 22.994466u$

$m\left({}_{11}^{23}Na\right) = 22.989770u.$

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13. The Q value of a nuclear reaction $A + b \rightarrow C + d$ is defined by $Q = [m_A + m_b - m_C - m_d]c^2$, where the masses refer to the respective nuclei. Determine from the given data the Q-value of the following reactions and state whether the reactions are exothermic or endothermic.

$i.\ {}_1^1H + 1^3H \rightarrow 1^2H + 1^2H$

$ii.\ {}_6^{12}C + 6^{12}C \rightarrow 10^{20}Ne + {}_2^4He$

Atomic masses are given to be

$m\left({}_1^2H\right) = 2.014102u$

$m\left({}_1^3H\right) = 3.016049u$

$m\left({}_6^{12}C\right) = 12.000000u$

$m_{{}_{10}^{20}Ne} = 19.992439u.$

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14. Suppose, we think of fission of a ${}_{26}^{56}Fe$ nucleus into two equal fragments ${}_{13}^{28}Al$. Is the fission energetically possible? Argue by working out Q of the process. Given $m\left({}_{26}^{56}Fe\right) = 55.93494u$ and $m\left({}_{13}^{28}Al\right) = 27.98191u$.

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15. The fission properties of ${}_{94}^{239}Pu$ are very similar to those of ${}_{92}^{235}U$. The average energy released per fission is $180MeV$. How much energy , in MeV, is released if all the atoms in 1kg of pure ${}_{94}^{239}Pu$ undergo fission?

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16. How long can an electric lamp of 100W be kept glowing by fusion of 2.0 kg of deuterium? Take the fusion reactions as ${}_1^2H + {}_1^2H \rightarrow {}_2^3He + n + 3.27MeV$.

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17. For the β^+ (positron) emission from a nucleus, there is another competing process known as electron capture (electron from an inner orbit, say, the K-shell, is captured by the nucleus and a neutrino is emitted).

$e^+ + {}_Z^AX \rightarrow {}_{Z-1}^AY + v$

Show that if β^+ emission is energetically allowed, electron capture is necesarily allowed but not vice - versa.

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18. In a periodic table, the average mass of magnesium is given as 24.312 u. The average value of based on their relative natural abudance on earth. The three isotopes and their masses are ${}_{12}^{24}Mg(23.98504u), {}_{12}^{25}Mg(24.98584u)$ and ${}_{42}^{26}Mg(25.98259u)$. The natural abundance of ${}_{12}^{24}Mg$ is 78.99% by mass. Calculate the abundances of ther two isotopes.

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19. The neutron separation energy is defined as the energy required to remove a neutron from the nucleus. Obtain the neutron separation energies of the nuclei ${}_{20}^{41}Ca$ and ${}_{13}^{27}Al$ from the following data:

$m\left({}_{20}^{40}Ca\right) = 39.962591u$

$m\left({}_{20}^{41}Ca\right) = 40.962278u$

$m\left({}_{13}^{26}Al\right) = 25.986895u$

$m\left({}_{13}^{27}Al\right) = 26.981541u.$

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20. A source contains two phosphorus radio nuclides ${}_{15}^{32}P\left(T_{1/2} = 14.3d\right)$ and ${}_{15}^{33}P\left(T_{1/2} = 25.3d\right)$. Initially , 10% of the decay come from ${}_{15}^{33}P$. How long one must wait until 90% do so?

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21. Under certain circumstances, a nucleus can decay be emitting a particle more massive than an α - particle. Consider the following decay processes :

${}_{88}^{223}Ra \to {}_{82}^{209}Pb + {}_{6}^{14}C$

$^{223}_{88}Ra \rightarrow {}^{219}_{86}Rn + {}^{4}_{2}He$

Calculate the Q-values for these decays and determine that both are energetically allowed.

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22. Calculate and compare the energy realesed by (a) fusion of 1.0 kg of hydrogen deep within Sun and (b) the fission of 1.0 kg of ^{235}U in a fission reactor.

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23. Suppose India had a target of producing by 2020 AD, 200,200 MW of electric power, ten percent of which was to be obtained from nuclear power plants. Suppose we are given that, on an average, the efficiency of utillization (i.e, conversion to

electric energy) of thermal energy produced in a reactor was 25%. How much amount of fissionable uranium would our country need per year by 2020 ? Take the heat energy per fission of ^{235}U to be about 200 MeV.

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Practice Problems For Self Assessment

1. Calculate the binding energy of a deutron. Given that

mass of proton = $1.007825a.\ m.\ u$

mass of neutron = $1.008665a.\ m.\ u.$

mass of a deutron = $2.014103a.\ m.\ u.$

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2. The binding energy of ${}_{10}^{20}Ne$ is 160.6 MeV. Find atomic mass .

Given that

mass of ${}_{1}^{1}H = 1.007825a.\,m.\,u$

mass of ${}_{0}^{1}n = 1.008665a.\,m.\,u$

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3. Show that the density of nuclear mass is constant for all isotopes.

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4. Calculate the binding energy per nucleon of ${}_{79}{}^{197}Au$. Mass of Au nucleus is 197.

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5. Calculate the biding enery per nucleon of ${}_{24}^{52}Cr$ which has a mass of 51.957 u.

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6. The mass of ${}_{17}^{35}Cl$ is $34.9800u$. Calculate its binding energy per nucleon.

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7. After a certain lapse of time, fraction of radioactive polonium undecayed is found to be 12.5% of the initial quantity. What is the duration of this time lapsed if the half life of polonium is 138 days?

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8. The half life of radioactive element is 8 years. In what time 0.6 g of the substance will be reduced to 0.15 g by disintegration?

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9. For every 10^6 atoms of radium in a sample today, find the number of atoms that will be left after 3200 years. Assume half-life of radium to be 1600 years.

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10. Find the density of nuclear mass in ${}_{92}^{238}U$. Given $R_0 = 1.5$ fermi and mass of each nucleon is $1.67 \times 10^{-27} kg$.

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11. Nuclear radius of $^{205}_{82}Pb$ is 7 fermi. Calculate the nuclear radius of $^{16}_{8}O$.

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12. A radiactive isotope of ^{197}Hg decays into ^{197}Au with a decay constant 0.0108 per hour. Calculate the half life. What amount of the sample will remain at the end of

a. three half-lives

b. 10 days .

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13. A nucleus X_1 has a half life of 24 days How long of sample of X_1 will take to change 80% of its to X_2 ?

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14. 4 g of a radioactive substance is kept in a store for 15 years. Its half life is 10 years. How much material is decayed?

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15. A certain substance has a half life of 28 hours. Calculate its means life (τ).

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16. Half life of a radioacitve substance is 4 hours . In how much time $\frac{7}{8}$ of the substance would decay?

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17. Find the half life of ${}_{238}U$ if one gram of ${}^{238}U$ emits $1.24 \times 10^4 \alpha$-particles per second. Avogardro No. $= 6.025 \times 10^{23}$.

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18. Calculate the activity of 1 mg of a radioactive sample whose mass no. is 90 and half life is 28 years.

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Evaluation Questions And Answers

1. How can you find the age of fossiles ?

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2. What is the significance of BE inside the nucleus.

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3. What happens to the stability of nucleus, when BE increases ?

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4. How does nuclear fusion occur, eventhough Coulombic repulsion exists?

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5. Nuclear fusion is called thermonuclear reaction. Why ?

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6. Classify the following statements into true or false.

i. Radioactivity is unaffected by pressure and temperature.

ii. Radioactivity is affected by large electric and magnetic fields.

iii. The rate of disintegration of a radioactive substance at a particular time is directly proportional to the number of atoms present initially.

iv. Nuclear force is charge independent but it depends on the relative orientation of the spins.

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7. Match the following

Match the following

α -Particle	Electromagnetic waves	Speed is greater than c
β - Particle	Fast moving neutrons	Speed is equal to c
γ -rays	Nuclei of helium atom	Speed is equal to 0.66 c
	Fast moving electrons	Speed is about $\frac{1}{10}^{th}$ velocity of light

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8. a. Is there any well defined boundary for a nucleus ?

b. What is the order of the size of a nucleus?

c. How will you conclude that an atom has a lot of empty space ?

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9. ${}_{4}^{9}Be + {}_{2}^{4}He \rightarrow {}_{6}^{12}C + P + Q$

a. What are 'P' and 'Q' ? b. What are the specialities of P ?

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10. The radius of a nucleus is R.

a. How is it related to atomic mass (A) ?

b. Give the relation .

c. What is the value of the constant of proportionality?

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11. You have ${}_{6}^{11}C, {}_{6}^{12}C$ and ${}_{6}^{13}C$.

a. What are these nuclides ? b. How do they differ?

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12. We have ${}^{39}_{19}K$ and ${}^{37}_{17}Cl$

a. What are these nuclides ?

b. How do they differ?

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13. There are two nuclides ${}^{22}_{10}Ne$ and ${}^{22}_{11}Na$.

a. What are these nuclides ?

b. How do they differ?

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14. What are Isomers?Give examples.

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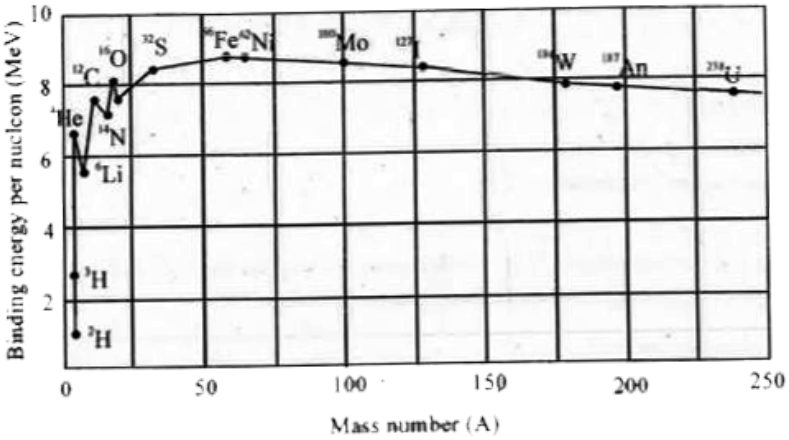

15.

a. What does the graph represent ?

b.What is the importance of this graph?

c. What does the peak in the graph represent?

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16. In certain isobars the number of protons of one isobar is equal to the number of protons in another.

a.What is the name given to such isobars?

b. Give one example.

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17. Z,A and M represent the atomic number, mass number and rest mass of a nucleus.

a. Show that 'M' is always less than the mass of the constituent particles.

b. What is this mass difference called ?

c. Give the relation.

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18. ${}_{Z}^{A}X \rightarrow {}_{Z+1}^{A}Y + {}_{-1}^{0}e + \bar{v} + \text{energy}$

a. What are ${}_{-1}^{0}e$ and $\bar{v}$?

what is the name given to this type of emission?

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19. A nuclear event is shown in the diagram.

a. Name the nuclear phenomenon.

b. What happens to the residual nucleus? Explain.

c. Compare the binding energy per nucleon of the daughter and the parent.

d. At what time the $h\upsilon$ is emitted ? Explain.

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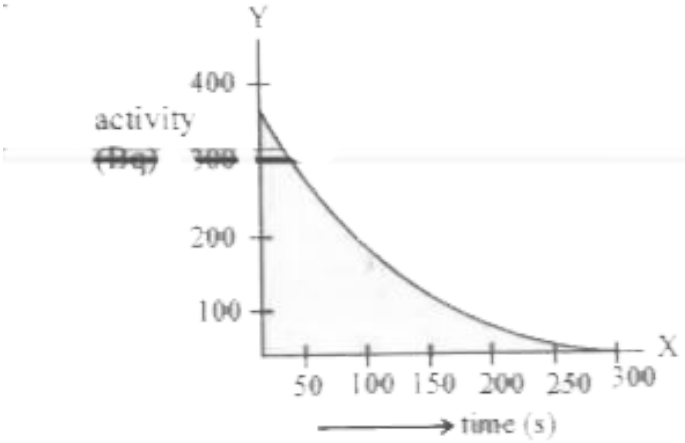

20.

The radioacitve decay of an element is shown in the graph.

a. What is the sort of functional decay shown here?

b. What is the change in activity in equal intervals of time?

c. Find the half-life.

d. Can you find the decay constant? If so, what is its value ?

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21. Mention the different units of radioactivity.

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22. Why are neutrons very effective as bombarding particles?

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23. $^{180}_{72}A \xrightarrow{a} B \xrightarrow{\beta} C \xrightarrow{\alpha} D \xrightarrow{\gamma} E$

a. What are dfferent types of emission taking place here ?

b. Name the product after each emission.

c. Justify your answer.

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24.

	Atom	Protons	Neutrons	Electrons
i	$^{16}_{8}O$	8	8	8
ii	$^{8}_{4}Be$	4	4	4

From the above table we can see that the ratio of their atomic masses is 2. But it is not exactly 2. Why is it so ? Explain.

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25. a. What is positron ? b. What is its charge ?

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26. What is i. neutrino ii. antineutrino?

Explain with examples.

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27. α-particles have a high ionizing power. Justify your answer.

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28. a. Are the equations of nuclear reactions such as ${}_{7}^{14}N + {}_{2}^{4}He \rightarrow {}_{8}^{16}O + {}_{1}^{2}H$ 'balanced' in the sense a chemical equation $2H_2 + O_2 \rightarrow 2H_2O$ is ? If not, in what sense are they balanced on both sides?

b. If the number of protons and number of neutrons are conserved in a nuclear reaction, in what way the mass is converted into energy (or vice versa) in a nuclear reaction?

c. A general impression exists that mass energy inter-conversion takes place only in nuclear reaction and never in chemical reaction. Strictly speaking, this is incorrect Explain.

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29. Complete the nuclear reaction

a.

$${}_{5}^{10}B + \ldots\ldots\ldots\ldots \rightarrow {}_{3}^{7}Li + {}_{2}^{4}He \qquad \text{b} {}_{\ldots\ldots}^{63}Ni \rightarrow {}_{29}^{\ldots}Cu + {}_{\ldots}^{0}\beta$$

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30. a. Which is more stable , ${}_{3}^{7}Li$ or ${}_{3}^{4}Li$?

b. Give reason for your answer.

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31. What is meant by chain reaction ?

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32. a. Are heavy nuclei stable or unstable ?

b. Give reason.

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33. You are given two nuclides ${}_{3}^{7}X$ and ${}_{3}^{4}Y$.

a. Are they the isotopes of the same element ?

b. Which one of the two is likely to be more stable?

c. Give reason.

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34. What is the ratio of nuclear densities of two nucleus having mass numbers in the ratio $1:2$?

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35. a. Give the expression for the radius of a nucleus.

b. What is the ratio of the nuclear radii of $^{197}_{79}Au$ and $^{107}_{47}Ag$?

c. What is the ratio of their nuclear densities ?

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36. a. Is free neutron a stable particle?

b. Give reason.

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37. a. Give two radioacitve elements which are not formed in observable quantities in nature.

b. Give reason for this.

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38. What is positive β - emission?

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39. The mechanism of β emission can be stated as a neutron decay. Explain.

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40. Which raw material is used in a fast breeder reactor ?

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41. Heavy water is used as a moderator in a nuclear reactor. Give reason.

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42. What are

a. Slow neutrons?

b. thermal neutrons?

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43. a. What factors make a fusion reaction difficult to achieve ?

b. Why does a fusion reactor produce less radioactive waste than a fission reactor?

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44. What is meant by self sustained nuclear reaction?

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Continuous Evaluation

1. An account of various energy sources including nuclear energy .

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2. Model of a thermonuclear reactor and its working.

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Continuous Evaluation Assignment

1. Write a note on steroids.

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2. Write a note on nuclear forces.

Watch Video Solution

3. Write a note on radioactivity.

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4. Compare the properties of alpha, beta, and gamma radiations.

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5. Explain the uses of radioisotopes.

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6. Explain the principle, construction and working of a nuclear reactor.

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7. Discuss the source of stellar energy.

Watch Video Solution

8. Discuss radiation hazards.

Watch Video Solution

9. Discuss the advantanges and disadvantages of fusion power from the point of view of safety, pollution and resources.

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Previous Year Questions

1. Energy generation in stars is due to nuclear fusion.

a. How a nuclear fusion is occurred ?

b. The energy released in nuclear fission process with uranium is the order of

c. Three types of radio active decay occur in nature. Briefly decribe them.

d. State the law of radio active decay.

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2. Obtain an expression for the number of radioactive nuclei present at any instant in terms of the decay constant and initial number of nuclei.

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Competitive Exam Corner

1. Radioactive ${}^{60}_{27}Co$ is transformed into stable ${}^{60}_{28}Ni$ by emitting two γ - rays of energies

A. A) $1.33MeV$ and $1.17MeV$ is succession

B. B) $1.17MeV$ and $1.33MeV$ is sucession

C. C) $1.37MeV$ and $1.13MeV$ in succession

D. D) $1.13MeV$ and $1.37MeV$ in seccession

Answer: B

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2. The nucleus which has radius one-third of the radius of Os^{189} is

A. A) Be^9

B. B) Li^7

C. C) F^{19}

D. D) C^{12}

Answer: B

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3. Pick out the incorrect statement from the following.

A. A) β^- emission from the nucleus is always accompanied with a neutrino

B. B) The energy of the α - particle emitted from a given nucleus is always constant

C. C) γ- ray emission makes the nucleus more stable

D. D) Nuclear force is charge-independent

Answer: A

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4. An electron and an alpha particle have same kinetic energy. How are the de Broglie wavelengths associated with them related ?

A. $r_\alpha = r_d > r_p$

B. $r_\alpha = r_d = r_p$

C. $r_\alpha < r_d < r_p$

D. $r_\alpha = r_d < r_p$

Answer: D

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5. A radioactive sample at any instant has its disintegration rate 5000 disintegrations per minute. After 5 minutes, the rate becomes 1250 disintegration per minute. Then its decay constant (per minute) is

A. (a) $0.8 \log_e 2$

B. (b) $0.4 \log_e 2$

C. (c) $0.2 \log_e 2$

D. (d) $0.1 \log_e 2$

Answer: B

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6. If the binding energy per nucleon of deuteron is 1.115 Me V, its mass defect in atomic mass unit is

A. (a) 0.0048

B. (b) 0.0024

C. (c) 0.0012

D. (d) 0.0006

Answer: B

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7. A uranium nucleus $_{92}U^{238}$ emits an α particle and a β - particle in succession. The atomic number and mass number of the final nucleus will be

A. (a) 90233

B. (b) 90238

C. (c) 91238

D. (d) 91234

Answer: D

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8. Heavy water is used in nuclear reactors

A. to absorb neutrons to sustain controlled reaction

B. to absorb neutrons to stop the chain reaction

C. to reduce hazardous radiation from nuclear reaction

D. to slow down the neutrons to thermal energies

Answer: D

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9. A freshly prepared radioactive sample of half-life 4 hours emits radiation of intensity which is 64 times the safe level. The minimum hours after which it would be safe to work with it is

A. 4

B. 6

C. 12

D. 24

Answer: D

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10. A radioactive decay can form as isotope of the original nucleus with the emission of particles

A. one α and four β

B. one α and two β

C. one α and one β

D. for α and one β

Answer: B

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11. The fraction of the radioactive sample will remain undecayed after 4 half-life periods is

A. (a) $\frac{1}{2}$

B. (b) $\frac{3}{4}$

C. (c) $\frac{15}{16}$

D. (d) $\frac{1}{16}$

Answer: D

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12. Four atoms of hydrogen combine to form an $_{2}^{4}He$ atom with a release of energy of

A. (a) 26.7 MeV

B. (b) 216 MeV

C. (c) 3.27 MeV

D. (d) 7.86 MeV

Answer: A

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13. A radioactive material of half-life time of 69.3 days is kept in a container. $\frac{2}{3}$ rd of the substance remains undecayed after (given $\frac{\ln 3}{2} = 0.4$)

A. (a) 20 days

B. (b) 25 days

C. (c) 35 days

D. (d) 40 days

Answer: D

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14. When alpha particle captures an electron, it becomes a

A. (a) helium atom

B. (b) hydrogen atom

C. (c) helium ion

D. (d) hydrogen ion

Answer: C

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15. The half-life of a radioactive substance is 20 minutes. The time taken between 50% decay and 87.5% decay of the substance will be

A. (a) 20 minutes

B. (b) 30 minutes

C. (c) 40 minutes

D. (d) 25 minutes

Answer: C

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16. The ratio of the surface area of the nuclei ${}_{52}Te^{125}$ to that of ${}_{13}Al^{27}$ is

A. (a) $\frac{5}{3}$

B. (b) $\frac{125}{17}$

C. (c) $\frac{1}{4}$

D. (d) $\frac{25}{9}$

Answer: D

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17. On an average, the number of neutrons and the energy of a neutron released per fission of a uranium atom are respectively

A. 2.5 and 2 keV

B. 3 and 1 keV

C. 2.5 and 2 MeV

D. 2.5 and 7 keV

Answer: C

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18. After 300 days, the activity of a radioactive sample is 5000 dps (disintegrations per sec). The activity become 2500 dps after another 150 days. The initial activity of the sample in dps is

A. 20000

B. 10000

C. 7000

D. 25000

Answer: A

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19. The contral rods used in a nuclear can be made up of

A. Graphite

B. Cadmium

C. Uranium

D. Barium

Answer: B

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20. The fusion reaction in the sun is a multi-step process in which the

A. helium is burned into deuterons

B. helium is burned into hydrogen

C. deuteron is burned into hydrogen

D. hydrogen is burned into helium

Answer: D

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21. A radioactive sample contains $10^{-3}kg$ each of two species A and B with half-life 4 days and 8 days respectively. The ratio of the amounts of A and B after a periof of 16 days is

A. $1:2$

B. $4:1$

C. $1:4$

D. $2:1$

Answer: C

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22. The binding energy per nucleon for deuteron $\left({}_1H^2\right)$ and helium $\left({}_2He^4\right)$ are 1.1 MeV and 7.0 MeV respectively. The energy released when two deuterons fuse to form a helium nucleus is

A. 36.2 MeV

B. 23.6 MeV

C. 47.2 MeV

D. 11.8 MeV

Answer: B

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23. In a series of radioactive decays, if a nucleus of mass number 180 and atomic number 72 decays into another nucleus of mass

number 172 and atomic 69, then the number of alpha and beta particles released respectively are

A. 2,3

B. 2,2

C. 2,1

D. 2,0

Answer: C

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