PHYSICS

BOOKS - BITSAT GUIDE

NULECUS

Pratice Exercise

1. The radius of Na^{23} nucleus is

A. $3.125 \times 10^{-15} m$

B. $23 \times 10^{-15} m$

C. $11 \times 10^{-15} m$

D. $1.1 \times 10^{-15} m$

Answer: A

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2. A heavy nucleus (mass number = A) splits into two new nuclei, whose mass numbers are in the ratio 3:2 . The ratio of radii of these new nuclei is

A. $3:2$

B. $2:3$

C. $3^{1/3}:2^{1/3}$

D. $2^{1/3}:3^{1/3}$

Answer: C

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3. Find the rest mass energy of electron.

A. 0.8 MeV

B. 1.66 amu

C. 0.519 MeV

D. None of these

Answer: A

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4. Find the mass of electron in atmoic mass unit.

A. 0,0005498

B. 0.5119

C. 0.5498

D. None

Answer: C

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5. The atomic mass of Al^{27} is 26.9815 amu . The mass of electron is 0.0005498 amu . The rest mass energy of Al^{27} nucleus is

A. 1862 MeV

B. 25119.78 MeV

C. 25113.12 MeV

D. None of these

Answer: A

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6. The atomic mass of B^{10} is 10.811 amu . Find the binding energy of B^{10} nucleus . The mass of electron is 0.0005498 amu. The mass of

proton is m_p = 1.007276 amu . The mass of neutron is m_n = 1.008665 amu.

A. 186.54 MeV

B. 678.932 MeV

C. 378.932 MeV

D. None of these

Answer: A

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7. Find the binding energy of Na^{23} . Atomic mass of Na^{23} is 22.9898 amu and that of „„„„ is 1.00783 amu. The mass of neutron = 1.00867 amu.

A. 931 MeV

B. 186.54 MeV

C. 5.38 MeV

D. None of these

Answer: B

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8. The binding energy per nucleon are 53 Mev, 6.2 MeV and 7.4 MeV for the nucleus with mass number ,3,4 and 5 respectively . If one nucleus of mass number 3 combines with one nucleus of mass number 5 to give two nuclei of mass number 4, then

A. 0.3 MeV energy is absorbed

B. 0.3 MeV energy is released

C. 28.1 MeV energy is absorbed

D. 3.3 MeV energy is absorbed

Answer: D

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9. What is the binding energy per nucleon of

$_{}(6)C^{12}$nucleus?

Given , mass of C^{12} $(m_c)_m$ = 12.000 u

Mass of proton m_p = 1.0078 u

Mass of neutron m_n = 1.0087 u

and 1 amu = 931.4 MeV

A. 5.26 MeV

B. 10.11 MeV

C. 15.65 meV

D. 7.68 MeV

Answer: D

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10. $O^{19} : - F^{19} + e + v$

In this decay , the rest mass energy of O^{19} and

F^{19} are 17692.33 MeV and 17687.51 MeV respectively . The Q factor of the dacay is

A. 4.82 MeV

B. 7 MeV

C. 17.69 MeV

D. None of these

Answer: A

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11. The binding energy expressed in MeV is given for the following nuclear reactions

$_{}(2)He^3 +_0 n^1 \rightarrow_2 He^4 + 20MeV$

$_{}(2)He^4 +_0 n^1 \rightarrow_2 He^5 + 0.9meV$

Which of the following conclusion is correct ?

A. $_{}(2)He^4$ is less stable than both $_{}(2)He^3$ and $_{}(2)He^5$

B. $_{}(2)He^4$ is less stable than $_{}(2)He^3$ but more stable than $_{}(2)He^5$.

C. $_{}(2)He^4$ is less stable than $_{}(2)He^3$

D. $_{(2)}He^4$ is more stable than both $_{(2)}He^4$ and $_{(2)}He^5$

Answer: A

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12. Calculate the energy of the reaction ,

$Li^7 + p \rightarrow 2_2He^4$

If the binding energy per nucleon in Li^7 and He^4 nuclei are 5.60 MeV and 7.06 MeV , respectively .

A. 19.6 MeV

B. 2.4 MeV

C. 8.4 MeV

D. 17.28 MeV

Answer: D

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13. A sample contains 1 kg O^{19} nuclei . The sample decays according to following equation

$O^{19} \rightarrow F^{19} + e + \bar{v}$

The mass of sample after one half-life period is

A. lesser than 1/2 kg

B. equal to 1/2 kg

C. slightly less than 1 kg

D. equal to 1 kg

Answer: C

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14. The number of C^{14} atoms in a sample is 100 . The half- life period of C^{14} is 5730 year . The number of C^{14} atoms in the sample after 5730 year.

A. must be equal to 50

B. must be equal to 100

C. may be equal to 90

D. must be equal to 90

Answer: C

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15. Half-life of an element A is 25 days. After 25 days , three atoms of A become

A. 1

B. 2

C. 3

D. all may be

Answer: D

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16. The half-life of Tc^{99} is 6 h. The activity of Tc^{99} in a patient , 60 h after receiving an injection conataining this radiosotope is at least 0.125 μCi. What was the minimum activity (in μci) of the sample injected?

A. 1.25μCi

B. 12.5μCi

C. 128 μCi

D. 125 μCi

Answer: C

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17. A radioactive sample has an initial activity of 50 dpm, 20 minute later, the activity is 25 dpm . How many atoms of the radioactivity nuclide were there originally?

A. 20

B. 1000

C. 1443

D. 2

Answer: C

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18. A radioactive sample has a disintegration rate of 36×10^{50} disintegration per minute. The sample itself consisting of $10^{-5}\mu$ mole of the active nuclei. The disintegration constant, λ is given by

A. $6 \times 10^{-7} s^{-1}$

B. $6 \times 10^{15} s^{-1}$

C. $6 \times 10^{9}\ s^{-1}$

D. $10^{-8}\ s^{-1}$

Answer: D

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19. A radioactive element undergoes two different types of radioactive disintegration, one with disintegration constant λ_1 and the

other with λ_2. The half-life of the element is

A. $\frac{0.693}{\lambda_1 + \lambda_2}$

B. $\frac{0.693}{(\lambda_1 + \lambda_2)/2}$

C. $(0.693).\ \frac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2}$

D. $\frac{0.693\lambda_1\lambda_2}{2(\lambda_1 + \lambda_2)}$

Answer: A

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20. Half-life period of a given radioactive sample is τ . Its average life would be

A. τ In 2

B. τ / In 2

C. 1 / τ

D. In 2 / τ

Answer: B

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21. Choose the correct option . If $\underset{n}{T}$ and $\underset{m}{T}$ denotes the half-value period and the mean-value period , respectively of a radioactive element.

A. $\underset{n}{T} = \underset{m}{T}$

B. $\underset{n}{T}$ gt $\underset{m}{T}$

C. $\underset{n}{T}$ lt $\underset{m}{T}$

D. $\underset{b}{T} \geq \underset{m}{T}$

Answer: C

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22. The half-life of radium is 1600 years . Calculate the number atoms that will decay from 1g sample of radium per second (given, atomic weight of radium = 226)

A. 3.6×10^{10}

B. 7.2 xx 10^(10)`

C. 4.2×10^{10}

D. 14.6×10^{10}

Answer: A

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23. At certain time, the activity of three radioactive materials are in the ratio of 3 : 4 : 5 . What will be the mark ratio of their activities at any further date?

A. $1:2:3$

B. $2:3:4$

C. $3:4:5$

D. $5:6:8$

Answer: C

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24. 20% of a radioactive substances decay in 10 days . Calculate the amount of the original material left after 30 days.

A. 0.512

B. 0.628

C. 0.15

D. 0.2127

Answer: A

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25. Calculate in how many months , $\left(\frac{3}{4}\right)^{th}$ of the substance will dacay, If half-life of the radioactive substance is 2 months.

A. 4 months

B. 6 months

C. 8 months

D. 14 months

Answer: A

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26. The half-life of a freely prepared radioactive sample is 2 hours . If the sample emits radiation of intensity which is 32 times the permissible safe level, then calculate the minimum time taken after which it would be possible to work safely with source .

A. 8 h

B. 10 h

C. 16 h

D. 2 h

Answer: B

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27. Calculate the ratio of half-life to the mean life of a radioactive sample . If λ be the decay constant of a radioactive sample.

A. 0.693

B. 0.746

C. 1/0.693

D. $(0.693)^2$

Answer: A

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28. Calculate the number of βparticles , If a radioactive element $_{(90)}X^{238}$ dacays into $_{(83)}\gamma^{222}$.

A. 4

B. 6

C. 2

D. 1

Answer: D

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29. A radiaoactive nucleus (initial mass number A and atomic number Z emits 3α- particles and 2 positrons The ratio of number of

neutrons to that of proton in the final nucleus will be

A. $\frac{A-Z-B}{Z-4}$

B. $\frac{A-Z-4}{Z-8}$

C. $\frac{A-Z-12}{Z-4}$

D. $\frac{A-Z-4}{Z-2}$

Answer: B

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30. How long will it take for 75% of the atoms of a certain radioactive element, originally present to disintegrate ? The half-life of the element is 10 days.

A. 240 days

B. 3.6 days

C. 15.6 days

D. 4.15 days

Answer: D

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31. For measuring the activity of a radioactive sample, a count rate meter is used. At certain observation , count rate meter 5050 counts per minute but after 10 minute later , the count rate showed 2300 counts per minute . Calculate the disintegration constant (λ)

A. 0.065 per min

B. 0.078 per min

C. 0.24 per min

D. 0.868 per min

Answer: B

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32. Consider $x \xrightarrow{-\alpha} y \xrightarrow{-\alpha} z$, where half-lives of x andy are z year and one month, the ratio of atoms of x and y when transient equilibrium $\left[T_{1/2}(x) > T_{1/2}(y)\right]$ has ben established is

A. $1:2$

B. $1:26$

C. $26:1$

D. $23:1$

Answer: D

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33. Analysis of potassium and argon atoms in a moon rock sample by a mass spectrometer shows that the ratio of the number of stable Ar^{40} atoms present to the number of

radioactive K^{40} atoms is 7 : 1 . Assume that all the argon were produced by the decay of potassium atoms, with a half-life of 1.25×10^9 year. How old is the rock?

A. $1.25 \times 10^9 yr$

B. 3.75×10^9 yr

C. 8.75×10^9 yr

D. 1.00×10^{10} yr

Answer: B

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34. A radiactive sample decays by two different processes .Half - life for the first process is t_1 and for the second process is t_2 . The effective half-life is

A. $(t_1 + t_2)$

B. $(t_1 - t_2)$

C. $(t_1 + t_2)/2$

D. $\frac{t_1 t_2}{t_1 + t_2}$

Answer: D

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35. The alongside is a plot of binding energy per nucleon E_b ,against the nuclear mass M,A,B,C,D,E,F correspond to different nuclei. Consider four reactions.

(i) A + B $\rightarrow$ C +ε (ii) C $\rightarrow$ A + B + ε

(iii) D + E $\rightarrow$ F + ε (iv) F $\rightarrow$ D + E + ε where ε is the energy released. In which reactions , is ε positive?

A. (i) and (iv)

B. (i) and (iii)

C. (ii) and (iv)

D. (ii) and (iii)

Answer: A

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36. If reactor takes 30 day to consume 4 kg of fuel and each fission gives 185 MeV of usable energy , then calculate the power output.

A. 2.75×10^{10} W

B. 0.012×10^{10} W

C. 3.5×10^{10} W

D. 7.63×10^{10} W

Answer: B

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37. Calculate the total energy released during a fission reaction .

The resulting fission fragements are unstable hence, decay into stable and products and by sucessive emission of β-particles . Take mass of neutron = 1.0087 amu , mass of =236.0526 amu, mass of =97.9054 amu and mass of =135.9170 amu.

A. 198 MeV

B. 220 MeV

C. 185 MeV

D. 230 MeV

Answer: A

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38. Calculate the energy released per nucleon of the reactant, in the thermonuclear reaction $3_1H^2 \rightarrow_2 He^4 \rightarrow_2 He^4 +_1 H^1 +_0 n^1 + 21.6$ MeV

A. 21.6 MeV

B. 7.2 MeV

C. 3.6 MeV

D. 1.8 MeV

Answer: C

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Bitsat Archives

1. Let binding energy per nucleon of nucleus is denoted by $\underset{bn}{E}$ and radius is denoted as r. If mass number of nuclei A,B are 64 and 125 respectively , then

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2. Half-lives of elements A and B are 1h and 2h respectively. Which of the following is correct?

A. Element A decays slower

B. Decay consist of A is smaller.

C. If initial number of nuclei are same, than activity of A is more

D. Mean-life of A is more

Answer: C

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3. If a radioactive substance reduces to $\frac{1}{16}$ of its original mass in 40 days, what is its half-life ?

A. 10 days

B. 20 days

C. 40 days

D. None of these

Answer: A

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4. If the total binding energies of ${}_{1}H^{2}$, ${}_{2}He^{4}$, ${}_{26}Fe^{56}$ and ${}_{92}U^{235}$ nuclei are $2.22, 28.3, 492$ and $1786MeV$ respectively, identify the most stable nucleus out of the following

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5. Fusion raction takes place at high temperature because

A. KE is high enough to overcome repulsion between nuclei

B. nuclei are most stable at this temperature

C. nuclei are unstable at this temperature

D. None of these

Answer: A

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6. Two nucleons are at a separation of $1 \times 10^{-15} m$. The net force between them is F_1, if both are neutrons, F_2 if both are protons and F_3 if one is a proton and other is a neutron. In such a case.

A. $F_1 = F_2$ gt F_3

B. $F_1 = F_2 = F_3$

C. F_1 lt F_2 lt F_3

D. F_1 gt F_2 gt F_3

Answer: B

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7. Mean life of a radioactive sample is 100s . Then ,its half-life (in min) is

A. 0.693

B. 1

C. 10^{-4}

D. 1.155

Answer: D

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8. Consider two nuclei of the same radioactive nucclide . One of the nuclei was created in a supernova explsion 5 billions year ago . The probability of decay during the next time is

A. different for each nuclei

B. nuclei created in explosion decays first

C. nuclei created in the reactor decays first

D. Independent of the time of creation

Answer: D

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