



# PHYSICS

## BOOKS - MBD -HARYANA BOARD

### ATOMS AND NUCLEI

#### Very Short Answer Type Questions

1. Compare the radii of two nuclei with mass number 1 and 27 respectively.

A.

B.

C.

D.

**Answer:**



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## 2. Impact Parameter

A.

B.

C.

D.

**Answer:**



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**3.** Write any two postulates of Bohr's model for hydrogen atom.

A.

B.

C.

D.

**Answer:**



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**4. Define atomic mass unit.**

A.

B.

C.

D.

**Answer:**



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5. What is the meaning of a.m.u. (atomic mass unit) ?

A.

B.

C.

D.

**Answer:**



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**6.** Give an equation representing the decay of a free electron.

A.

B.

C.

D.

**Answer:**



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**7. Define mass defect.**

A.

B.

C.

D.

**Answer:**



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**8. Define binding energy of a nucleus.**

A.

B.

C.

D.



**Answer:**



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9. Energy in the ground state of hydrogen atom is  $-13.6$  eV. What is the energy in the first excited state ?

A.

B.

C.

D.

**Answer:**



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**10.** The energy of the hydrogen atom in its ground state is  $-13.6$  eV. Determine the energy of the energy level whose quantum number is 2.

A.

B.

C.

D.

**Answer:**



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**11.** The energy of hydrogen atom in its ground state is  $-13.6\text{eV}$ . The energy of the level corresponding to the quantum number  $n$  is equal 5 is

A.

B.

C.

D.

**Answer:**



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**12. Define isotones.**

A.

B.

C.

D.

**Answer:**



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**13. Define isotope and isobar.**

A.

B.

C.

D.

**Answer:**



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**14. What are isotopes ?**

A.

B.

C.

D.

**Answer:**



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**15. Define half life of a radioactive material.**

A.

B.

C.

D.

**Answer:**



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16. What is radioactivity ?

A.

B.

C.

D.

**Answer:**



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17. What is the role played by the moderator in a nuclear reactor ?

A.

B.

C.

D.

**Answer:**



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**18.** Why is heavy water used as moderator in a nuclear reactor ?

A.

B.

C.

D.

**Answer:**



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19. What is nucleus ?

A.

B.

C.

D.

**Answer:**



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20. Write the relation between kinetic energy of  $\alpha$ - particle and its distance of closest approach from nucleus in Rutherford  $\alpha$ -scattering experiment.

A.

B.

C.

D.

**Answer:**



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21. Name the experiment in which nucleus was first discovered.

A.

B.

C.

D.

**Answer:**



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22. What happens if the electrons in an atom were stationary ?

A.

B.

C.

D.

**Answer:**



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**23.** Explain the significance of negative energy of electron in an orbit.

A.

B.

C.

D.

**Answer:**



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24. What is the relation between nuclear radius and mass number ?

A.

B.

C.

D.

**Answer:**



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25. What is the size of the nucleus ?

A.

B.

C.

D.

**Answer:**



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26. What is the ratio of size of atom and size of nucleus ?

A.

B.

C.

D.

**Answer:**



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27. How is the radius of a nucleus related to its mass number ?

A.

B.

C.

D.

**Answer:**



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28. Express 1 amu in kilogram.

A.

B.

C.

D.

**Answer:**



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**29.** What is SI unit of activity of Radioactive substance ?

A.

B.

C.

D.

**Answer:**



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## Short Answer Type Questions

1. In a head on collision between an alpha particle and gold nucleus ( $Z=79$ ), the distance of closest approach is 39.5 fermi. Calculate the energy of  $\alpha$ -particle.

A.

B.

C.

D.

**Answer:**



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2. What do you mean by the charge independent nature of nuclear force ?

A.

B.

C.

D.

**Answer:**



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**3.** How does radius of a nucleus vary with mass number ? Show that nuclear density is the same for all nuclei.

A.

B.

C.

D.



**Answer:**



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4. Write the relation for (i) the distance of closest approach and (ii) impact parameter.

A.

B.

C.

D.

**Answer:**



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5. Define 'binding energy'. Sketch the graph between binding energy per nucleon and mass number.

A.

B.

C.

D.

**Answer:**



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**6.** Draw a graph showing variation of binding energy per nucleon with mass number. Write two main inferences drawn from the graph.

A.

B.

C.

D.

**Answer:**



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7. Explain the concept of nuclear binding energy. Draw a curve between mass number and average binding energy per nucleon. What conclusions do you draw from this curve ?

A.

B.

C.

D.

**Answer:**



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**8.** Draw a graph between potential energy of a pair of nucleons and separation between them. Also write its main features.

A.

B.

C.

D.

**Answer:**



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**9. Explain Mass defect and Binding energy and establish a relation between them.**

A.

B.

C.

D.

**Answer:**



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**10.** Define mass defect and nuclear binding energy. For a nucleus  ${}^A_Z X$ , write the value of mass defect and nuclear binding energy.

A.

B.

C.

D.

**Answer:**



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**11.** Express 16 mg mass into equivalent energy in eV.

A.



B.

C.

D.

**Answer:**



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**12.** The energy equivalent of one atomic mass unit is

A.

B.

C.

D.

**Answer:**



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**13.** State the laws of radioactive decay. Define the term 'decay constant' for a radioactive substance.

A.

B.

C.

D.

**Answer:**



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**14.** State the law of radioactive decay. Define the term 'decay constant' for a radioactive substance. How is it related to half life ?

A.

B.

C.

D.

**Answer:**



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**15.** Define decay constant and half-life and derive relation between them and explain graphically.

A.

B.

C.

D.

**Answer:**



**View Text Solution**

**16.** Define radioactive decay constant and half-life and derive a relation between them.

A.

B.

C.

D.

**Answer:**



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**17.** Sketch a graph to illustrate radioactive decay. Define the half life of a radioactive

element and find its value in terms of decay constant  $\lambda$

A.

B.

C.

D.

**Answer:**



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**18.** What are alpha rays ? Briefly explain alpha decay.

A.

B.

C.

D.

**Answer:**



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19. What are beta rays ? What is the main feature of beta ray energy spectrum?

A.

B.

C.

D.

**Answer:**



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20. Calculate binding energy per nucleon of deuteron whose mass is 2.013554 a.m.u. Take mass of proton and neutron as 1.007825 a.m.u. and 1.008665 a.m.u. respectively and 1 a.m.u. = 931 M eV.

A.

B.

C.

D.

**Answer:**



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21. What is the value of charge and mass of beta particles ? Why is beta particle energy spectrum continuous ?

A.

B.

C.

D.

**Answer:**



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22. Derive equation of radioactivity using laws of radioactive decay. Define half life period.

A.

B.

C.

D.

**Answer:**



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**23.** Derive radioactive decay equation using laws of radioactivity.

A.

B.

C.

D.

**Answer:**



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24. What is radioactivity ? Derive an expression

$N = N_0 e^{-\lambda t}$  for radioactive disintegration.

A.

B.

C.

D.

**Answer:**



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**25.** Describe the laws of radioactive decay. Derive equation of radioactive decay using these laws.

A.

B.

C.

D.

**Answer:**



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**26.** State and explain the laws of radioactive disintegration. On its basis define disintegration constant and half life period.

A.

B.

C.

D.

**Answer:**



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27. What are alpha particles ? In the reaction

${}_z X^A \rightarrow Y + \alpha\text{-particle}$ , give the atomic

number and mass number of Y.

A.

B.

C.

D.

**Answer:**



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**28.** Define nuclear fission. Write the fission reaction of a neutron with uranium isotope  ${}_{92}\text{U}^{235}$ .

Write one use of nuclear fission reaction.

A.

B.

C.

D.

**Answer:**



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29. What is the nuclear fission reaction ? Give one example.

A.

B.

C.

D.

**Answer:**



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30. Draw a labelled diagram of a nuclear reactor and explain the functions of moderator, control rods and coolant.

A.

B.

C.

D.

**Answer:**



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**31.** Explain the function of moderator, control rods and coolant in a nuclear reactor.

A.

B.

C.

D.

**Answer:**



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**32.** Draw a simplified diagram showing working of Nuclear Power Plant.

A.

B.

C.

D.

**Answer:**



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**33.** Write a detailed note on nuclear reactor with diagram.

A.

B.

C.

D.

**Answer:**



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**34.** Explain the role of control rods in a reactor. Why are they made of cadmium ?

A.

B.

C.

D.

**Answer:**



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**35.** Distinguish between nuclear fission and nuclear fusion.

A.

B.

C.

D.

**Answer:**



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**36.** Calculate binding energy per nucleon of  ${}_{83}\text{Bi}^{209}$ . Given mass of  ${}_{83}\text{Bi}^{209} = 208.980388$  a.m.u, mass of neutron = 1.008665 a.m.u. and mass of proton = 1.007825 a.m.u. Take 1 a.m.u. = 931 MeV.

A.

B.

C.

D.

**Answer:**



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**37.** Explain the Rutherford experiment on the scattering of alpha particles and state the conclusion drawn from the result.

A.

B.

C.

D.

**Answer:**



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38. Uranium  ${}_{92}\text{U}^{238}$  is not suitable for chain reaction . Why ?

A.

B.

C.

D.

**Answer:**



39. How are  $\beta$ -rays emitted from a nucleus, when it does not contain electrons ?

A.

B.

C.

D.

**Answer:**



**40.** Discuss three basic postulates of Bohr's model of atom.

A.

B.

C.

D.

**Answer:**



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**41.** What are important features of J.J. Thomson's atom model ? Why was it discarded ?

A.

B.

C.

D.

**Answer:**



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**42.** What is nuclear fission ? Give an example to illustrate it. What is the importance of fission phenomenon ?

A.

B.

C.

D.

**Answer:**



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**43.** Explain Nuclear fission reaction with an example.

A.

B.

C.

D.

**Answer:**



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44. What is the basic nuclear process underlying  $\beta^-$  decay? Write nuclear reaction of this decay for  ${}_{83}^{210}\text{Bi}$ .

A.

B.

C.

D.

**Answer:**



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## Long Answer Type Questions

1. What is meant by average life of a radioactive element ? Derive an expression for it. What is the relation between average life and half life ?

A.

B.

C.

D.

**Answer:**



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2. Explain nuclear fusion reaction with an example.

A.

B.

C.

D.

**Answer:**



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**3.** What is nuclear fusion ? Write its one example and one use of this reaction.

A.

B.

C.

D.

**Answer:**



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## Objective Type Questions

1. If 13.6 eV energy is required to ionise the hydrogen atom, then energy required to remove an electron from  $n = 3$  is :

A. 9 eV

B. 6.8 eV

C. 3.4 eV

D. 1.5 eV

**Answer: D**



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2. If an electron jumps from 1st orbital to 3rd orbital, than it will.

A. Release energy

B. Absorb energy

C. No gain of energy

D. None of these.

**Answer: B**



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3.  ${}_{92}\text{U}^{238} \rightarrow {}_{90}\text{Th}^{234} + {}_2\text{X}^4$ , what is X ?

A. Thorium

B. Hydrogen

C. Oxygen



D. Helium

**Answer: D**



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4. A radioactive element has half-life period  $800\text{yr}$ . After  $6400\text{yr}$ , what amount will remain?

A.  $\frac{1}{2}$

B.  $\frac{1}{16}$

C.  $\frac{1}{8}$

D.  $\frac{1}{256}$

**Answer: D**



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5. In Rutherford scattering experiment, what will be the correct angle for  $\alpha$  scattering for an impact parameter  $b = 0$ ?

A.  $90^\circ$

B.  $270^\circ$

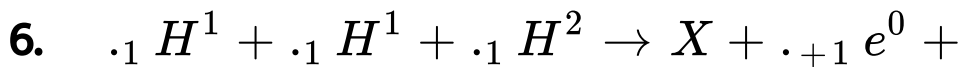
C.  $0^\circ$

D.  $180^\circ$

**Answer: D**



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energy. The emitted particle is.

A. Neutron

B. Proton

C.  $\alpha$ - particle

D. Neutrino

**Answer: C**



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7. Which of the following isotopes is used for treatment of cancer ?

A.  $K^{40}$

B.  $Co^{60}$

C.  $Sr^{90}$

D.  $I^{131}$

**Answer: B**



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**8.** If half life of radioactive atom is 2.3 days, then its decay constant would be :

A.  $0.1\text{days}^{-1}$

B.  $0.2\text{days}^{-1}$

C.  $0.3\text{days}^{-1}$

D.  $2.3\text{days}^{-1}$

**Answer: C**



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9. A radioactive element  ${}_{.90}X^{238}$  decay into  ${}_{.83}Y^{222}$ . The number of  $\beta$  – particles emitted are.

A. 4

B. 6

C. 2

D. 1

**Answer: D**



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**10.** The ionization of H-atom is :

A. 13.6 J

B. 13.6 eV

C. 1 eV

D. 10.2 eV

**Answer: B**



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**11.** The volume occupied by an atom is greater than the volume of the nucleus by factor of about

A.  $10^1$



B.  $10^5$

C.  $10^{11}$

D.  $10^{15}$

**Answer: D**



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**12. What percentage (approximate) of original radioactive substance left after 4 half-Life?**

A. 0.2

B. 0.1

C. 0.05

D. 0.06

**Answer: D**



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**13.** Which of the following particles has similar mass of electron ?

A. Neutron

B. Proton

C. Positron

D. Neutrino

**Answer: C**



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**14.** If half life period of radium is 1600 years, its average life period will be:

A. 3200 years

B. 4800 years

C. 2309 years

D. 4217 years

**Answer: C**



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**15.** The energy equivalent of one atomic mass unit is

A.  $1.6 \times 10^{-19} J$

B.  $6.02 \times 10^{23} J$

C. 931 MeV

D. 9.31 MeV

**Answer: C**



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**16.** Hydrogen bomb is based on the principle of

A. Nuclear fusion

B. Nuclear fission

C.  $\beta$ -decay

D. None of these.

**Answer: A**



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**17.** Energy generation in stars is mainly due to

A. Nuclear fusion

B. Nuclear fission

C. Gravitational pull

D. Chemical reaction.

**Answer: A**



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**18. Who discovered the nucleus ?**

A. Thomson

B. Bohr

C. Rutherford

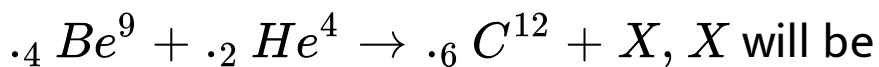
D. de-Broglie

**Answer: C**



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**19.** In nuclear reaction



A. Proton

B. Electron

C. Neutron



D. None.

**Answer: C**



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**20.** What does X stand for in the given reaction ?



A. Proton

B. Electron

C. Neutron

D.  $\alpha$ -particle.

**Answer: C**



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**21.** Which of the following series of H-atom lies in visible range?

A. Lyman

B. Paschen

C. Brackett

D. Balmer

**Answer: D**



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**22.** Which spectral series of hydrogen atom lie in the ultraviolet region ?

A. Lyman

B. Paschen

C. P Fund

D. Balmer

**Answer: A**



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**23. Who discovered the nucleus ?**

A. Thomson

B. Bohr

C. Rutherford

D. de-Broglie

**Answer: C**



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