PHYSICS

BOOKS - FULL MARKS PHYSICS (TAMIL ENGLISH)

ATOMIC AND NUCLEAR PHYSICS

Solved Examples

1. The radius of the 5^{th} orbit of hydrogen atom is 13.25Å. Calculate the wavelength of the

electron in the 5^{th} orbit.

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2. Find the (i) angular momentuum (ii) velocity of the electron in the 5^{th} orbit of hydrogen atom

$\left(h = 66 \times 10^{-34} Js, m = 9.1 \times 10^{-31} kg\right)$

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3. (a)Show that the ratio of velocity of an electron in the first Bohr orbit to the speed of light c is a dimensionless number.

(b) Compute the velocity of electrons in ground state, first excited state and second excited state in Bohr atom model.

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4. The Bohr atom model is derived with the assumption that the nucleus of the atom is

stationary and only electrons revolve around the nucleus. Suppose the nucleus is also in motion, then calculate the energy of this new system.

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5. Suppose the energy of a hydrogen- like atom is given as $E_n = \frac{-54.4}{n^2} eV$ where $n \in N$. Calculate the following:

(a) Sketch the energy levels for this atom and compute its atomic number.

(b) If the atom is in ground state, compute its first excitation potential and also its ionization potential.

(c) When a photon with energy 42 eV and another photon with energy 56 eV are made to collide with this atom, does this atom absorb these photons?

(d) Determine the radius of its first Bohr orbit.

(e) Calculate the kinetic and potential energies in the ground state.

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6. Calculate the average atomic mass of chlorine if no distinction is made between its different isotopes?

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7. Calculate the radius of^{197}_{79} Au.

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8. Calculate the density of the nucleus with mass number A.

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9. Compute the binding energy of $_{2}^{4}\mathrm{He}$ nucleus using the following data: Atomic mass of Helium atom, $M_A(He) = 4.00260u$ and that of hydrogen atom, $m_H = 1.00785u$.

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10. Compute the binding energy per nucleon of $_{2}^{4}\mathrm{He}$ nucleus.

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11. (a) Calculate the disintegration energy when stationary $_{92}^{232}\mathrm{U}$ nucleus decays to thorium $_{90}^{228}\mathrm{Th}$ with the emission of α particle. The atomic masses are of $_{92}^{232}\mathrm{U} = 232.037156u$, $_{90}^{228}\mathrm{Th} = 228.028741u$ and $_{2}^{4}\mathrm{He} = 4.002603u$

(b) Calculate kinetic energies of $_{90}^{228}\mathrm{Th}$ and α-particle and their ratio.

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12. Calculate the number of nuclei of carbon -14 undecayed after 22,920 years if the initial number of carbon - 14 atoms is 10, 000. The half- life of carbon-14 is 5730 years.

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13. A radioactive sample has $2.6\mu g$ of pure $^{13}_{7}\mathrm{N}$ which has a half - life of 10 minutes.

(a) How many nuclei are present initially?

(b) What is the activity initially?

(c) What is the activity after 2 hours?

(d) Calculate mean life of this sample.

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14. Keezhadi a small hamlet, has become one of the very important archeological places of Tamilnadu.It is located in Sivagangi district. A lot of artefacts(gold coin, pottery, beads, iron tools,jewellery and charcol, etc) have been unearthed in Keezhadi which have been given substantial evidence that an ancient urban

civilization had thrived on the banks of river Vaigai.

To determine the age of those materials , the charcoal of 200 g sent for carbon dating is given in the following figure(b). The activity of $^{14}_{6}\mathrm{C}$ is found to be 38 decays/s. Calculate the age of charcoal.

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15. Calculate the amount of energy released when 1 kg of $^{235}_{92}\mathrm{U}$ undergoes fission reaction.

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Textual Evaluation Solved Multiple Choice Question

1. Suppose an alpha particle accelerated by a potential of V volt is allowed to collide with a nucleus whose atomic number is Z, then the

distance of closest approach of alpha particle to the nucleus is

A. $14.4\frac{Z}{V}\text{Å}$

B. $14.4\frac{V}{Z}\text{Å}$

C. $1.44\frac{Z}{V}\text{Å}$

D. $1.44\frac{V}{Z}\text{Å}$

Answer: C

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2. In a hydrogen atom, the electron revolving in the fourth orbit, has angular momentum equal to

A. h

B. $\frac{h}{\pi}$

C. $\frac{4h}{\pi}$

D. $\frac{2h}{\pi}$

Answer: D

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3. Atomic number of H-like atom with ionization potential 122.4 V for n = 1 is

A. 1

B. 2

C. 3

D. 4

Answer: C

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4. The ratio between the first three orbits of hydrogen atom is

A. $1:2:3$

B. $2:4:6$

C. $1:4:9$

D. $1:3:5$

Answer: C

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5. The charge of cathode rays is

A. positive

B. negative

C. neutral

D. not defined

Answer: B

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6. In J.J. Thomson e/m experiment, a beam of electron is replaced by that of muons (particle with same charge as that of electrons but mass 208 times that of electrons). No deflection condition is achieved only if

A. B is increased by 208 times

B. B is decreased by 208 times

C. B is increased by 14.4 times

D. B is decreased by 14.4 times

Answer: C

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7. The ratio of the wavelength for the transition from n = 2 to n = 1 in Li^{++}. He^{+} and H is

A. $1:2:3$

B. $1:4:9$

C. $3:2:1$

D. $4:9:36$

Answer: D

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8. The electric potential between a proton and an electron is given by $V = V_0 In\left(\frac{r}{r_0}\right)$ where r_0 is a constant. Assume that Bohr atom model is applicable to potential, then variation of radius of n^{th} orbit r_n with the principal quantum number n is

A. $r \infty \frac{1}{n}$

B. $r_n \infty n$

C. $r_n \propto \frac{1}{n^2}$

D. $r_n \propto n^2$

Answer: B

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9. If the nuclear radius of ^{27}Al is 3.6 fermi, the approximate nuclear radius of ^{64}Cu is

A. 2.4

B. 1.2

C. 4.8

D. 3.6

Answer: C

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10. The nucleus is approximately spherical in shape. Then the surface area of nucleus haviing mass number A varies as.

A. $A^{\frac{2}{3}}$

B. $A^{\frac{4}{3}}$

C. $A^{\frac{1}{3}}$

D. $A^{\frac{5}{3}}$

Answer: A

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11. The mass of a $^{3}_{7}Li$ nucleus is 0.042 u less than the sum of the masses of all its nucleons. The binding energy per nucleon of $^{3}_{7}Li$ nucleus is nearly

A. 46 MeV

B. 5.6 MeV

C. 3.9 MeV

D. 23 MeV

Answer: B

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12. M_p denotes the mass of the proton and M_n denotes mass of a neutron. A given nucleus of binding energy B, contains Z

protons and N neutrons. The mass M(N, Z) of the nucleus is given by (where c is the speed of light)

A. $M(N, Z) = NM_n + ZM_p - Bc^2$

B. $M(N, Z) = NM_n + ZM_p + Bc^2$

C. $M(N, Z) = NM_n + ZM_p - \frac{B}{c^2}$

D. $M(N, Z) = NM_n + ZM_p + \frac{B}{c^2}$

Answer: C

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13. A radioactive nucleus (initial mass number A and atomic number Z) emits 2α and 2 positrons. The ratio of number of neutrons to that of proton in the final nucleus will be

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

B. $\frac{A-Z-2}{Z+6}$

C. $\frac{A-Z-4}{Z-6}$

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

Answer: B

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14. The half-line period of a radioactive element A is same as the mean life time of another radioactive element B. Initially both have the same number of atoms. Then

A. A and B have the same decay rate initially

B. A and B decay at the same rate always

C. B will decay at faster rate than A

D. A will decay at faster rate than B

Answer: C

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15. A system consists of N_0 nucleus at t = 0. The number of nuclei remaining after half of a half-life (that is, at time $t = \frac{1}{2}T_{\frac{1}{2}}$)

A. $\frac{N_0}{2}$

B. $\frac{N_0}{\sqrt{2}}$

C. $\frac{N_0}{4}$

D. $\frac{N_0}{8}$

Answer: B

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Textual Evaluation Solved Short Answer Questions

1. What are cathode rays?

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2. Write the properties of cathode rays.

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3. Explain the results of Rutherford α-particle scattering experiment.

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4. Write down the postulates of Bohr atom model.

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5. What is meant by excitation energy?

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6. Define the ionization energy and ionization potential.

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7. Write down the draw backs of Bohr atom model.

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8. What is distance of closest approach?

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9. Define impact parameter.

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10. Write a general notation of nucleus of element X. What each term denotes?

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11. What is isotope? Give an example.

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12. What is isotone? Give an example.

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13. What is isobar? Give an example.

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14. Define atomic mass unit u.

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15. Show that nuclear density is almost constant for nuclei with $Z > 10$.

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16. What is mass defect?

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17. What is binding energy of a nucleus? Give its expression.

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18. Calculate the energy equivalent of 1 atomic mass unit.

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19. Give the physical meaning of binding energy per nucleon.

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20. What is meant by radioactivity?

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21. Give the symbolic representation of alpha decay, beta decay and gamma decay.

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22. In alpha decay, why the unstable nucleus emits $_{2}^{4}\mathrm{He}$ nucleus ? Why it does not emit four separate nucleons?

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23. What is mean life of nucleus? Give the expression.

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24. What is half-life of nucleus? Give the expression.

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25. What is meant by activity or decay rate? Give its unit.

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26. Define curie.

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27. What are the constituent particles of neutron and proton?

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Textual Evaluation Solved Long Answer Questions

1. Explain the J.J. Thomson experiment to determine the specific charge of electron.

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2. Discuss the Millikan's oil drop experiment to determine the charge of an electron.

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3. Derive the energy expression for hydrogen atom using Bohr atom model.

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4. Discuss the spectral series of hydrogen atom.

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5. Explain the variation of average binding energy with the mass number by graph and discuss its features.

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6. Explain in detail the nuclear force.

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7. Discuss the alpha decay process with example.

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8. Discuss the beta decay process with examples.

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9. Discuss the gamma decay process with example.

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10. Write a note on radioactivity.

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11. Discuss the properties of neutrino and its role in beta decay.

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12. What is radio carbon dating ?

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13. Discuss the process of nuclear fission and its properties.

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14. Discuss the process of nuclear fusion and how energy is generated in stars.

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15. Describe the working of nuclear reactor with a block diagram.

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16. Explain in detail the four fundamental forces.

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17. Briefly explain the elementary particles of nature.

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Textual Evaluation Solved Exercise

1. Consider two hydrogen atoms H_A and H_B in ground state. Assume that hydrogen atom H_A is at rest and hydrogen atom H_B is moving with a speed and make head-on collide on the stationary hydrogen atom H_A. After the strike, both of them move together. What is minimum value of the kinetic energy of the moving hydrogen atom H_B, such that any one of the hydrogen atoms reaches one of the excitation state.

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2. In the Bohr atom model, the frequency of transitions is given by the following expression $v = Rc\left(\frac{1}{n^2} - \frac{1}{m^2}\right)$, where $n < m$, Consider the following transitions:

Transitions	$m \to n$
1	$3 \to 2$
2	$2 \to 1$
3	$3 \to 1$

Show that the frequency of these transitions obey sum rule (which is known as Ritz combination principle)

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3. (a) A hydrogen atom is excited by radiation of wavelength 97.5 nm. Find the principal quantum number of the excited state.

(b) Show that the total number of lines in emission spectrum is $\frac{n(n-1)}{2}$ and compute the total number of possible lines in emission spectrum.

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4. Calculate the radius of the earth if the density of the earth is equal to the density of the nucleus. [mass of earth 5.97×10^{24}kg].

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5. Calculate the mass defect and the binding energy per nucleon of the ${}_{47}^{108}Ag$ nucleus.

[atomic mass of Ag = 107.905949]

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6. Half lives of two radioactive elements A and B are 20 minutes and 40 minutes respectively. Initially, the samples have equal number of nuclei. Calculate the ratio of decayed numbers of A and B nuclei after 80 minutes.

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7. On your birthday, you measure the activity of the sample ^{210}Bi which has a half - life of 5.01 days. The initial activity that you measure is $1\mu Ci$. (a) What is the approximate activity of

the sample on your next birthday? Calculate (b) the decay constant (c) the mean life (d) initial number of atoms.

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8. Calculate the time required for 60% of a sample of radon undergo decay. Given $T_{1/2}$ of radon = 3.8 days.

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9. Assuming that energy released by the fission of a single $^{235}_{92}U$ nucleus is 200MeV, calculate the number of fissions per second required to produce 1 kilowatt power.

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10. Show that the mass of radium $\left(^{226}_{88}Ra\right)$ with an activity of 1 curie is almost a gram. Given $T_{1/2}$ = 1600 years.

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11. Charcol pieces of tree is found from an archeological site. The carbon - 14 content of this charcol is only 17.5% that of equivalent sample of carbon from a living tree. What is the age of tree?

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Additional Question Multiple Choice Question

1. The potential difference applied to an X-ray tube is 5kV and the current through it is 3.2 mA. Then the number of electrons striking the target per second is

A. 2×10^{16}

B. 5×10^{18}

C. 1×10^{17}

D. 4×10^{5}

Answer: A

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2. The allowed energy for the particle for a particular value of n is proportional to

A. a^{-2}

B. $a^{-\frac{3}{2}}$

C. a^{-1}

D. a^{2}

Answer: A

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3. A diatomic molecular has moment of inertia I. By Bohr's quantization condition its rotational energy in the n^{th} level (n = 0 is not allowed) is

A. $\frac{1}{n^2}\left(\frac{h^2}{8\pi^2 I}\right)$

B. $\frac{1}{n}\left(\frac{h^2}{8\pi^2 I}\right)$

C. $n\left(\frac{h^2}{8\pi^2 I}\right)$

D. $n^2\left(\frac{h^2}{8\pi^2 I}\right)$

Answer: D

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4. The speed of the particle, that can take discrete values is proportional to

A. $n^{-\frac{3}{2}}$

B. n^{-1}

C. $n^{\frac{1}{2}}$

D. n

Answer: D

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5. If 13.6 eV energy is required to 10ise the hydrogen atom, then energy required to remove an electron from n = 2 is

A. 10.2 eV

B. 0 eV

C. 3.4 eV

D. 6.8 eV

Answer: C

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6. Which of the following transitions in hydrogen atoms emits photon of highest frequency?

A. n = 1 to n = 2

B. n = 2 to n = 6

C. n = 6 to n = 2

D. n = 2 to n = 1

Answer: D

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7. The wavelenths involved in the spectrum of deuterium $\left({}_{1}^{2}H\right)$ are slightly different from that of hydrogen spectrum because

A. sizes of the two nuclei are different

B. masses of the two nuclei are different

C. attraction between the electron and the nucleus is different in the two cases

D. nuclear forces are different in the two cases

Answer: B

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8. Energy required for the electron excitation in Li^{++} from the first to the third Bohr orbit is

A. 12.1 eV

B. 36.3 eV

C. 108.8 eV

D. 122.4 eV

Answer: C

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9. Minimum energy required to take out the only one electron from ground state of He^+ is

A. 13.6 eV

B. 54.4 eV

C. 27.2 eV

D. 6.8 eV

Answer: B

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10. Energy of characteristic X-ray is a consequence of

A. a) energy of projectile electron

B. b) thermal energy of target

C. c) transition in target atoms

D. d) none of the above

Answer: C

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11. How much energy is needed to excite an electron in H-atom from ground state to first excited state?

A. -13.6 eV

B. -10.2 eV

C. $+10.2$ eV

D. $+13.6$ eV

Answer: C

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12. For an electron is the second orbit of hydrogen, what is the moment of momentum as per the Bohr's model?

A. $2\pi h$

B. πh

C. $\frac{h}{\pi}$

D. $\frac{2h}{\pi}$

Answer: C

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13. The total energy of an electron in the first excited state of hydrogen atom is about –3.4 eV. Its kinetic energy in this state is

A. 3.4 eV

B. 6.8 eV

C. -3.4 eV

D. -6.8 eV

Answer: A

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14. The energy of the ground state of hydrogen is -13.6eV. The energy of the first excited state is

A. -27.2 eV

B. -52.4 eV

C. -3.4 eV

D. -6.8 eV

Answer: C

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15. The total energy of electron in the ground state of hydrogen atom is $(-13.6eV)$. The

kinetic energy of an electron in the first excited state is

A. 6.8 eV

B. 13.6 eV

C. 1.7 eV

D. 3.4 eV

Answer: D

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16. Bohr's theory of hydrogen atom didi not explain fully

A. diameter of H-atom

B. emission spectra

C. ionisation energy

D. the first structure of even hydrogen spectrum

Answer: D

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17. In Bohr's model of an atom, which of the following is an integral multiple of $\frac{h}{2\pi}$?

A. Kinetic energy

B. Radius of an atom

C. Potential energy

D. Angular momentum

Answer: D

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18. According to Bohr's theory, relation between n and radius of orbit is:

A. $r \propto \frac{1}{n}$

B. $r \propto n$

C. $r \propto n^2$

D. $r \propto \frac{1}{n^2}$

Answer: C

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19. In Bohr's model of hydrogen atom, the radius of the first electron orbit is 0.53 A. What will be the radius of the third orbit?

A. 4.77Å

B. 47.7Å

C. 9Å

D. 0.09Å

Answer: A

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20. In Bohr model of hydrogen atom, which of the following is quantised?

A. linear velocity of electron

B. angular veocity of electron

C. linear momentum of electron

D. angular momentum of electron

Answer: C

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21. In Bohr's model, the atomic radius of the first orbit is r_0. Then, the radius of third orbit is

A. $\frac{r_0}{9}$

B. r_0

C. $9r_0$

D. $3r_0$

Answer: C

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22. What is the ratio of Bohr magneton to the nuclear magneton?

A. $\frac{m_p}{m_e}$

B. $\frac{m_p^2}{m_e^2}$

C. 1

D. $\frac{m_e}{m_p}$

Answer: A

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23. In terms of Bohr radius a_0, the radius of the second Bohr orbit of hydrogen atom is given by

A. $4a_0$

B. $8a_0$

C. $\sqrt{2}a_0$

D. $2a_0$

Answer: A

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24. If an α- particle collides head on with a nucleus, what is impact parameter?

A. zero

B. infinite

C. 10^{-10}m

D. 10^{10}m

Answer: A

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25. One femtometre is equivalent to

A. 10^{15}m

B. 10^{-15}m

C. 10^{-12}m

D. 10^{12}m

Answer: B

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26. Wavelength of K_a line of X-ray spectra varies with atomic number as

A. $\lambda \propto Z$

B. $\lambda \propto \sqrt{Z}$

C. $\lambda \propto \frac{1}{Z^2}$

D. $\lambda \propto \frac{1}{\sqrt{Z}}$

Answer: C

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27. The shortest wavelength of X-rays, emiited from a X-ray tube, depend upon

A. current in the tube

B. voltage applied to the tube

C. nature of glass material in the tube

D. atomic number of the target material

Answer: B

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28. During X-ray formation, if voltage is increased

A. minimum wavelength decreases

B. minimum wavelength increases

C. intensity decreases

D. intensity increases

Answer: A

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29. What would be the radius of second orbit of He^+ ions?

A. 1.058Å

B. 3.023Å

C. 2.068Å

D. 4.458Å

Answer: A

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30. The minimum wavelength of the X -rays produced by electrons accelerated through a potential difference of V volts is directly proportional to

A. $\frac{1}{\sqrt{V}}$

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

C. $\sqrt{V}$

D. V^2

Answer: B

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31. Which source is associated with a line emission spectrum?

A. Electric fire

B. Neon street sign

C. Red traffic light

D. Sun

Answer: B

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32. Which one of the relation is correct between time period and number of orbits while an electron is revolving in a orbit?

A. $T \propto \frac{1}{n^2}$

B. $T \propto n^2$

C. $T \propto n^3$

D. $T \propto \frac{1}{n}$

Answer: C

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33. The size of atom is proportional to

A. A

B. $A^{\frac{1}{3}}$

C. $A^{\frac{2}{3}}$

D. $A^{-\frac{1}{3}}$

Answer: B

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34. If an electron jumps from 1^{st} orbit to 3^{rd} orbit, then it will

A. not lose energy

B. not given energy

C. release energy

D. absorb energy

Answer: D

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35. According to uncertainty principal for an electron, time measurement will become uncertain if following is measured with high certainty

A. energy

B. momentum

C. location

D. velocity

Answer: A

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36. According to Rutherford's atomic model, the electron inside an atom are

A. stationary

B. centralized

C. non-stationary

D. none of these

Answer: C

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37. Wavelength of a light emitted from second orbit to first orbit in a hydrogen atom is

A. 1.215×10^{-7} m

B. 1.215×10^{-5}m

C. 1.215×10^{-4} m

D. 1.215×10^{-3} m

Answer: A

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38. In terms of Rydberg constant R, the wave number of the first Balmer line is

A. R

B. 3R

C. $\frac{5R}{36}$

D. $\frac{8R}{9}$

Answer: C

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39. The K_∞ X-ray emission line of tungsten occurs at $\lambda = 0.021$ nm.The energy difference between K and L levels in this atom is about

A. 0.51MeV

B. 1.2 MeV

C. 59 keV

D. 136 eV

Answer: C

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40. The radius of an electron orbit in a hydrogen atom is of the order of

A. 10^{-8} m

B. 10^{-9}m

C. 10^{-11}m

D. 10^{-13}m

Answer: C

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41. Which of the following atoms has the lowest ionisation potential?

A. $^{14}_{7}\mathrm{N}$

B. $^{133}_{55}\mathrm{Cs}$

C. $^{40}_{18}\mathrm{Ar}$

D. $^{16}_{8}\mathrm{O}$

Answer: B

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42. The transition from the state n = 4 to n = 1 in a hydrogen like atom result in ultraviolet radiation. Infrared radiation will be obtained in the transition from

A. $2 \rightarrow 1$

B. $3 \rightarrow 2$

C. $4 \rightarrow 2$

D. $5 \rightarrow 4$

Answer: D

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43. The number of waves contained in a unit length of the medium is called .....

A. elastic wave

B. wave number

C. wave pulse

D. electromagnetic wave

Answer: B

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44. When hydrogen atom is in its first excited level, its radius is _____ of the Bohr radius.

A. same

B. half

C. twice

D. four times

Answer: D

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45. The ground state of energy of hydrogen atom is $-13.6eV$.What is the potential energy of the electron in this state?

A. 0 eV

B. -27.2 eV

C. 1 eV

D. 2 eV

Answer: B

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46. For ionising an excited hydrogen atom, the energy required (in eV) will be

A. a little less than 13.6

B. 13.6

C. more than 13.6 eV

D. 3.4 or less

Answer: D

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47. What is the energy of He^+ electron in first order?

A. 40.8 eV

B. -27.2 eV

C. -54.4 eV

D. -13.6 eV

Answer: C

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48. If voltage across on X-ray tube is doubled, then energy of X-ray emitted by

A. be doubled

B. be quadrupled

C. become half

D. remain the same

Answer: D

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49. When hydrogen atom is in its first excited level, its radius is _____ of the Bohr radius.

A. twice

B. 4 times

C. same

D. half

Answer: B

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50. The ionisation energy of hydrogen atom is $13.6eV$, the ionisation energy of a singly ionsed helium atom would be

A. 13.6 eV

B. 27.2 eV

C. 6.8 eV

D. 54.4 eV

Answer: D

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51. When an electron makes transition from n = 4 to n = 2, then emitted line spectrum will be

A. first line of lyman series

B. second line of Balmer series

C. first line of paschen series

D. second line of paschen series

Answer: B

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52. Maximum frequency of emission is obtained for the transition

A. $n = 2$ to $n = 1$

B. $n = 6$ to $n = 2$

C. $n = 1$ to $n = 2$

D. $n = 2$ to $n = 6$

Answer: A

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53. Hydrogen atoms are excited from ground state to the state of priciple quantum number 4.Then the number of spectral lines observed will be

A. 3

B. 6

C. 5

D. 2

Answer: B

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54. The radius of hydrogen atom, in the ground state is of the order of

A. 10^{-18} cm

B. 10^{-7} cm

C. 10^{-6} cm

D. 10^{-4} cm

Answer: A

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55. According to Bohr's theory of the hydrogen atom, the speed v_n of the electron in a stationary orbit is related to the principal quantum number n as(c is a constant)

A. $v_n = \frac{c}{n^2}$

B. $v_n = \frac{c}{n}$

C. $v_n = c \times n$

D. $v_n = c \times n^2$

Answer: B

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56. Out of the following which one is not a possible energy for a photon to be emitted by hydrogen atom according to Bohr's atomic model?

A. 13.6 eV

B. 0.65 eV

C. 1.9 eV

D. $11.1eV$

Answer: D

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Additional Question Short Answer Questions

1. What are the drawbacks of Rutherford atom model?

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2. Define excitation potential.

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3. What is atomic number?

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4. What is meant by neutron number?

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5. What is meant by mass number?

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6. Write the properties of neutrino?

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Additional Question Numerical Problems

1. What is the distance of closest approach when a 5 MeV proton approaches a gold nucleus ?

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2. Calculate the impact parameter of a 5 MeV particle scattered by 90° when it approaches a gold nucleus.

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3. What is the angular momentum of an electron in the third orbit of an atom?

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4. Write down the expression for the radii of orbits of hydrogen atom. Calculate the radius of the smallest orbit.

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5. Calculate the frequency of the photon,which can excite the electron to $-3.4eV$ from $-13.6eV$.

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6. The ground state energy of hydrogen atom is $-13.6eV$. If an electron makes a transition from an energy level $-0.85eV \rightarrow -1.51eV$, Calculate the wavelength of the spectral line

emitted. To which series of hydrogen spectrum does this wavelength belong?

7. Express 16 mg mass into equivalent energy in eV.

8. The nuclear mass of $^{56}_{26}\mathrm{Fe}$ is 55.85 amu. Calculate its nuclear density.

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9. Calculate the density of hydrogen nuclear in SI units. Given $R_0 = 1.1$ fermi and $m_p = 1.007825$ amu.

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10. 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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11. The decay constant, for a given radioactive sample is $\frac{0.3465}{day}$. What percentage of this sample will get decayed in a period of 4 years?

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12. Assuming that energy released by the fission of a single $^{235}_{92}U$ nucleus is 200MeV, calculate the number of fissions per second required to produce 1 kilowatt power.

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