PHYSICS

BOOKS - MHTCET PREVIOUS YEAR PAPERS AND PRACTICE PAPERS

ATOMS, MOLECULES AND NUCLEI

Example

1. Radius of the third Bohr orbit of the electron of the hydrogen atom is (Given $h = 6.625 \times 10^{-34} J - s, e = 1.6 \times 10^{-19} C, \varepsilon_0 = 8.85 \times 10^{-12} Fm^{-1}$)

A. 2.48 Å

B. 3.68 Å

C. 2.68 Å

D. 4.77 Å

Answer: D

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2. A $10kg$ satellite circles earth once every $2hr$ in an orbit having a radius of $8000km$. Assuming that Bohr's angular momentum postulate applies to satellites just as it does to an electron in the hydrogen atom, find the quantum number of the orbit of the satellite.

A. 10×10^{40}

B. 5.3×10^{45}

C. 4×10^{10}

D. 3.2×10^{25}

Answer: B

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3. The energy of an excited H-atom is $-3.4eV$. Calculate angular momentum of e^{-}

A. $2.11 \times 10^{-34} J - s$

B. $3.34 \times 10^{-32} J - s$

C. $3.34 \times 10^{-30} J - s$

D. None of these

Answer: A

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4. The H_α line of Balmer series is obtained from the transitio n=3 (energy=-1.5eV) to n=2 (energy =-3.4 eV). What is the wavelength for this line. Given,

$h = 6.6 \times 10^{-34} Js : 1eV = 1.6 \times 10^{-19} J, c = 3 \times 10^8 ms^{-1}$

A. 9210 Å

B. 8231 Å

C. 7321 Å

D. 6513 Å

Answer: D

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5. The frequency of the H_β-line of the Balmer series for hydrogen is

A. 6.17×10^{14}

B. 6.12×10^{12}

C. 6.15×10^{12}

D. 6.18×10^{13}

Answer: A

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6. The lagest and shortest wavelengths in the Lyman series for hydrogen

A. 1215 Å and 911 Å

B. 1315 Å and 900 Å

C. 1115 Å and 800 Å

D. 1015 Å and 850 Å

Answer: A

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7. The increase in mass of water when 1.0 kg of water absorbs $34.2 \times 10^3 J$ of energy to produce a temperature riise of 1 K will be

A. $4.2 \times 10^{-13} kg$

B. $3.8 \times 10^{-13} kg$

C. $5.1 \times 10^{-14} kg$

D. $6.2 \times 10^{-13} kg$

Answer: B

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8. A given coin has a mass of 3.0g. What is 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 $._{29}^{63}Cu$ atoms (of mass 62.9260 u).

A. 1.58×10^{25} MeV

B. 1.23×10^{19} MeV

C. 1.26×10^{16} MeV

D. 1.26×10^{16} MeV

Answer: A

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9. What would be the mean life of $._{27}Co^{60}$, if half-life period is 5.3 years?

A. 2791 days

B. 3080 days

C. 1918 days

D. 4000 days

Answer: A

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10. The de-Broglie wavelength of a particle having a momentum of $2 \times 10^{-28} kg - ms^{-1}$ is

A. $3.3 \times 10^{-5} m$

B. $6.6 \times 10^{-6} m$

C. $3.3 \times 10^{-6} m$

D. $1.65 \times 10^{-6} m$

Answer: C

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11. If the accelerating potential in Davisson and Germer experiment is 30 V, the de-Broglie wavlength of the electron in

A. 0.65 Å

B. 233 Å

C. 265 Å

D. 0.165 Å

Answer: B

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Exercise 1 Topical Problems

1. According to the bohr's atomic model, the relation between principal quantum number (n) and radius of orbit (r) is

A. $r \propto n^2$

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

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

D. $r \propto n$

Answer: D

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2. The decreasing order of wavelength of infrared, microwave, ultraviolet and gamma rays is

A. gamma rays, ultraviolet, infrared, microwave

B. microwave, gamma rays, infrared, ultraviolet

C. infrared, microwave, ultraviolet, gamma rays

D. microwave, infrared, ultraviolet, gamma rays

Answer: D

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3. Rutherford's atomic model could account for

A. stability of atoms

B. origin of spectra

C. the positive charged central core of an atom

D. concept of stationary orbit

Answer: C

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4. In an inelastic collision an electron excites a hydrogen atom from its ground state to a M-Shell state. A second electron collides instantaneously with the excited hydrogen atom in the m-Shell state and ionizes it. At leas how much energy the second electron transfors to the atom is the M-shell state?

A. $+34eV$

B. $+151eV$

C. $-34eV$

D. $-1.51eV$

Answer: D

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5. In Rutherford experiment, a 5.3 MeV α-particle moves towards the gold nucleus (Z=79). How close does the α-particle to get the centre of the nucleus, before it comes momentarily to rest and reverses its motion? ($\varepsilon_0 = 8.8 \times 10^{-12} F/m$)

A. $3.4 \times 10^{-15} m$

B. $8.6 \times 10^{-14} m$

C. $4.3 \times 10^{-14} m$

D. $1.6 \times 10^{-14} m$

Answer: C

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6. When an electron jumps from the orbit n=2 to n=4, then wavelength of the radiations absorbed will be where, (where R is Rydberg's constant)

A. $\frac{16}{3R}$

B. $\frac{16}{5R}$

C. $\frac{5R}{16}$

D. $\frac{3R}{16}$

Answer: A

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7. The wavelength of the first line of Lyman series for hydrogen atom is equal to that of the second line of Balmer series for a hydrogen-like ion. The atomic number Z of hydrogen-like ion is

A. 4

B. 1S

C. 2

D. 3

Answer: C

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8. In the Bohr model of a hydrogen atom, the centripetal force is furnished by the coulomb attraction between the proton and the electron. If a_0 is the radius of the ground state orbit, m is the mass and e is the chargeon the electron and ε_0 is the vacuum permittivity,the speed of the electron is

A. $\dfrac{e}{\sqrt{\varepsilon_0 a_0 m}}$

B. zero

C. $\dfrac{e}{\sqrt{4\pi\varepsilon_0 a_0 m}}$

D. $\dfrac{\sqrt{4\varepsilon_0 a_0 m}}{e}$

Answer: C

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9. The spectrum of an oil flame is an example for

A. line emission spectrum

B. continuous emission spectrum

C. line absorption spectrum

D. band emission spectrum

Answer: B

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10. In a Rutherford scattering experiment when a projectile of change Z_1 and mass M_1 approaches s target nucleus of change Z_2 and mass M_2, te distance of closed approach is r_0. The energy of the projectile is

A. directly proportional to $M_1 \times M_2$

B. directly proportional to $Z_1 Z_2$

C. directly proportional to Z_1

D. directly proportional to mass M_1

Answer: B

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11. Atoms consist of a positively charged nucleus is obviously from the following observation of Geiger-Marsden experiment

A. most of α-particles do not pass straight through the gold foil

B. many of α-particles are scattered through acute angles

C. very large number of α-particles are defeated by large angles

D. None of these

Answer: D

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12. From Rutherford's experiment, estimated sizes of nucleus and atom are

A. $10^{-15}m, 10^{-10}m$

B. $10^{-15}m, 10^{-14}m$

C. $10^{-15}m, 10^{-20}m$

D. $10^{-15}m, 10^{-15}m$

Answer: A

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13. Godl foil used in Geiger-marsden experiment is about 10^{-8} in thick. This ensures

A. gold foil's gravitational pull is small or possible

B. gold foil is deflected when α-particle stream is not incident centrally over it

C. gold foil provides no resistance to passage of α-particles

D. an α-particle will suffer not more than one scattering during passage through gold foil

Answer: D

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14. In Geiger-Marsden experiment, it can be fairly assumed that the gold nucleus remains stationary throughout the scattering process as

A. gold foild is very thin

B. α-particles are moving very fast

C. α-particles carry positive charge

D. gold nucleus is about 50 times heavier then α-particles

Answer: D

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15. In Geiger-Mersden experiment, collimation of α-particles into a narrow beam is done by passing

A. α-particles through a narrow gap between lead bricks

B. α-particles through gold foil

C. α-particles through an electric field

D. α-particles through a magnetic field

Answer: D

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16. In Geiger-Mersden experiment, detection of α-particles scattered at a particular angle is done by

A. counting flashes produced by α-particles on a ZnS coated screen

B. counting spots produced on a photographic film

C. using a galvanometer detector

D. using a Geigher-conuter

Answer: D

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17. The ionization enegry of the electron in the hydrogen atom in its ground state is $13.6 ev$. The atoms are excited to higher energy levels to emit radiations of 6 wavelengths. Maximum wavelength of emitted radiation corresponds to the transition between

A. n=3 to n=2 states

B. n=3 to n=1 states

C. n=2 to n=1 states

D. n=4 to n=3 states

Answer: D

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18. If v_1 is the frequency of the series limit of lyman seies, v_2 is the freqency of the first line of lyman series and v_3 is the fequecny of the series limit of the balmer series, then

A. $v_1 - v_2 = v_3$

B. $v_1 = v_2 - v_3$

C. $\frac{1}{v_2} = \frac{1}{v_1} + \frac{1}{v_3}$

D. $\frac{1}{v_2} = \frac{1}{v_1} + \frac{1}{v_3}$

Answer: A

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19. An electron jumps from the first excited state to the ground stage of hydrogen atom..What will be the percentage change in the speed of electron ?

A. 0.25

B. 0.5

C. 1

D. 2

Answer: B

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20. In hydrogen atom, an electron jumps from bigger orbit to smaller orbit, so that radius of smaller orbit is one-fourth of radius of bigger orbit. If speed of electron in bigger orbit was v,then speed in smaller orbit is

A. $\frac{v}{4}$

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

C. v

D. 2v

Answer: D

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21. A hydrogen atom ia in excited state of principal quantum number n . It emits a photon of wavelength λ when it returnesto the ground state. The value of n is

A. $\sqrt{\lambda R(\lambda R - 1)}$

B. $\sqrt{\frac{\lambda R - 1}{\lambda R}}$

C. $\sqrt{\frac{\lambda R}{\lambda R - 1}}$

D. $\sqrt{\lambda(R - 1)}$

Answer: C

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22. In Rutherford scattering experiment, what will b ethe correct angle for α scattering for an impact parameter $b = 0$?

A. 90°

B. 270°

C. 0°

D. 180°

Answer: D

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23. An electron is moving in an orbit of a hydrogen atom from which there can be a maximum of six transition. An which there can be a maximum of three transition. Find ratio of the velocities of the electron in these two orbits.

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

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

C. $\frac{5}{4}$

D. $\frac{3}{4}$

Answer: D

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24. If λ_1 and λ_2 are the wavelengths of the first members of the Lyman and Paschen series respectively, then $\lambda_1 : \lambda_2$ is

A. $1:3$

B. $1:30$

C. $7:50$

D. $7:108$

Answer: D

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25. If the electron in the hydrogen atom jumps from third orbit to second orbit the wavelength of the emitted radiation in term of Rydberg constant is

A. $\frac{6}{5R}$

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

C. $\frac{64}{7R}$

D. None of these

Answer: B

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26. Balmer series of hydrogen atom lies in

A. microwave region

B. visible region

C. ultraviolet region

D. infrared region

Answer: B

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27. Consider $3rd$ orbit of He^{+} (Helium) using nonrelativistic approach the speed of electron in this orbit will be (given $K = 9 \times 10^{9}$ constant $Z = 2$ and h (Planck's constant) $= 6.6 \times 10^{-34} Js.$)

A. $2.92 \times 10^{6} ms^{-1}$

B. $1.46 \times 10^{6} ms^{-1}$

C. $0.73 \times 10^{6} ms^{-1}$

D. $3.0 \times 10^{18} ms^{-1}$

Answer: B

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28. What is the wavelength of ligth for the least energetic photon emitted in the Lyman series of the hydrogen spectrum. (Take , hc

=1240 eV -nm)

A. 122 nm

B. 82 nm

C. 150 nm

D. 102 nm

Answer: B

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29. The total energy of an electron in 4th orbit of hydrogen atom is

A. $-13.6eV$

B. $-3.4eV$

C. $-1.51eV$

D. $-0.85eV$

Answer: D

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30. In Rutherford's α particle cexperiment with thin gold faill, 8100 scattered α-particles per unit ara per unit area per minute were observed at an anle of 60° . Find the number of scattered αparticles pr unit area per minut e at and angle of 120°

A. 900

B. 2025

C. 32400

D. 4050

Answer: A

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31. Consider the spectral line resulting from the transition from n=2 to n=1, in atoms and ions given below. The shortest wavelength is produced by

A. hydrogen atom

B. deuterium atom

C. singly ionized helium

D. doubly ionized lithium

Answer: D

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32. If and α-paricle of mass m, charged q and velocity v is incident on a nucleus charge Q and mass m, then the distance of closest approach is

A. $\frac{Qq}{4\pi\varepsilon_0 m^2 v^2}$

B. $\frac{Qq}{2\pi\varepsilon_0 m v^2}$

C. $\frac{Qqmv^2}{2}$

D. $\frac{Qq}{mv^2}$

Answer: B

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33. The energy of an electron in excited hydrogen atom is -3.4 eV . Then, according to Bohr's therory, the angular momentum of the electron of the electron is

A. $2.1 \times 10^{-34} J - s$

B. $3 \times 10^{-34} J - s$

C. $2 \times 10^{-34} J - s$

D. $0.5 \times 10^{-34} J - s$

Answer: A

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34. The radius of the smallest electron orbitin hydrogen like ion is $(0.51 \times 10^{-10} / 4)m$, then it is

A. Hydrogen atom

B. He^{+}

C. Li^{2+}

D. Be^{3+}

Answer: D

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35. First Bohr radius of an atom with Z=82 is r. radius its third orbit is

A. 9r

B. 6r

C. 3r

D. r

Answer: A

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36. The ratio of minimum wavelengths of Lyman and Balmer series will be

A. 1.25

B. 0.25

C. 5

D. 10

Answer: B

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37. Solar spectrum is an example for

A. line emission spectrum

B. continuous emission spectrum

C. band absorption spectrum

D. line absorption spectrum

Answer: D

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38. If the series limit wavelength of the Lyman series for hydrogen atom is 912Å, then the series limit wavelength for the Balmer series for the hydrogen atom is

A. 912 Å

B. 912×2 Å

C. 912×4 Å

D. $\frac{912}{2}$ Å

Answer: C

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39. What will be the angular momentum in fourth orbit, if L is the angular momentum of the electron in the second orbit of hydrogen atom?

A. 2L

B. $\frac{3}{2}L$

C. $\frac{2}{3}L$

D. $\frac{L}{2}$

Answer: A

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40. The total energy of eletcron in the ground state of hydrogen atom is $-13.6eV$. The kinetic enegry of an electron in the first excited state is

A. 3.4 eV

B. 6.8 eV

C. 13.6 eV

D. 1.7 eV

Answer: A

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41. If the binding energy of the electron in a hydrogen atom is $13.6 eV$, the energy required to remove the electron from the first excited state of Li^{++} is

A. 30.6 eV

B. 13.6 eV

C. 3.4 eV

D. 12.24 eV

Answer: A

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42. If the energy of a hydrogen atom in nth orbit is E_n, then energy in the nth orbit of a singly ionised helium atom will be

A. $4E_n$

B. $E_n / 4$

C. $2E_n$

D. $E_n / 2$

Answer: A

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43. the ionization energy of Li ^(++)` is equal to

A. 9 hcR

B. 6 hcR

C. 2hcR

D. hcR

Answer: A

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44. An electron with kinetic energy $5eV$ is incident on a hydrogen atom in its ground state.The collision

A. must be elastic

B. may be partially elastic

C. may be completely elastic

D. may be completely inelastic

Answer: A

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45. The potential energy of the orbital electron in the ground state of hydrogen atoms is -E, what is the kinetic energy?

A. 4E

B. 2E

C. $\frac{E}{2}$

D. $\frac{E}{4}$

Answer: C

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46. In which of the following systems will the radius of the first orbit (n=1) be minimum?

A. Deuterium atom

B. Hydrogen atom

C. Doubly ionized lithium

D. Singly ionized helium

Answer: C

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47. Compare the radii of the nuclei of mass numbers 27 and 64.

A. $3:4$

B. $4:3$

C. $9:16$

D. $16:9$

Answer: A

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48. The wavelength of K_{α} line in copper is 1.54Å. The ionisation energy of K electron in copper in Joule is

A. 11.2×10^{-17}

B. 12.9×10^{-16}

C. 1.7×10^{-15}

D. 10×10^{-16}

Answer: C

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49. In Raman effect, Stokes' lines are spectral lines having

A. frequency greater than that of the original line

B. wavelength equal to that of the original line

C. wavelength less than that of the orginal line

D. wavelength greater than that of the original line

Answer: D

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50. Electrons in a certain energy level $n = n_1$ can emit 3 spectral lines. When they are in another energy level, $n = n_2$, they can emit 6 spectral lines. The orbital speed of the electrons in the two orbits are in the ratio

A. $4:3$

B. $3:4$

C. $2:1$

D. $1:2$

Answer: A

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51. A hydrogen-like atom emits rediationof frequency 2.7×10^{15} Hz $when$ if $makesatransitionomn = 2$ to $n = 1$ $. Theequencyemied \in atransitionomn$ = 3 to n = 1` will be

A. $3.2 \times 10^{15} Hz$

B. $32 \times 10^{15} Hz$

C. $1.6 \times 10^{15} Hz$

D. $16 \times 10^{15} Hz$

Answer: A

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52. Taking the Bohr radius $a_0 = 53$ pm, the radius of Li^{++} ion in its gnround state, on the basis of Bohr's model, will be about.

A. 53 pm

B. 27 pm

C. 18 pm

D. 13 pm

Answer: C

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53. K_α and K_β X-rays are emitted when there is a transition of electron between the levels

A. n=2 to n=1 and n=3 to n=1, respectively

B. n=2 to n=1 and n=3 to n=2, respectively

C. n=3 to n=2 and n=4 to n=2, respectively

D. n=3 to n=2 and n=4 to n=3, respectively

Answer: A

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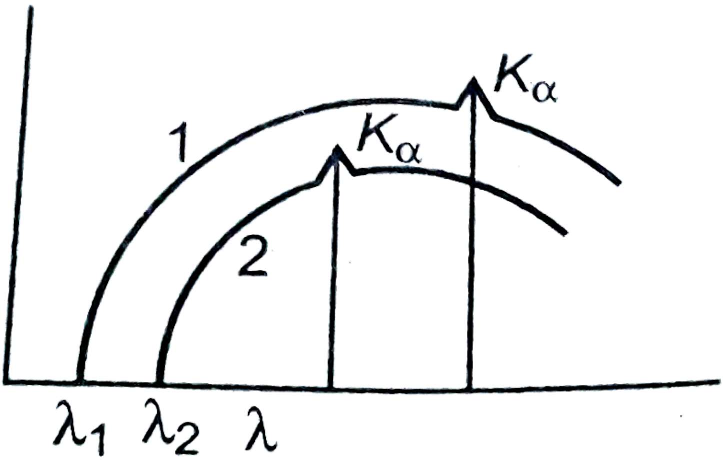
54. When two different materials A and B having atomic number Z_1 and Z_2 are used as the target in Coolidge γ-ray tube at different operating voltage V_1 and V_2 respectively their spectrums are found as below.



The correct relation is

A. $V_1 > V_2$ and $Z_1 > Z_2$

B. $V_1 < V_2$ and $Z_2 < Z_2$

C. $V_1 < V_2$ and Z_1 and Z_2

D. $V_1 > V_2$ and $Z_1 < Z_2$

Answer: C

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55. Hard X -rays for the study of fractures in bones should have a minimum wavelength of $10^{-11}m$. The accelerating voltage for electrons in X -ray machine should be

A. < 124 kV

B. > 124 kV

C. between 60 ikV and 70 kV

D. $= 100kV$

Answer: D

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56. A beam of 350 keV electrons a molybdenum target, generating the X-rays. What is the cut-off wavelength?

A. 3.55 pm

B. 400 pm

C. 1595 pm

D. 182 pm

Answer: A

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57. An X-rays of wavelength 0.140 nm are scattered from a block of carbon. What will be the wavelengths of X-rays scattered at 90°?

A. 01.40 nm

B. 0.142 nm

C. 01.44 nm

D. 01.46 nm

Answer: B

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58. X-ray of wavelength $\lambda = 2$ Å is emitted from the metal target. The potential difference applied across the cathode and the metal target is

A. 5525 V

B. 320 V

C. 6200 V

D. 3250 V

Answer: C

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59. If a source of power $4kW$ produces 10^{20} photons / second, the radiation belongs to a part of the spectrum called:

A. X-rays

B. ultraviolet rays

C. microwaves

D. γ-rays

Answer: A

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60. A nucleus splits into two nuclear parts having radii in the ratio $1:2$ Their velocities are in the ratio

A. $4:1$

B. $8:1$

C. $2:1$

D. $6:1$

Answer: B

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61. The mass defect in a particular nuclear reaction is 0.3 grams. The amont of energy liberated in kilowatt hours is.

(Velocity of light $= 3 \times 10^8 m/s$).

A. 1.5×10^6

B. 2.5×10^6

C. 3×10^6

D. 7.5×10^6

Answer: A

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62. Number of neutrons in C^{12} and C^{14} are

A. 8 and 6

B. 6 and 8

C. 6 and 6

D. 8 and 8

Answer: A

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63. The density of a nucleus of mass number A is proportional to

A. A^3

B. $A^{1/3}$

C. A

D. A^0

Answer: D

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64. The stable nucleus that has a radius $1/3$ that of Os^{189} is-

A. Be^9

B. Li^7

C. Fe^{19}

D. C^{12}

Answer: D

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

A. $r_A < r_B, E_{\text{bnA}} < E_{\text{bnB}}$

B. $r_A > r_B, E_{\text{bnA}} > E_{\text{bnB}}$

C. $r_A = \frac{4}{5} r_B, E_{\text{bnA}} < E_{\text{bnB}}$

D. $r_A < r_B, E_{\text{bnA}} > E_{\text{bnB}}$

Answer: B

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66. The nuclear force

A. is purely an electrostatic force

B. obeys inverse square law of distance

C. is equal in strength to gravitational force

D. is short range force

Answer: D

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67. If $M(A, Z)$, M_p and M_n denote the masses of the nucleus $._Z X^A$, proton and neutron respectively in units of U (where $1U = 931MeV/c^2$) and B.E. represents its B.E. in MeV, then

A. $M(A, Z) = ZM_p + (A - Z)M_n + BE/c^2$

B. $M(A, Z) = ZM_p + (A - Z)M_n + BE$

C. $M(A, Z) = ZM_p + (A - Z)M_n - BE$

D. $M(A, Z) = ZM_p + (A - Z)M_n + BE/c^2$

Answer: B

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68. What is the Q-value of the reaction?

$^{1}H + ^{7}Li \rightarrow ^{4}He + ^{4}He$

The atomic masses of $^{1}H, ^{4}He$ and ^{7}Li 1.007825u, 4.0026034u and 7.01600u, respectively.

A. 17.35 MeV

B. 18.06 MeV

C. 177.35 MeV

D. 170.35 MeV

Answer: D

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69. Binding energy per nucleon relation with mass number

A. first decreases then increases

B. first increases then decreases

C. increases

D. decreases

Answer: D

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70. The curve of blinding energy per nucleon as a function of atomic mass number has a sharp peak for helium nucleus. This implies that helium.

A. can easily be broken up

B. is very stable

C. can be used as fissionable material

D. is radioactive

Answer: A

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71. Atomic mass of $6C13$ is 1300335 amu and its mass number is 13.0 If 1 amu=931 MeV, binding energy of the neutrons presents in the nucleus is

A. 0.24 MeV

B. 1.44 MeV

C. 1.68 MeV

D. 3.12 MeV

Answer: D

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72. Let N_{β} be the number of β particles emitted by 1 gram of Na^{24} radioactive nuclei (half life $= 15$ hrs) in 7.5 hours, N_{β} is close to (Avogadro number $= 6.023 \times 10^{23} / \text{g. mole}$) :-

A. 6.2×10^{21}

B. 7.5×10^{21}

C. 1.25×10^{22}

D. 1.75×10^{22}

Answer: B

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73. A radioactive decay can form an isotope of the original nucleus with the emission of particles

A. one α and one β

B. one α and four β

C. four α and one β

D. one α and two β

Answer: C

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

A. 25 min

B. 30 min

C. 10 min

D. 40 min

Answer: D

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

A. 90 and 233

B. 90 and 238

C. 91 and 238

D. 91 and 234

Answer: D

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76. $_{92}U^{235}$ undergoes successive disintegrations with the end product of $_{82}Pb^{203}$. The number of α and β particles emitted are

A. $\alpha = 6, \beta = 4$

B. $\alpha = 6, \beta = 0$

C. $\alpha = 8, \beta = 6$

D. $\alpha = 3, \beta = 3$

Answer: D

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77. A nucleus with Z =92 emits the following in a sequence:

$\alpha, \beta^-, \beta^-, \alpha, \alpha, \alpha, \alpha, \alpha, \beta^-, \beta^-, \alpha, \beta^+, \beta^+, \alpha$. The Z of the resulting nucleus is

A. 76

B. 78

C. 82

D. 74

Answer: D

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78. Half life of a radio-active substance is 20 minutes. The time between 20% and 80% decay will be

A. 20 min

B. 30 min

C. 40 min

D. 25 min

Answer: D

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79. The fraction of atoms of radioactive element that decays in 6 days is 7/8. the fraction that decays in 10 days will be

A. 77/80

B. 71/80

C. 31/32

D. 15/16

Answer: C

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80. A common example of β^- decay is $._{15}P^{32} \rightarrow ._{16}S^{32} + x + y.$ Then, x and y stand for

A. electron and neutrino

B. positron and neutrino

C. electron and anti-neutrino

D. positro and anti-neutrino

Answer: C

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81. The activity of a radioactive sample is measures as N_0 counts per minute at $t = 0$ and N_0 / e counts per minute at $t = 5 \text{ min}$. The time (in minute) at which the activity reduces to half its value is.

A. $\log_2 2 / 5$

B. $\frac{5}{\log_e 2}$

C. $5 \log_{10} 2$

D. $5 \log_2 2$

Answer: C

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82. For the radioactive nuclei that undergo either α or β decay, which one of the following cannot occur?

A. Isobar of original nucleus is produced

B. Isotope of original nucleus is produced

C. Nuclei with higher atomic number that of the original nucleus is produced

D. Nuclei with lower atomic number than that of the original nucleus is produced

Answer: C

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83. The radioactivity of a sample is l_1 at a time t_1 and l_2 time t_2. If the half-life of the sample is $\tau_{1/2}$, then the number of nuclei that have disintegrated in the time $t_2 - t_1$ is proportional to

A. $(l_1 - t_2 - l_2 t_1$

B. $l_1 - l_2$

C. $\frac{l_1 - l_2}{\tau_{1/2}}$

D. $(l_1 - l_2)\tau_{1/2}$

Answer: D

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84. A radioactive nucleus of mass number A, initially at rest, emits an $\alpha -$ particle with a speed v. What will be the recoil speed of the daughter nucleus ?

A. $\dfrac{2v}{A-4}$

B. $\dfrac{2v}{A+4}$

C. $\dfrac{4v}{A-4}$

D. $\dfrac{4v}{A+4}$

Answer: D

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85. In a radioactive disintegration, the ratio of initial number of atoms to the number of atoms present at an instant of time equal to its mean life is

A. $\dfrac{1}{e^2}$

B. $\dfrac{1}{e}$

C. e

D. e^2

Answer: C

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86. The activity of a radioactive sample is measured as 9750 counts per minute at $t = 0$ and as 975 counts per minute at $t = 5$ minutes. The decay constant is approximately

A. 0.922min^{-1}

B. 0.691min^{-1}

C. 0.461min^{-1}

D. 0.230min^{-1}

Answer: D

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87. A radioactive sample S_1 having the activity A_1 has twice the number of nucleic as another sample S_2 of activity A_2. If $A_2 = 2A_1$, then the ratio of half-life of S_1 to the half-life of S_2 is

A. 4

B. 2

C. 0.25

D. 0.75

Answer: C

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88. A radioactive material decays by simulataneous emission of two particle from the with respective half - lives 1620 and 810 year . The time , in year , after which one - fourth of the material remains is

A. 4860 yr

B. 3240 yr

C. 2340 yr

D. 1080 yr

Answer: C

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89. Number of nuclei of a radioactive substance at time t=0 are 2000 and 1800 at time t=2 s. number of nuclei left after t=6s is

A. 1442

B. 1554

C. 1652

D. 1458

Answer: C

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90. The ratio of molecular mass of two radioactive substances is $3/2$ and the ratio of their decay cosntatnt is $4/3$. Then. The ratio of their initial activity per mole will be

A. 2

B. $4/3$

C. $8/9$

D. $9/8$

Answer: A

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91. Number of nuclei of a radioactive substance at time t=0 are 2000 and 1800 at time t=2 s. number of nuclei left after t=6s is

A. 800

B. 810

C. 790

D. 700

Answer: B

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92. A radioactive isotope has h half-life of 2 yr. how long will itt take the activity to reduce to 3% of its original value

A. 48yr

B. 7 yr

C. 10yr

D. 96 yr

Answer: D

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93. A sample of a radioactive element has a mass of $10g$ at an instant $t = 0$. The approxiamte mass of this element in the sample after two mean lives is .

A. $10 / e^2$

B. $10 / e$

C. 10e

D. e/10

Answer: A

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94. What is the respective number of α and β particles emitted in the following radioactive decay? $._{90}X^{200} \rightarrow ._{80}Y^{168}$

A. 6 and 8

B. 8 and 8

C. 6 and 6

D. 8 and 6

Answer: B

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95. Two radioactive materials X_1 and X_2 have decay constants 5λ and λ respectively. If initially they have the same number of nuclei, then the ratio of the number of muclei of X_1 to that of X_2 will be $\frac{1}{e}$ after a time

A. λ

B. $\frac{1}{2}\lambda$

C. $\frac{1}{4\lambda}$

D. $\frac{e}{\lambda}$

Answer: C

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96. Activity of a radioactive sample decreases to (1/3)rd of its original value in 3 days. Then, in 9 days its activity will become

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97. Starting with a sample of pure $.^{66}Cu, 7/8$ of it decays into Zn in 15 minute. The corresponding half-life is:

A. 10 min

B. 15 min

C. 5 min

D. $7\frac{1}{2}$ min

Answer: D

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98. Which of the following cannot be emitted by radioactive substances during their decay ?

A. Protons

B. Neutrinos

C. Helium nuclei

D. Electrons

Answer: C

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99. The ratio of half-life times of two elements A and B is $\frac{T_A}{T_B}$. The ratio of respective decay constant $\frac{\lambda_A}{\lambda_B}$,is

A. $\frac{T_B}{T_A}$

B. $\frac{T_A}{T_B}$

C. $\frac{T_A + T_B}{T_A}$

D. $\frac{T_A - T_B}{T_A}$

Answer: A

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100. The half-life of the isotope $._{11}Na^{24}$, is 15h. How much time does it take for $\frac{7}{8}$th of a same of this isotope to decay?

A. 75 h

B. 65 h

C. 55 h

D. 45 h

Answer: C

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101. In aluminium extraction by the Baeyer's process, $hv = e^{+} + e^{-}$ is known as

A. pair production

B. photoelectric effect

C. compton effect

D. Zeeman effect

Answer: A

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102. A free neutron decays spontaneously into

A. a proton, an electron and anti-neutrino

B. a proton, an electron and a neutrino

C. a proton and electron

D. a proton and electron, a neutrino and an anti-neutrino

Answer: A

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103. In the nuclear reaction $._{7}^{14}N + X \rightarrow ._{6}^{14}C + ._{1}^{2}H$, the X will be

A. $._{-1}^{0}e$

B. $._{1}^{1}H$

C. $._{1}^{2}H$

D. $.2_{0}^{1}n$

Answer: D

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104. $._{92}U^{238}$ on absorbing a neutron goes over to $._{92}U^{239}$. This nucleus emits an electron to go over to neptunium which on further emitting an electron goes over to plutonium. How would you represent the resulting plutonium ?

A. $._{94}Pb^{239}$

B. $._{92}Pb^{219}$

C. $._{93}Pb^{240}$

D. $._{92}Pb^{240}$

Answer: D

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105. IF in a nuclear fission, piece of uranium of mass 5.0g is lost, the energy obtained in kWh is

A. 1.25×10^7

B. 2.25×10^7

C. 3.25×10^7

D. 0.25×10^7

Answer: A

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106. The energy released by the fission of one uranium atom is 200 MeV. The number of fissions per second required to produce 3.2 MW of power is :

A. 10^{17}

B. 10^{10}

C. 10^{15}

D. 10^{11}

Answer: A

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107. An α-particlee of mass m suffers one dimensional elastic collision with a nucleus of unknown mass. After the collision the α-particle is scattered directly backwards losing 75% of its kinetic energy. Then, the mass of the nucleus is

A. m

B. 2m

C. 3m

D. $\frac{3}{2}$ m

Answer: D

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108. The operation of a nuclear reactor is said to be critical, if the multiplication factor (k) has a value

A. $k > 1$

B. $k < 1$

C. $k = 1$

D. $k = 0$

Answer: A

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109. On bombardment of U^{235} by slow neutrons, $200 MeV$ energy is released. If the power output of atomic reactor is $1.6 MW$, then the rate of fission will be

A. $5 \times 10^{22} s^{-1}$

B. $5 \times 10^{16} s^{-1}$

C. $8 \times 10^{16} s^{-1}$

D. $20 \times 10^{16} s^{-1}$

Answer: A

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110. The binding energies of the atoms of elements A and B are E_a and E_b, respectively. Three atoms of the element B fuse to give one atom of element A. this fusion process is accompanied by release of energy e. then, E_a, E_b are e are related to each other as

A. $E_a + e = 3E_b$

B. $E_a = 3E_b$

C. $E_a - e = 3E_b$

D. $E_a + 3E_b + e = 0$

Answer: D

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111. If 200 MeV of energy is released in the fission of 1 nucleus of $._{92}U^{235}$, the number of nuclei that undergo fission to produce energy of 10 kWh in 1 s is

A. 11.25×10^{18}

B. 22.5×10^{17}

C. 11.25×10^{17}

D. 22.5×10^{18}

Answer: C

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112. If 200 MeV energy is released in the fission of a single nucleus of $._{92}U^{235}$, how many fissions must occur per sec to produce a power of 1 kW?

A. 3.12×10^{13}

B. 3.12×10^{3}

C. 3.1×10^{17}

D. 3.12×10^{19}

Answer: A

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113. When a sample of solid lithium is placed in a flask of hydrogen gas then following reaction happened

$._1^1 H + ._3 Li^7 \rightarrow ._2 He^4 + ._2 He^4$. This statement is.

.

A. 1

B.

C. may be true at a particular pressure

D. None of these

Answer: C

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114. What is de-Broglie wavelength of the electron accelerated through a potential difference of 100V?

A. 0.12 Å

B. 12 Å

C. 1.22 Å

D. None of these

Answer: B

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115. What is de-Broglie wavelength of the electron accelerated through a potential difference of 100V?

A. 12.27 Å

B. 1.227 Å

C. 0.1227 Å

D. 0.001227 Å

Answer: A

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116. In Davisson-Germer experiment maximum intensity is observed at

A. $50^\circ \text{ and } 54V$

B. $54^\circ \text{ and } 50V$

C. $50^\circ \text{ and } 50V$

D. $65^\circ \text{ and } 50V$

Answer: C

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117. The energy of a photon is equal to the kinetic energy of a proton. If λ_1 is the de-Broglie wavelength of a proton, λ_2 the wavelength associated with the proton and if the energy of the photon is E, then (λ_1 / λ_2) is proportional to

A. E^4

B. $E^{1/2}$

C. E^2

D. E

Answer: A

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118. If the linear momentum of a particle is $2.2 \times 10^{4} kg - ms^{-1}$, then what will be its de-broglie wavelength? (Take, $h = 6.6 \times 10^{-34}$ J-s)

A. $3 \times 10^{-39} m$

B. $3 \times 10^{-29} nm$

C. $6 \times 10^{-29} m$

D. $6 \times 10^{-29} nm$

Answer: B

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119. An electron is accelerated under a potential difference of 182 V. the maximum velocity of electron will be (Given, charge of an electron is $1.6 \times 10^{-19} C\,ms^{-1}$ and its mass is $9.1 \times 10^{-31} kg$)

A. $5.65 \times 10^6 ms^{-1}$

B. $4 \times 10^6 ms^{-1}$

C. $8 \times 10^6 ms^{-1}$

D. $16 \times 10^6 ms^{-1}$

Answer: C

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120. The kinetic energy of an electron gets tripled, then the de-Broglie wavelength associated with it changes by a factor

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

B. $\sqrt{3}$

C. $\frac{1}{\sqrt{3}}$

D. 3

Answer: C

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121. The de-Broglie wavelength of the electron in the ground state of the hyddrogen atom is (Given, radius of the first orbit of hydrogen atom=0.53Å)

A. 1.67 Å

B. 3.33 Å

C. 1.06 Å

D. 0.53 Å

Answer: A

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122. An α- particle and a proton are accelerated from rest by a potential difference of $100V$ After this their de Broglie wavelength are λ_a and λ_p respectively The ratio $\frac{\lambda_p}{\lambda_p}$, to the nearest integer is

A. 3

B. 4

C. 2

D. 45

Answer: B

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123. An electron of mass m_e and a proton of mass m_p are moving with the same speed. The ratio of their de-Broglie wavelength λ_e / λ_p is

A. 918

B. $\frac{1}{1836}$

C. 1836

D. 1

Answer: B

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124. Electrons with de-Broglie wavelength λ fall on the target in an X-ray tube. The cut-off wavelength of the emitted X-ray is

A. $\lambda_0 = \frac{2mc\lambda^2}{h}$

B. $\lambda_0 = \frac{2h}{mc}$

C. $\lambda_0 = \frac{2m^2c^2\lambda^3}{h^2}$

D. $\lambda_0 = \lambda$

Answer: B

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125. The de-Brogile wavelength associated with electron in the $n = 4$ level is :-

A. $\frac{1}{4}$th of the de-Broglie wavelength of the electron in the ground state

B. four times the de-Broglie wavelength of the electron in the ground state

C. two times the de-Broglie wavelength of the electron in the ground state

D. half of the de-Broglie wavelength of the electron in the ground state

Answer: B

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126. Find the de-Broglie wavelength of an electron with kinetic energy of 120 eV.

A. 112 pm

B. 95 pm

C. 124 pm

D. 102 pm

Answer: A

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Exercise 2 Miscellaneous Problems

1. To explain theory of hydrogen atom, Bohr considered

A. quantisation of linear momentum

B. quantisation of angular momentum

C. quantisation of angular frequency

D. quantisation of energy

Answer: B

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2. The ratio of kinetic energy to the total energy of an electron in a Bohr orbit of the hydrogen atom, is

A. -1

B. 2

C. $1:2$

D. None of these

Answer: A

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3. In a hypothetical Bohr hydrogen atom, the mass of the electron is double then

A. $E_0 = -27.2eV, r_0 = a_0/2$

B. $E_0 = -27.2eV, r_0 = a_0$

C. $E_0 = -13.6eV, r_0 = a_0/2$

D. $E_0 = -13.6eV, r_0 = a_0$

Answer: A

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4. An electron jumps from the $4th$ orbit to the $2nd$ orbit of hydrogen atom. Given the Rydberg's constant $R = 10^5 cm^{-1}$. The frequency in Hz of the emitted radiation will be

A. $\frac{3}{16} \times 10^5$

B. $\frac{3}{16} \times 10^{15}$

C. $\frac{9}{16} \times 10^{15}$

D. $\frac{3}{4} \times 10^{15}$

Answer: C

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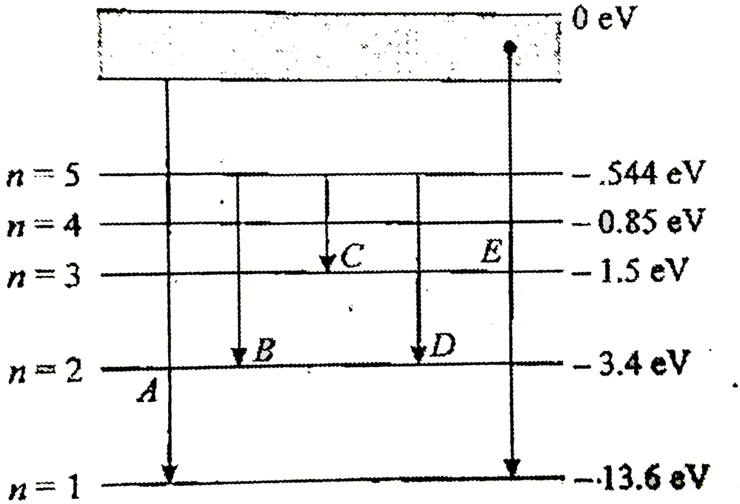
5. In the following figure the energy levels of hydroge atom have been shown along with some transitions marked A, B,C,D and E.The transitionsy A,B and C respectively represent:



A. the first member of the Lyman series, third member of Balmer series and second member of Paschen series

B. the ionisation potential of H, second member of Bamer series and third member of paschen series

C. the series limit of Lyman series, second member of balmer series and second member of paschen series

D. the series limit of lyman series, third member of balmer series and second member of paschen series

Answer: C

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6. An hydrogen atom moves with a velocity u and makes a head on inelastic collision with another stationary H-atom. Both atoms are in ground state before collision. The minimum value of u if one of them is to be given a minimum excitation energy is

A. $2.64 \times 10^4 ms^{-1}$

B. $6.24 \times 10^4 ms^{-1}$

C. $2.02 \times 10^6 ms^{-1}$

D. $6.24 \times 10^8 ms^{-1}$

Answer: B

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7. A hydrogen like ion having wavelength difference between first Balmer and Lyman series equal 593 Å has Z equal to

A. 2

B. 3

C. 4

D. 1

Answer: B

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8. In the Bohr's model of hydrogen-like atom the force between the nucleus and the electron is modified as $F = \frac{e^2}{4\pi\varepsilon_0}\left(\frac{1}{r^2} + \frac{\beta}{r^3}\right)$, where β is a constant. For this atom, the radius of the nth orbit in terms of the bohr radius $\left(a_0 = \frac{\varepsilon_0 h^2}{m\pi e^2}\right)$ is

A. $r_n = a_0 n - \beta$

B. $r_n = a_0 n^2 + \beta$

C. $r_n = a_0 n^2 - \beta$

D. $r_n = a_0 n + \beta$

Answer: B

View Text Solution

9. In rutherford's experiment, the mumber of alpha-particles scattered through an angle of 90° is 28 per minute. Then,the number of particles scattered through an angle of 60° per minute by the same nucleus is

A. 28 per minute

B. 112 per minute

C. 125 per minute

D. 7 per minute

Answer: B

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10. A small particle of mass m move in such a way the potential energy $\left(U = \frac{1}{2}m^2\omega^2r^2\right)$ when a is a constant and r is the distance of the particle from the origin Assuming Bohr's model of quantization of angular momentum and circular orbits , show that radius of the nth allowed orbit is proportional to in

A. $\sqrt{n}$

B. $\sqrt{n^3}$

C. $\frac{1}{\sqrt{n}}$

D. $\frac{1}{\sqrt{n^3}}$

Answer: A

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11. In the Bohr model an electron moves in a circular orbit around the proton. Considering the orbiting electron to be a circular current loop, the magnetic moment of the hydrogen atom, when the electron is in nth excited state, is :

A. $\left(\frac{e}{2m}\right)\frac{n^2h}{\pi}$

B. $\left(\frac{e}{m}\right)\frac{nh}{2\pi}$

C. $\left(\frac{e}{2m}\right)\frac{nh}{2\pi}$

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

Answer: C

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12. In a hydrogen like atom electron make transition from an energy level with quantum number n to another with quantum number $(n-1)$ if $n > > 1$, the frequency of radiation emitted is proportional to :

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

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

C. $\frac{1}{n^3/2}$

D. $\frac{1}{n^3}$

Answer: D

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13. If the atom$(_ 100)Fm^{257}$ follows the Bohr model the radius of $\_ (100)Fm^{257}$ is n time the Bohr radius , then find n .

A. 100

B. 200

C. 4

D. $1/4$

Answer: D

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14. Given a sample of radius -226 having half-life of 4 days. Find, the probability, a nucleus disintegrates after 2 half lifes.

A. 1

B. $1/2$

C. 1.5

D. $3/4$

Answer: D

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15. Hydrogen atom is exited from ground state to another state with principal quantum number equal to 4 Then the number of spectral line in the emission spectra will be

A. 2

B. 3

C. 5

D. 6

Answer: D

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16. A diatomic molecule is made of two masses m_1 and m_2 which are separated by a distance r . If we calculate its rotational energy by applying Bohr's rule of angular momentum quantization it energy will be (n is an integer)

A. $\frac{(m_1+m_2)^2 n^2 h^2}{2m_1^2 m_2^2 r^2}$

B. $\frac{n^2 h^2}{2(m_1+m_2)r^2}$

C. $\frac{2n^2 h^2}{(m_1+m_2)r^2}$

D. $\frac{(m_1+m_2)n^2 h^2}{2m_1 m_2 r^2}$

Answer: D

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17. Suppose an electron is attracted toward the origin by a force $\frac{k}{r}$ where k is a constant and r is the distance of the electron from the origin .By applying Bohr model to this system the radius of the n^{th}

orbital of the electron is found to be r_n and the kinetic energy of the electron to be T_n , Then which of the following is true ?

A. $T_n \propto \frac{1}{n^2}, r_n \propto n^2$

B. T_n independent of $n, r_n \propto n$

C. $T_n \propto \frac{1}{n}, r_n \propto n$

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

Answer: B

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18. The largest wavelength in the ultraviolet region of the hydrogen spectrum is 122 nm. The smallest wavelength in the infrared region of the hydrogen spectrum (to the nearest integer) is

A. 802 nm

B. 823 nm

C. 1882 nm

D. 1648 nm

Answer: B

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19. The filament current in the electron gun of a coolidge tube is increased while the potential difference used to accelerate the electrons is decreased. As a result, in the emitted radiation

A. the intensity increases while the minimum wavelength decreases

B. The intensity decreases while the minimum wavelength increases

C. the intensity as well as the minimum wavelength increases

D. the intensity as well as the minimum wavelength decreases

Answer: C

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20. The binding energy of the innermost electron in tungsten is $40keV$. To produce characteristic X - rays using a tungsten target in an X - rays tube the potential difference V between the cathode and the anti - cathode should be

A. $V < 40$ kV

B. $V \leq 40kV$

C. $V > 40$ kV

D. $V = 40$ kV

Answer: C

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21. Hydrogen $\left(._1 H^1\right)$, Deuterum $\left(._1 H^2\right)$, singly ionised Hellium $\left(._2 He^4\right)^+$ and doubly ionised lithium $\left(._3 Li^6\right)^{++}$ all have one electron around the nucleus. Consider an electron tranition from $n = 2$ to $n = 1$. If the wave lengths of emitted radiation are $\lambda_1, \lambda_2, \lambda_3$ and λ_4 respectively then approximately which one of the follwing is correct ?

A. $4\lambda_1 = 2\lambda_2 = 2\lambda_3 = \lambda_4$

B. $\lambda_1 = 2\lambda_2 = 3\lambda_3 = \lambda_4$

C. $\lambda_1 = \lambda_2 = 4\lambda_3 = 9\lambda_4$

D. $\lambda_1 = 2\lambda_2 = 3\lambda_3 = 4\lambda_4$

Answer: C

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22. Electrons with energy $80 keV$ are incident on the tungsten target of an X - rays tube , k- shell electrons of tungsten have $72.5 keV$ energy X- rays emitted by the tube contain only

A. a continuous X-rays spectrum (Bremsstrahlung) with a minimum wavelength of ~0.155 Å)

B. a continuous X-ray spectrum (Bremsstrahlung) with all wavelengths

C. the characteristic X-ray spectrum of tungsten

D. a continuous X-ray spectrum (Bremsstrahlung) with a minimum wavelength of ~0.155Å and the characteristics X-ray spectrum of tungsten

Answer: C

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23. During X-ray production from coolidge tube if the current increased, then

A. the penetration power increases

B. the penetration power decreases

C. the intensity of X-rays increases

D. the intensity of X-rays decreases

Answer: C

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24. A charged oil drop falls with terminal velocity v_0 in the absence of electric field. An electric field E keeps it stationary. The drop acquires charge 3q, it starts moving upwards with velocity v_0. The initial charge on the drop is

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

B. q

C. $\frac{3q}{2}$

D. 2q

Answer: C

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25. Two identical photocathode receive light of frequencies f_1 and f_2. If the maximum velocities of the photoelectrons (of mass m) coming out are respectively v_1 and v_2 then:

A. $v_1 - v_2 = \left[\frac{2h}{m}(f_1 - f_2)\right]^{1/2}$

B. $v_1^2 - v_2^2 = \frac{2h}{m}(f_1 - f_2)$

C. $v_1 + v_2 = \left[\frac{2h}{m}(f_1 + f_2)\right]^{1/2}$

D. $v_1^2 + v_2^2 = \frac{2h}{m}(f_1 + f_2)$

Answer: B

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26. An oil drop carrying a charge q has a mass m kg. it is falling freely in air with terminal speed v. the electric field required to make, the drop move upwards with the same speed is

A. $\frac{mg}{q}$

B. $\frac{2mg}{q}$

C. $\frac{mgv}{q^2}$

D. $\frac{2mgv}{q}$

Answer: B

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1. When an electron in hydrogen atom revolves in stationary orbit, it

A. does not radiate light though its velocity changes

B. does not radiate light and velocity remains unchanged

C. radiates light but its velocity is unchanged

D. radiates light with the change of energy

Answer: A

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2. An electron of mass m has de broglie wavelength λ when accelerated through a potential difference V . When a proton of mass M is accelerated through a potential difference 9V, the de broglie wavelength associated with it will be (Assume that wavelength is determined at low voltage) .

A. $\frac{\lambda}{3}\sqrt{\frac{M}{m}}$

B. $\frac{\lambda}{3}\frac{M}{m}$

C. $\frac{\lambda}{3}\sqrt{\frac{m}{M}}$

D. $\frac{\lambda}{3}\frac{m}{M}$

Answer: C

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3. For Balmer series, wavelength of first line is λ_1 and for Brackett series, wavelength of first line is λ_2 then $\frac{\lambda_1}{\lambda_2}$

A. 0.081

B. 0.162

C. 0.198

D. 0.238

Answer: B

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4. For the hydrogen atom, the energy of radiation emitted in the transition from 4th excited state to 2nd excited state, according to Bohr's theory is

A. 0.567 eV

B. 0.667 eV

C. 0.967 eV

D. 1.267 eVs

Answer: B

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5. The rartio $(\text{in} S1 units)$ of magnetic dipole moment to that of the angular momentum of an electron of mass mkg and charge e coulomb in Bohr's orbit of hydrogen atom is

A. $\frac{e}{m}$

B. $\frac{m}{e}$

C. $\frac{2m}{e}$

D. $\frac{e}{2m}$

Answer: D

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6. If, an electron in hydrogen atom jumps from an orbit of lelvel n=3 to an orbit of level n=2, emitted radiation has a freqwuency (R=

Rydbertg's contant ,c = velocity of light)

A. $\frac{3Rc}{27}$

B. $\frac{Rc}{25}$

C. $\frac{8Rc}{9}$

D. $\frac{5Rc}{36}$

Answer: D

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7. The de-Broglie wavelength of an electron in 4th orbit is (where, r=radius of 1st orbit)

A. $2\pi r$

B. $4\pi r$

C. $8\pi r$

D. $16\pi r$

Answer: C

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8. Ratio of longest wavelengths corresponding to Lyman and Balmer series in hydrogen spectrum is

A. $\frac{5}{27}$

B. $\frac{3}{23}$

C. $\frac{7}{29}$

D. $\frac{9}{31}$

Answer: A

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9. The half-life of a radioactive isotope X is $20yr$. It decays to another element Y which is stable. The two elements X and Y were found to be in the ratio $1:7$ in a sample of given rock. The age of the rock is estimated to be

A. 40 yr

B. 60 yr

C. 80 yr

D. 100 yr

Answer: B

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10. A certain mass of hydrogen is changed to helium by the process of fusion. The mass defect in fusion reaction is $0.02866u$. The energy liberated per u is

$(\text{given} \quad 1u = 931MeV)$

A. 2.67 MeV

B. 26.7 MeV

C. 6.675 MeV

D. 13.35 MeV

Answer: C

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11. When the kinetic energy of an electron is increased , the wavelength of the associated wave will

A. increase

B. decrease

C. wavelength does not depends upon kinetic energy

D. None of these

Answer: B

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12. Orbital acceleration of electron is

A. $\frac{n^2h^2}{4\pi^2m^2r^2}$

B. $\frac{n^2h^2}{2n^2r^3}$

C. $\frac{4n^2h^2}{\pi^2m^2r^3}$

D. $\frac{4n^2h^2}{4\pi^2m^2r^3}$

Answer: A

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13. As par Bohr model, the minimum energy (in eV) required to remove an electron from the ground state of doubly ionized Li atom $(Z = 3)$ is

A. 1.51

B. 13.6

C. 40.8

D. 122.4

Answer: D

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14. An electron moves in Bohr's orbit. The magnetic field at the centre is proportional to

A. n^{-5}

B. n^{-3}

C. n^{-4}

D. n^{-2}

Answer: A

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15. The de-Broglie wavelength of an electron in the ground state of the hydrogen atom is

A. πr^2

B. $2\pi r$

C. πr

D. $\sqrt{2\pi r}$

Answer: B

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16. The product of linear momentum and angular momentum of an electron of the hydrogen atom is proportional to n^x, where x is

A. 0

B. 1

C. -2

D. 2

Answer: A

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17. The orbital frequency of an electron in the hydrogen atom is proportional to

A. n^3

B. n^{-3}

C. n^1

D. n^0

Answer: B

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18. The radius of hydrogen atom in its ground state is $5.3 \times 10^{-11}m$. After collision with an electron it is found to have a radius of $21.2 \times 10^{-11}m$. What is the principle quantum number of n of the final state of the atom ?

A. $n = 4$

B. $n = 2$

C. $n = 16$

D. $n = 3$

Answer: B

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19. If an electron is revolving around the hydrogen nucleus at a distance 0.1 mm. What should be its speed

A. $2.188 \times 10^6 ms^{-1}$

B. $1.094 \times 10^6 ms^{-1}$

C. $4.376 \times 10^6 ms^{-1}$

D. $1.59 \times 10^6 ms^{-1}$

Answer: D

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20. If M_O is the mass of an oxygen isotope $._8 O^{17}$, M_p and M_n are the masses of a proton and a neutron, respectively, the nuclear binding energy of the isotope is

A. $(M_O - 8M_p)c^2$

B. $(M_O - 8M_p - 9M_n)c^2$

C. M_Oc^2

D. $(M_O - 17M_n)c^2$

Answer: B

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21. m_p and m_n are masses of proton and neutron respectively. An element of mass M has Z protons and N neutrons then

A. $M > Zm_p + Nm_n$

B. $M = Zm_p + Nm_n$

C. $M < Zm_p + Nm_n$

D. M may be greater than

Answer: C

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22. In a radioactive material the activity at time t_1 is R_1 and at a later time t_2, it is R_2. If the decay constant of the material is λ, then

A. $R_1 = R_2 e^{-\lambda(t_1 - t_2)}$

B. $R_1 = R_2 e^{\lambda(t_1 - t_2)}$

C. $R_1 = R_2 (t_2 / t_1)$

D. $R_1 = R_2$

Answer: A

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23. Ionization potential of hydrogen atom is 13.6 eV. Hydrogen atoms in the ground state are excited by monochromatic radiation of photon energy 12.1 eV. According to Bohr's theory, the spectral lines emitted by hydrogen will be

A. two

B. three

C. four

D. one

Answer: B

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24. Two nucleons are at a separation of 1 fermi. 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 the other is a neutron

A. $F_1 > F_2 > F_3$

B. $F_2 > F_1 > F_3$

C. $F_1 = F_3 > F_2$

D. $F_1 = F_2 > F_3$

Answer: C

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25. The first line in the Lyman series has wavelength λ. The wavelegnth of the first line in Balmer series is

A. $\frac{5}{27}\lambda$

B. $\frac{36}{5}\lambda$

C. $\frac{27}{5}\lambda$

D. $\frac{5}{36}\lambda$

Answer: C

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26. If 8g of a radioactive substance decays into 0.5 g in 1 h, then the half-life of the substance is

A. 45 min

B. 15 min

C. 10 min

D. 30 min

Answer: B

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27. Maximum energy is evolved during which of the following transitions ?

A. n=1 to n=2

B. n=2 to n=6

C. n=2 to n=1

D. n=6 to n=2

Answer: C

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28. When a charged particle of charge a revolves in a circular orbit of radius r with frequency n, then orbital current will be

A. $\frac{ev}{\pi r^2}$

B. $\frac{ev}{4\pi r}$

C. $\frac{ev}{2\pi r}$

D. $\frac{ev}{4\pi r^2}$

Answer: C

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29. The electron in a hydrogen atom circles around the proton in 1.5941×10^{-18}s. the equivalent current due to motion of the electron is

A. 127.37 mA

B. 122.49 mA

C. 100.37 mA

D. 94.037 mA

Answer: C

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30. The wavelength of radiation emitted is λ_0 when an electron jumps from the third to the second orbit of hydrogen atom. For the electron jump from the fourth to the second orbit of hydrogen atom, the wavelength of radiation emitted will be

A. $\frac{25}{16}\lambda_0$

B. $\frac{27}{20}\lambda_0$

C. $\frac{20}{27}\lambda_0$

D. $\frac{16}{25}\lambda_0$

Answer: C

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