JEE-ADVANCE-2014-P1-Model

Time: 09:00 AM to 12:00 Noon **IMPORTANT INSTRUCTIONS** **Max Marks: 180**

PHYSICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 1 – 10)	Questions with Multiple Correct Choice	3	0	10	30
Sec – II(Q.N : 11 – 20)	Questions with Integer Answer Type	3	0	10	30
Total				**20**	**60**

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 21 – 30)	Questions with Multiple Correct Choice	3	0	10	30
Sec – II(Q.N : 31 – 40)	Questions with Integer Answer Type	3	0	10	30
Total				**20**	**60**

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 41 – 50)	Questions with Multiple Correct Choice	3	0	10	30
Sec – II(Q.N : 51 – 60)	Questions with Integer Answer Type	3	0	10	30
Total				**20**	**60**

PART-I_PHYSICS **Max Marks : 60**

Section-1
(One or More options Correct Type)

This section contains 10 multiple choice equations. Each question has four choices (**A**) (**B**),(**C**) and (**D**) out of which **ONE** or **MORE THAN ONE** are correct.

1. Suppose the potential energy between electron and proton at a distance r is given by $-\frac{Ke^2}{3r^3}$. Application of Bohr's theory of hydrogen atom in this case shows that

   A) energy in the nth orbit is proportional to n^6.

   B) energy is proportional to m^{-3}

   C) energy in the nth orbit is proportional to n^{-2}

   D) energy is proportional to m^3(m=mass of electron)

2. The wavelength of a light incident on a metal surface is increased keeping the intensity constant. Then the

   A) number of photo-electrons will increase

   B) energy of emitted photo-electrons will decrease

   C) number of emitted photo-electrons remains the same

   D) stopping potential required will decrease

3. A source of light is at a distance "s" from metal plate. The plate emits electrons having stopping potential "V"

A) V decreases as s increases

B) V decreases as s decreases

C) V increases when frequency of light is increased

D) V changes if metal is changed

4. When an electron in the hydrogen atom moves from the second orbit to the third orbit,

A) both K.E. and P.E. decrease

B) P.E. increases and K.E. decreases

C) M.E. increases and P.E. decreases

D) the period of revolution increases by a factor $\frac{27}{8}$

5. $^{40}_{19}K$ converts to $^{40}_{18}Ar$ by positive β decay as well as electron capture. Let Q values for the β decay and electron capture be Q_1 and Q_2 respectively in the above reaction.

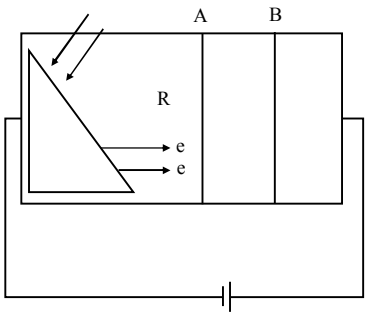
A) $Q_1 = Q_2$

B) $Q_1 < Q_2$

C) neutrino emitted in positive β decay is monoenergetic

D) neutrino emitted in electron capture is monoenergetic

6. In a photoelectric experiment, under the condition of saturation current, if we consider different cross sections as shown, then ($i = neAV_d$, where V_d is average drift speed of photo-electrons)



A) $i_A > i_B$ B) $V_{dA} = V_{dB}$ C) $i_A < i_B$ D) $V_{dA} < V_{dB}$

7. In a sample of hydrogen like atoms all of which are in ground state, a photon beam containing photons of various energies is passed. In absorption spectrum, three dark lines are observed. Which of the following are wavelength (in nm) of the bright lines in the emission spectrum (assume that all transitions take place)

A) 103 B) 434 C) 486 D) 462

8. If the ground state of hydrogen atom is chosen as zero potential energy level,

A) then the value of the total energy in the second excited state is 25.69 eV

B) then the value of the potential energy in the first excited state is 20.4 eV

C) then the value of the total energy in the first energy state is 13.6 eV

D) then the value of the total energy in the second excited state is 10.2 eV

9. Which of the following observations on Photoelectric effect are correct and supports quantum nature of light.

A) There is minimum frequency of light below which no photoelectrons are emitted

B) Electric charge of photoelectrons is quantised

C) The maximum kinetic energy of photoelectrons depends only on the frequency of light and not on its intensity

D) Even when the metal surface is faintly illuminated, the photoelectrons leave the surface immediately

10. An electron makes a transition from n=2 to n=1 state in a hydrogen like atom.

A) magnetic field at the site of nucleus becomes 1/16 times.

B) magnetic field at the site of nucleus becomes 32 times.

C) frequency of revolution of electron in the final orbit is more than the frequency of photon emitted.

D) frequency of revolution of electron in the initial orbit is less than the frequency of photon emitted.

Section-2
(Integer Value Correct Type)

This section contains 10 questions. The answer to each question is a **single digit integer, ranging** from 0 to 9 (both inclusive).

11. In a nuclear reactor an element X decays to a radio active element Y at a constant rate 10^{15} atoms per sec. Each decay releases 100 MeV energy. Half life of Y equals T and decays to a stable product Z. Each decay of Y releases 50 MeV. All energy released inside the reactor is used to produce electricity at an efficiency of 25%. Calculate the electrical power in kw generated in the reactor in steady state.

12. The binding energy of a deuteron is $2\times10^{6}eV$. Find the minimum kinetic energy a proton should possess to split the deuteron at rest. (in 10^6 eV).

13. A stationary He^+ ion emits a (K_α) photon corresponding to the first line of the Lyman series. The photon liberates electron from a stationary hydrogen atom in the ground state. The velocity of the liberated electron is 3.1×10^{x} unit. Find x (You can make necessary approximations)

14. A radioactive substance 'A' is being generated at a constant rate $C\left(100\times10^{6}\ atoms/\sec\right)$.It disintegrates with rate constant of λ (37 dps) to form stable substance B. Initially there are no A or B atoms. If the number of atoms of B after one mean life of A is $x\times10^{6}$ atoms, then find the value of x.

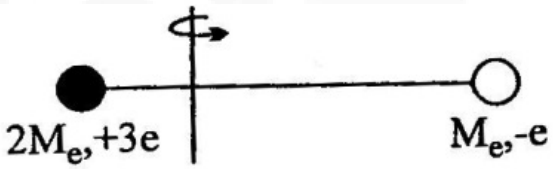
15. In a sample of rock, the ratio of number of ^{206}Pb to ^{238}U nuclei is found to be 0.5. The age of the rock is $(18/n)\times10^{9}\frac{\ln\left(\frac{3}{2}\right)}{\ln 2}$ year (Assume that all the Pb nuclides in the rock was produced due to the decay of Uranium nuclides and $T_{1/2}(^{238}U)=4.5\times10^{9}$ year).find n

16. The present day abundances (in moles) of the isotopes U^{238} and U^{235} are in the ratio of 128: 1. They have half lives of 4.5×10^{9} years and 7×10^{8} years respectively. If age of earth in $\frac{49X}{76}\times10^{7}$ years, then calculate X (Assume equal moles of each isotope existed at the time of formation of the earth)

17. An electron and proton are separated by a large distance and the electron approaches the proton with an initial kinetic energy of 2.9eV. The electron is captured by the proton to form a hydrogen atom in the ground state. If the wavelength(in nm) of the photon given off is 15 X, find the value of X.

18. A cobalt (atomic no = 27) target is bombarded with electrons, and the wavelengths of its characteristic x-ray spectrum are measured. A second weak characteristic spectrum is also found, due to an impurity in the target. The wavelengths of the K_α lines are 225.0 pm (cobalt) and 100.0 pm (impurity). If atomic number of the impurity is Z=10X, Find X (take b=1).

19. Consider a two particle system having the properties as mentioned in the diagram. The system is rotating about the common center of mass. Assume Bohr's quantization principle to be valid for this system. If the radius corresponding to the first energy level of the electrons orbit is R_0 /x, find the value of x. (R_0 is the radius of first orbit of H atom)



20. A radioactive sample contains 0.125kg each of two substances X and Y with half-lives 4s and 8s respectively. Their atomic masses are in the ratio 1:2. Find the ratio of activity of substance Y to substance X after an interval of 16s.