BBF-003-1016031 Seat No. _____

B. Sc. (Sem. VI) (CBCS) Examination

July – 2021

Paper-601 : Physics

(New Course)

Faculty Code : 003
Subject Code : 1016031

Time : **2½** Hours]   [Total Marks : **70**

Instructions :
1. Attempt Any five questions.
2. Make suitable assumption wherever necessary.
3. Figure on the right indicates full marks.
4. Non programmable calculator is permitted.
5. Notations have their usual meaning.

1 (a) Answer each question - one mark each :   **4**
   1) In alpha particle scattering experiment _____ is a source of alpha particle.
   2) Nucleus is positively charged. (True/ False)
   3) What is impact parameter for backward scattering ?
   4) Define isotope nuclei.

   (b) If an alpha particle was released with zero velocity near the surface of a $_{90}\text{Th}^{228}$ nucleus. What would its K.E. be the when far away ?
        Take R_0 = 1.2 fm, K = 9 X10^9 SI   **2**

   (c) Rutherford's explanation of alpha scattering experiment.   **3**

   (d) Derive semi empirical mass formula.   **5**

2 (a) Answer each question - one mark each   **4**
   1) How many protons, neutrons and nucleons respectively in the $^{206}_{82}\text{Pb}$ nucleus ?
   2) _____ used in a screen in alpha particle scattering experiment.
   3) The binding energy per nucleon is the measure of the stability of a nucleus. (True / False)
   4) What is the approximate value of density of nucleus ?

BBF-003-1016031]   1   [Contd...

(b) Find the binding energy per nucleon for $^{56}_{26}$Fe   **2**

nucleus from the data given below :

Mass of proton M_p = 1.007825 amu. Mass of neutron m_n = 1.008665 amu,

Mass of Fe nucleus M_{Fe} = 55.934939 amu,
1 amu = 931.494 MeV.

(c) Give similarity between liquid drop and nucleus.   **3**

(d) Show the nature of the graph of average binding   **5**
energy per nucleon against atomic mass number
and explain its notable points.

3 (a) Answer each question - one mark each :   **4**
1) During the life time of a radioactive element as
time passes the number of its nuclei _____.
2) Internal conversion process is like photo electric
effect. (True/ False)
3) Half life of a radioactive element is 5 min. at the
end of 20 min. its _____ % quantity will remain
undisintegrated.
4) Give unit of decay constant.

(b) If by successive disintegration of $^{238}_{92}$U, the final   **2**

product obtained is $^{206}_{82}$Pb how many α and β

particles are emitted ?

(c) Obtain the exponential law of radioactive disintegration. **3**

(d) Explain pauli's neutrino hypothesis for beta decay.   **5**

4 (a) Answer each question - one mark each :   **4**
1) 5 mCi = ... Bq. 5x 3.7 × 10^7·
2) Who give the neutrino hypothesis for beta decay ?
3) Write relative ionizing power of α, β and γ ?
4) Define Natural radioactivity.

(b) 1 gram of radium is reduced by 2.1 mg in 5 years   **2**
by α-decay. Calculate the half life period of radium.

(c) Explain internal conversion.   **3**

(d) Explain how we can determine the age of earth   **5**
using radio isotopes.

5 (a) Answer each question - one mark each :   **4**
   1) The pair production can take place only when the energy of γ–rays is more than _____ MeV.
   2) Define Stopping Power for Nuclear radiation.
   3) Which P–N Junction used m solid state detectors for detecting gamma rays ?
   4) In photo-multiplier electrode is called diode. (True/False)

  (b) The linear attenuation coefficient for 2 MeV gamma rays in water is about $5m^{-1}$. Find the relative intensity of a beam of 2 MeV gamma rays after it has passed through 0.1 m of water.   **2**

  (c) Explain Char. Curve of G.M. tube in detail.   **3**

  (d) Describe the construction and working of ionization chamber.   **5**

6 (a) Answer each question - one mark each :   **4**

   1) $_1H^2 + \gamma \rightarrow _1H^1 + _0n^1$, this nuclear reaction is _____

   2) Complete the following nuclear reaction

   $_5B^{10} + \underline{\hspace{2cm}} \rightarrow _3Li^7 + _2He^4$.

   3) Define elastic scattering.
   4) What is endoergic reaction ?

  (b) Usually in laboratory, neutrons are obtained by bombarding α-particles, emitted from ^{226}Ra, on   **2**

$_4^9$Be through the reaction $_4^9\text{Be} + _2^4\text{He} \rightarrow _6^{12}\text{C} + _0^1\text{n}$.

The energy of these α-particles is 4.78 MeV.
Find the maximum kinetic energy of neutron.
[Take M_{α} = 4.002603 amu, M_{Be} = 9.012183 amu, M_c = 12.000000 amu, M_n = 1.0086 amu, 1 amu = 931.494 MeV]

  (c) Describe the Rutherford's experiment of artificial transmutation.   **3**

  (d) Drive the Q value equation for nuclear reaction.   **5**

7 (a) Answer each question - one mark each :   **4**
   1) If multiplication factor, K = 1, then reactor is in _____ state.
   2) The larger the size of the body, the escape rate of neutron is small. (True/False)
   3) U^{238} is fissionable with _____ neutron.
   4) What is Breeder reaction. ?

  (b) Find energy released by 1kg. of U^{235} in kilo watt hour.   **2**
   Avogrado number = 6.023×10^{23}

(c) Explain one method of estimate energy released in nuclear fission. **3**

(d) What is nuclear reactor ? Explain it in detail. **5**

8 (a) Answer each question - one mark each : **4**
   1) Betatron is a device to accelerate _____ to very high energy.
   2) A particle Accelerator is a device for increasing _____ of charged particle.
   3) Synchrocyclotron consists of one dee placed in a vacuum chamber. (True/False)
   4) Draw figure of Cyclotron ?

(b) Deuterons in a cyclotron describe a circle of radius 0.32 m just before emerging from the dees. The frequency of the applied e.m.f. is 10 MHz. Find the flux density of the magnetic field and the velocity of deuterons emerging out of the cyclotron. Mass of deuterium = 3.32×10^{-27} kg; e = 1.6×10^{-19} C. **2**

(c) Explain principle and working of Proton synchrotron. **3**

(d) Explain principle, construction and working of linear accelerator. **5**

9 (a) Answer each question - one mark each : **4**
   1) What is tokamark ?
   2) Why fusion known as thermonuclear reaction ?
   3) Define fusion.
   4) Write principle of H bomb.

(b) Find the energy released in single helium nucleus formed by the fusion of two deuterium nuclei. Mass of $_1H^2$ = 2.014102 amu
Mass of $_2He^4$ = 4.002604 amu   1 amu = 931.3 Mev **2**

(c) Explain proton-proton cycle. **3**

(d) Explain plasma confinement in detail. **5**

10 (a) Answer each question - one mark each : **4**
   1. Neutrinos have _____ charge.
   2. Any fermion would have its intrinsic spin _____
   3. Write full form of LHC ?
   4. Anderson discovered positron. (True/False)

(b) Estimate the temperature required for the D-T fusion reaction to occur if the kinetic energy of each particle is 0.225 Mev. The radius of the deuterium nucleus is 1.5 fm and tritium is 1.7 fm.
Take K_B = 1.38×10^{-23} J/K **2**

(c) Give properties of quarks. **3**

(d) Write note on quark model. **5**

_____