

**B.Sc. Semester - 6 (CBCS) Examination**  
**May/June-2021 (OLD COURSE)**  
**NUCLEAR AND PARTICLE PHYSICS(CORE)**

**Time: 1:30 Hours****Marks: 42****Instructions:**

1. Figure to the right indicate marks.
  2. There are five questions in the question paper.
  3. Answer any three of the following questions.
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**Q.1(A) Answer The Following Questions. (Any One Out of Two) (07)**

1. Derive semi empirical mass formula of binding energy.
2. Show the nature of the graph of average binding energy per nucleon against atomic mass number and explain its notable points.

**Q.1(B) Answer The Following Questions. (Any One Out of Two) (04)**

1. 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  $R_0 = 1.2 \text{ fm}$ ,  $K = 9 \times 10^9 \text{ SI}$ .
2. Rutherford's explanation of alpha scattering experiment.

**Q.1(C) Answer The Following Questions. (Any Three Out of Five) (03)**

1. How many protons, neutrons and nucleons respectively in the  ${}_{82}^{206}\text{Pb}$  nucleus?
2. Nucleus is positively charged. (True/ False)
3. What is impact parameter for backward scattering?
4. Define isotope nuclei.
5. What is the approximate value of density of nucleus?

**Q.2(A) Answer The Following Questions. (Any One Out of Two) (07)**

1. Write note on radio carbon dating.
2. Explain pauli's neutrino hypothesis for beta decay

**Q.2(B) Answer The Following Questions. (Any One Out of Two) (04)**

1. Obtain the exponential law of radioactive disintegration.
2. If by successive disintegration of  ${}_{92}^{238}\text{U}$ , the final product obtained is  ${}_{82}^{206}\text{Pb}$  how many  $\alpha$  and  $\beta$  particles are emitted?

**Q.2(C) Answer The Following Questions. (Any Three Out of Five) (03)**

1.  $5 \text{ mCi} = \dots\dots\dots \text{Bq}$ .
2. Write relative ionizing power of  $\alpha$ ,  $\beta$  and  $\gamma$ ?
3. Define Natural radioactivity.
4. Half life of a radioactive element is 5 min. at the end of 20 min. its \_\_\_\_% quantity will remain undisintegrated.
5. Give unit of decay constant.

**Q.3(A) Answer The Following Questions. (Any One Out of Two) (07)**

1. Describe the construction and working of ionization chamber.
2. Drive the Q value equation for nuclear reaction.

- Q.3(B) **Answer The Following Questions. (Any One Out of Two)** (04)
1. Explain Char. Curve of G.M. tube in detail.
  2. Describe the Rutherford's experiment of artificial transmutation.
- Q.3(C) **Answer The Following Questions. (Any Three Out of Five)** (03)
1. Define elastic scattering.
  2. What is endoergic reaction?
  3. The pair production can take place only when the energy of  $\gamma$  – rays is more than \_\_\_\_\_ MeV
  4.  ${}_1\text{H}^2 + \gamma \rightarrow {}_1\text{H}^1 + {}_0\text{n}^1$  this nuclear reaction is \_\_\_\_
  5. Complete the following nuclear reaction  ${}_5\text{B}^{10} + \text{_____} \rightarrow {}_3\text{Li}^7 + {}_2\text{He}^4$
- Q.4(A) **Answer The Following Questions. (Any One Out of Two)** (07)
1. What is nuclear reactor? Explain it in detail.
  2. Explain principle, construction and working of linear accelerator.
- Q.4(B) **Answer The Following Questions. (Any One Out of Two)** (04)
1. Find energy released by 1kg. of  $\text{U}^{235}$  in kilo watt hour .  
Avogadro number =  $6.023 \times 10^{23}$
  2. Explain principle and working of Proton synchrotron.
- Q.4(C) **Answer The Following Questions. (Any Three Out of Five)** (03)
1. Betatron is a device to accelerate \_\_\_\_\_ to very high energy.
  2. A particle Accelerator is a device for increasing \_\_\_\_\_ of charged particle.
  3. If multiplication factor,  $K = 1$ , then reactor is in \_\_\_\_\_ state.
  4. The larger the size of the body, the escape rate of neutron is small. (True/False)
  5. What is Breeder reaction?
- Q.5(A) **Answer The Following Questions. (Any One Out of Two)** (07)
1. Explain plasma confinement in detail.
  2. Write note on quark model.
- Q.5(B) **Answer The Following Questions. (Any One Out of Two)** (04)
1. Explain proton-proton cycle.
  2. Find the energy released in single helium nucleus formed by the fusion of two deuterium nuclei. Mass of  ${}_1\text{H}^2 = 2.014102$  amu Mass of  ${}_2\text{He}^4 = 4.002604$  amu  
1 amu = 931.3 Mev
- Q.5(C) **Answer The Following Questions. (Any Three Out of Five)** (03)
1. Why fusion known as thermonuclear reaction?
  2. Define fusion.
  3. Write principle of H bomb.
  4. Neutrinos have \_\_\_\_\_ charge.
  5. Any fermion would have its intrinsic spin \_\_\_\_\_

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