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**B.Sc. – III (Semester – V) (CGPA) Examination, 2018
PHYSICS (Special Paper – X)
Nuclear Physics**

Day and Date : Wednesday, 18-4-2018
Time : 2.30 p.m. to 5.00 p.m.

Max. Marks : 70

- Instructions:** i) **All questions are compulsory.**
 ii) Figures to the **right** indicate **full marks.**
 iii) Draw **neat diagram wherever necessary.**
 iv) **Use of log table or calculator is allowed.**

1. Select the correct alternative :

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- 1) Energy equivalent of 1 a.m.u. is _____
 a) 931 Mev b) 931 Kev c) 921 Mev d) 931 ev
- 2) Heavy elements with $A > 180$ have packing fraction _____
 a) zero b) positive c) negative d) one
- 3) Radius of nucleus is given by _____
 a) $R = R_0 A^{3/2}$ b) $R = R_0 A^{2/3}$
 c) $R = R_0 A^{1/3}$ d) $R = R_0 A^3$
- 4) The bombarding particle in nuclear reaction is called _____
 a) target b) product c) resultant d) projectile
- 5) One barn is equal to _____
 a) 10^{-28} m^2 b) 10^{-28} cm^2
 c) 10^{28} m^2 d) 10^{28} cm^2
- 6) The principle of phase stability is incorporated in _____
 a) cyclotron b) betatron
 c) bubble chamber d) synchrocyclotron
- 7) An accelerator is used for increasing _____ of a charged particle.
 a) kinetic energy b) potential energy
 c) binding energy d) total energy

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- 8) Betatron works on the principle of _____
 a) phase stability b) induction coil
 c) transformer d) magnetic resonance
- 9) The liquid used in bubble chamber must be _____
 a) non conducting b) highly conducting
 c) semi conducting d) super conducting
- 10) In scintillation counter, the phosphor converts energy of incoming particle into _____
 a) magnetic field b) heat
 c) light d) photoelectric current
- 11) K-electron capture is accompanied by emission of _____
 a) positron b) neutrino c) electron d) beta rays
- 12) Kinetic energy of α -particle is given by _____
 a) $qBr/2m$ b) $q^2 B^2 r^2/2m$
 c) $qB^2 r^2/2m$ d) None of the above
- 13) The field particle in electromagnetic forces is _____
 a) photon b) positron c) pion d) muon
- 14) Hadrons means _____
 a) heavy b) light in weight
 c) weight less d) bulky

2. Attempt **any seven** of the following :

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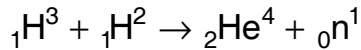
- 1) Define packing fraction of a nucleus.
- 2) Explain electric quadrupole.
- 3) What is pick-up reaction ?
- 4) What is Betatron condition ?
- 5) Explain self-quenching mechanism of GM counter.
- 6) Define α -disintegration energy.
- 7) Give the types of interactions.
- 8) What are the baryons ?

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3. A) Attempt **any two** of the following : 10

- i) Explain general scheme of representation of nuclear reaction.
- ii) Describe the working of scintillation counter.
- iii) Calculate Q-value of the following reaction and comment on its result.



Given : Mass of ${}_1\text{H}^3 = 3.0969$ a.m.u.

Mass of ${}_1\text{H}^2 = 2.0147$ a.m.u.

Mass of ${}_2\text{He}^4 = 4.0038$ a.m.u.

Mass of ${}_0\text{n}^1 = 1.0089$ a.m.u.

B) Explain continuous β -ray spectrum. 4

4. Attempt **any two** of the following : 14

- 1) Explain the construction and working of Geiger-Muller counter.
- 2) Explain the structure of α -line spectra and long range α -particle spectrum.
- 3) What are the elementary particles ? Give a brief history of elementary particles.

5. Attempt **any one** of the following : 14

- 1) Explain binding energy of nucleus. What is binding energy curve ? Explain in detail binding energy curve.
- 2) Explain construction and working of cyclotron. Obtain expression for maximum kinetic energy attained by an ion. Give the limitations of cyclotron.
