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TB246723M

Reg. No :.....

Name :.....

BACHELOR'S DEGREE (C.B.C.S) EXAMINATION, MARCH 2024

2021 ADMISSIONS REGULAR

SEMESTER VI - CORE COURSE (PHYSICS)

PH6B11B18 - Nuclear, Particle and Astrophysics

Time : 3 Hours **Maximum Marks : 60**

Part A

I. Answer any Ten questions. Each question carries 1 mark **(10x1=10)**

1. Explain the term packing fraction.
2. State the basic principle employed in an ionization chamber.
3. Graphically plot the nuclear stability curve.
4. Illustrate the concepts of positron emission and electron capture.
5. Explain the natural radioactive series.
6. Write a short note on surface temperature of a star.
7. Write down the relation between mass of the star and its luminosity.
8. Explain the principle of a nuclear reactor.
9. Mention any two problems related to the operation of fusion reactors.
10. Name the heaviest and lightest quarks.
11. Elaborate on the strangeness number associated with elementary particles.
12. Explain hypercharge.

Part B

II. Answer any Six questions. Each question carries 5 marks **(6x5=30)**

13. Calculate the rest mass energy of the electron in units of MeV.
14. Establish that the ratio of radii of nuclei ${}^{27}_{13}\mathrm{Al}$ and ${}^{125}_{52}\mathrm{Te}$ is approximately equal to 6:10.
15. A nucleus with mass number 235 splits into two nuclei whose mass numbers are in the ratio 2:1. Determine the radii of the two nuclei.
16. Write a note on (i) nuclear isomerism and (ii) internal conversion.
17. Discuss about the birth and the ageing of star.
18. Calculate the approximate mass of Uranium which must undergo fission to produce the same energy as is produced by the combustion of 10 kg of coal. The energy released per fission of uranium is 200 MeV. Heat of combustion of coal is 8000 kcal/kg. (1 cal= 4.2 J).
19. Determine the energy released per kilogram of the hydrogen consumed in C-N cycle.
20. Give short notes on particles and their antiparticles.
21. Examine the following reaction and prove that this is an allowed one.

$$p + p \rightarrow n + p + \pi^{+}$$

Part C

III. Answer any Two questions. Each question carries 10 marks **(2x10=20)**

22. Discuss the general properties of an atomic nucleus.

23. Discuss Soddy-Fajan's displacement law. Also discuss the biological effects of nuclear radiations.

24. Describe the origin of the β ray line and continuous spectrum. Discuss the neutrino hypothesis.

25. Discuss the symmetry principles and the conservation laws that are applicable to elementary particles.