

C 20226

(Pages : 3)

Name.....

Reg. No.....

**SIXTH SEMESTER (CUCBCSS-UG) DEGREE EXAMINATION, MARCH 2022**

Physics/Applied Physics

PHY 6B 12/APY 6B 13—NUCLEAR PHYSICS, PARTICLE PHYSICS AND ASTROPHYSICS

(2014—2018 Admissions)

Time : Three Hours

Maximum : 80 Marks

**Section A (Answer in a word or phrase)***Answer all questions.**Each question carries 1 mark.*

1. Charge of u quark is \_\_\_\_\_.
2. The empirical formula for the nuclear radius is \_\_\_\_\_.
3. The total amount of energy radiated from a star from its surface per second is called \_\_\_\_\_.
4. The hydrogen isotope \_\_\_\_\_ is radioactive.
5. A particle and antiparticle possess the same \_\_\_\_\_.

Question 6 to 10 : Write True or false :

6. Neutrino possesses a mass.
7. Tokamak is used for the confinement of plasma.
8. The principle of a betatron is the use of cross electric and magnetic fields so as to accelerate charged particles.
9. A scintillation counter is very fast in response.
10. Ionisation chamber is used to accelerate charged particle.

(10 × 1 = 10 marks)

**Section B (Answer in two or three sentences)***Answer all questions.**Each question carries 2 marks :*

11. What are baryons and leptons ?
12. Mention some of the uses of a nuclear reactor.
13. Explain decay constant.

**Turn over**

14. List out the confinement methods.
15. Comment on the saturation property of nuclear forces.
16. State the properties of Beta rays.
17. Give the quark combination of a proton.

(7 × 2 = 14 marks)

### Section C (Paragraph type)

*Answer in a paragraph of about half a page to one page.*

*Answer any five questions.*

*Each question carries 4 marks.*

18. Discuss about radio-carbon dating and mention its application.
19. Write a short note on strangeness.
20. Discuss about meson theory of nuclear forces.
21. Give a brief account on nuclear fission and its important applications.
22. Explain the working principle of electron synchrotron.
23. Explain geomagnetic effect in cosmic rays.
24. Explain the term stellar parallax and the units of stellar distances.

(5 × 4 = 20 marks)

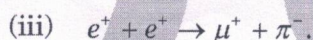
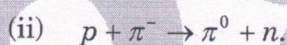
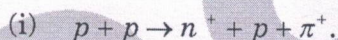
### Section D (Problems)

*(Problems write all relevant formulas, all important steps carry separate marks.)*

*Answer any four questions.*

*Each question carries 4 marks.*

25. Consider a single helium nucleus formed by the fusion of two deuterium nuclei. Mass of  ${}_1\text{H}^2 = 2.014102\text{u}$  ; mass of  ${}_2\text{He}^4 = 4.002604\text{u}$ . Find out the energy released in fusion.
26. Explain Carbon-Nitrogen and proton-proton cycle in sun.
27. Determine whether the following reactions are allowed or forbidden :



28. The disintegration constant  $\lambda$  of a radioactive element is 0.00231 per day. Calculate its half-life and average life.
29. A reactor is developing energy at the rate of 3000 kW. How many atoms of  $U^{235}$  undergo fission per second?
30. Briefly explain equatorial and ecliptic co-ordinate systems.
31. List the four fundamental interaction and their properties.

(4 × 4 = 16 marks)

**Section E (Essays—Answer in about two pages)**

*Answer any two questions.*

*Each question carries 10 marks.*

32. Give the principle of nuclear reactor. What are the roles of moderator and control rods in the reactor? List the main parts and explain the working of the reactor.
33. Discuss the origin and nature of cosmic rays. Differentiate between primary and secondary cosmic rays. Explain properties of beta and gamma rays.
34. Explain liquid drop model of nucleus. How does it lead to the semi-empirical mass formula. Write any two application of Semi-empirical mass formula.
35. Explain the classification of elementary particles with examples.

(2 × 10 = 20 marks)