

D 40051

(Pages : 3)

Name.....

Reg. No.....

**SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, MARCH/APRIL 2018**

(CUCBCSS—UG)

Physics/Applied Physics

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

Time : Three Hours

Maximum : 80 Marks

*The symbols used in this question paper have their usual meanings.*

**Section A (Answer in a word or a phrase)**

*Answer all questions ; each question carries 1 mark.*

1. The energy equivalent of 1 atomic mass unit is \_\_\_\_\_ MeV.
2. When an electron is captured by a nuclear proton, the resulting particle is \_\_\_\_\_.
3. Which is the lightest meson ?
4. Is the output of a cyclotron continuous ?
5. 1 par sec is equal to \_\_\_\_\_ light years.

*Questions 6 to 10 : write True or False.*

6. Neutrons possess a spin magnetic moment.
7. Barn has the dimension of volume.
8. A proportional counter is used for neutron counting.
9. Secondary cosmic rays mainly contain alpha particles.
10. Gravitons are not detected.

(10 × 1 = 10 marks)

**Section B**

*(Answer in two or three sentences)*

*Answer all questions; each question carries 2 marks.*

11. What do you mean by Larmor frequency ? Give an expression for the Larmor frequency.
12. What are isotopes ? Give an example.
13. List the different radioactive series. Mention the parent element in each case.

**Turn over**

14. Explain the confinement method used in a Tokamak.
15. What is the strange behavior of kaons and hyperons ?
16. What are the fundamental interactions in nature?
17. What do you mean by ecliptic ?

(7 × 2 = 14 marks)

### Section C

*(Answer in a paragraph of about half a page to one page)*

*Answer any five questions; each question carries 4 marks.*

18. Comment on the nuclear stability using an N vs. Z plot.
19. Discuss the principle of radiocarbon dating. Mention its application.
20. What are the steps involved in a carbon-nitrogen cycle in sun ?
21. Briefly explain the working principle of a proportional counter.
22. List the elementary particles.
23. Discuss the principle of a betatron accelerator.
24. Explain what is meant by celestial sphere.

(5 × 4 = 20 marks)

### Section D

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

*Answer any four questions; each question carries 4 marks.*

25. Estimate the binding energy of the nucleus  $^{12}_6\text{C}$ . Also determine its density.
26. The half life of radon is 3.8 days. After how many days will only one twentieth of a radon sample be left over ?
27. Obtain the energy released by fission of 1 kg of  $^{235}\text{U}$ , if the energy released per fission is 200 MeV.
28. With the help of a neat diagram, explain the working principle of a Wilson cloud chamber.
29. Discuss the effect of geomagnetic field on the movement of cosmic rays.
30. Check whether the following muon decay is allowed or not.  $\mu^- \rightarrow e^- + \bar{\nu}_e + \nu_\mu$ .
31. Which are the colour indices of stars ?

(4 × 4 = 16 marks)

**Section E**

*(Essays-answer in about two pages)*

*Answer any **two** questions; each question carries 10 marks.*

32. Obtain an expression for the binding energy per nucleon of a nucleus using liquid drop model. Discuss the corrections to the expression from asymmetry energy and pairing energy and obtain the semi empirical binding energy formula.
33. Discuss the tunnel theory of alpha decay.
34. Discuss the quark model. Give the features of the different quarks. What is the quark composition of  $\pi^+$ ,  $K^+$  and  $\Omega^-$  ?
35. Using a neat diagram explain the working principle of a van de Graaf electrostatic generator.

(2 × 10 = 20 marks)