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Reg. No. :

Code No. : 30049 E Sub. Code : GMPH 61

B.Sc. (CBCS) DEGREE EXAMINATION,
APRIL 2020.

Sixth Semester

Physics – Main

NUCLEAR PHYSICS

(For those who joined in July 2012 – 2015)

Time : Three hours

Maximum : 75 marks

PART A — ($10 \times 1 = 10$ marks)

Answer ALL the questions.

Choose the correct answer :

1. The atomic nucleus was dissolved by
 - (a) Fermi
 - (b) Bohr
 - (c) Rutherford
 - (d) Sommer field

2. Nuclear forces are
 - (a) Electrostatic
 - (b) Force between electron and proton
 - (c) Force between electron and positron
 - (d) Charge independent

3. The penetrating power is maximum for
 - (a) α -particles
 - (b) β -particles
 - (c) gamma rays
 - (d) protons

4. The relation connecting half life and mean life of radio active sample is
 - (a) $C = 0.6931 T_{y2}$
 - (b) $T_{y2} = 0.6931/C$
 - (c) $C = 0.6931/T_{y2}$
 - (d) $T_{y2} = 0.6931C$

5. In a nuclear reaction $X + x \rightarrow Y + y$ where X, x, Y, y are the target nucleus, bombarding particle product nucleus and product particle respectively and the respective masses are M_x, m_x, M_y and m_y . Q value of the reaction is
 - (a) $(M_y + m_y - M_x - m_x)C^2$
 - (b) $(M_x + m_x - M_y - m_y)C^2$
 - (c) $(M_x + M_y - m_x - m_y)C^2$
 - (d) $(m_x + m_y - M_x - m_y)C^2$

6. In the nuclear reaction ${}_2\text{He}^4 + {}_7\text{N}^{14} \rightarrow {}_8\text{O}^{17} + \text{X}$. X stands for
- (a) An electron (b) A proton
(c) A neutron (d) A positron
7. In the process of fission, the binding energy per nuclear
- (a) increases (b) decreases
(c) remain unchanged (d) none of the above
8. Chain reaction is possible only if the size of the nuclear mass is
- (a) Less than the critical size
(b) Half of the critical size
(c) Greater than the critical size
(d) None of the above
9. Wilson-dour chamber detects
- (a) α -particles only
(b) β -particles only
(c) γ -particles only
(d) α and β particles only
10. The antiparticle of electron is
- (a) positron (b) α -particle
(c) β -particle (d) proton

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Explain the nuclear composition on the basis of proton-neutron theory.

Or

- (b) What are nuclear forces? Give their properties.

12. (a) State the properties of α -rays.

Or

- (b) Write a note on origin of Gamma rays.

13. (a) Describe the construction and working of proton-synchrotron.

Or

- (b) Explain the balance of mass and energy in nuclear reactions.

14. (a) Briefly discuss thermo nuclear reactions.

Or

- (b) Write a note on radiation hazards.

15. (a) Explain the working of Cerenkov counter.

Or

- (b) Write a note on elementary particles.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Discuss in detail the liquid drop model of the nucleus.

Or

- (b) Write an essay on the general properties of nucleus.

17. (a) Describe the laws of radioactive disintegration.

Or

- (b) Outline the theory of gamma-decay.

18. (a) Describe the working of betatron.

Or

- (b) Derive the Q-value equation for a nuclear reaction. Find the energy balance in nuclear reactions and the Q-value.

19. (a) Explain in detail the critical size of a reactor.

Or

- (b) Outline Bohr-Wheeler's theory of nuclear fission.

20. (a) Describe the constructional features of bubble chamber. Explain the working of a bubble chamber.

Or

- (b) Describe a GM counter and explain its working as a particle detector.
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