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Reg. No. : .....

Code No. : 30306 E **Sub. Code : AMPH 53**

B.Sc. (CBCS) DEGREE EXAMINATION, NOVEMBER 2024.

Fifth Semester

Physics — Core

ATOMIC AND NUCLEAR PHYSICS

(For those who joined in July 2020 only)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Free electron gas theory assumes
   (a) electrons are free from coulomb force
   (b) the coulomb force of repulsion is negligible
   (c) electrons are free to move anywhere
   (d) all the above

2. In the Hall effect, electrons experience
   (a) electrostatic force
   (b) magnetic force
   (c) lorentz force
   (d) all the above

3. The magnetic moment (μ) of a revolving electron around the nucleus varies with principal quantum number n as
   (a) $\mu \propto 1/n$ (b) $\mu \propto 1/n^2$
   (c) $\mu \propto n$ (d) $\mu \propto n^2$

4. Zeeman energy is which energy of a magnetized body?
   (a) Magnetic energy (b) Kinetic energy
   (c) Potential energy (d) Total energy

5. Bragg's law is used in which process?
   (a) X-ray production
   (b) Gamma-ray production
   (c) X-ray crystallography
   (d) X-ray scan

6. Which law was helpful in determining the atomic number of rare earth elements?

(a) Bragg's law (b) Pauli's law

(c) Periodic law (d) Moseley's law

7. The sum of a number of proton and neutron is called

(a) Atomic number (b) Mass number

(c) Isotopes (d) None of these

8. The atomic number is not changed by which type of radioactive decay?

(a) Beta

(b) Gamma

(c) Alpha

(d) The atomic number is affected by all forms of radioactive decay

9. Helium nuclei particles are called

(a) Gamma particles

(b) Beta particles

(c) Alpha particles

(d) No particles that are helium nuclei

10. When two atomic nucleic combine it is called as

(a) Chain reaction (b) Nuclear fusion

(c) Nuclear decay (d) Nuclear fission

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Obtain an expression for thermal conductivity of metals.

Or

(b) Classify the solids on the basis of band theory.

12. (a) Explain vector atom model.

Or

(b) Illustrate the examples of L-S coupling and J-J coupling.

13. (a) List out the properties of X-rays.

Or

(b) State and explain Moseley's law.

14. (a) Explain shell model.

Or

(b) Describe about the working principle of betatron.

15. (a) Discuss about the chain reaction.

Or

(b) Explain nuclear fusion.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b)
Each answer should not exceed 600 words.

16. (a) Discuss about the free electron theory of metals.

Or

(b) Explain Aston's mass spectrograph.

17. (a) Discuss about the theory of anomalous zeeman effect.

Or

(b) Explain stark effect.

18. (a) Sketch and explain Laue's method.

Or

(b) Establish the theory of cosmic rays.

19. (a) Classify the properties of Alpha, beta and gamma rays.

Or

(b) Explain the working action of GM counter.

20. (a) State and explain the principle and working action of atom.

Or

(b) Explain quark model.

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