2020

PHYSICS (Honours)

Paper Code : IX - A & B
[New Syllabus]

Full Marks : 90   Time : Four Hours

Important Instructions
for Multiple Choice Question (MCQ)

- Write Subject Name and Code, Registration number, Session and Roll number in the space provided on the Answer Script.

  Example : Such as for Paper III-A (MCQ) and III-B (Descriptive).

  Subject Code : | III | A | & | B |

  Subject Name : | |

- Candidates are required to attempt all questions (MCQ). Below each question, four alternatives are given [i.e. (A), (B), (C), (D)]. Only one of these alternatives is 'CORRECT' answer. The candidate has to write the Correct Alternative [i.e. (A)/(B)/(C)/(D)] against each Question No. in the Answer Script.

  Example — If alternative A of 1 is correct, then write :
         1. — A

- There is no negative marking for wrong answer.

মাল্টিপল চয়েস প্রশ্নের (MCQ) জন্য জরুরী নির্দেশাবলী

• উত্তরপত্রে নির্দেশিত স্থানে বিষয়ের (Subject) নাম এবং কোড, রেজিস্ট্রেশন নম্বর, সেশন এবং রোল নম্বর লিখতে হবে।

উদাহরণ — যেমন Paper III-A (MCQ) এবং III-B (Descriptive)।

Subject Code : | III | A | & | B |

Subject Name :

• পরীক্ষার্থীদের সবগুলি প্রশ্নের (MCQ) উত্তর দিতে হবে। প্রতিটি প্রশ্নে চারটি করে সম্ভাব্য উত্তর, যথাক্রমে (A), (B), (C) এবং (D) করে দেওয়া আছে। পরীক্ষার্থীকে তার উত্তরের স্বপক্ষে (A) / (B) / (C) / (D) সঠিক বিকল্পটিকে প্রশ্ন নম্বর উল্লেখসহ উত্তরপত্রে লিখতে হবে।

উদাহরণ — যদি **1** নম্বর প্রশ্নের সঠিক উত্তর **A** হয় তবে লিখতে হবে :

1. — A

• ভুল উত্তরের জন্য কোন নেগেটিভ মার্কিং নেই।

Paper Code : IX - A

Choose the correct answer.

Each question carries 4 marks.

1. For atomic energy level(on term) $S = \frac{1}{2}, J = \frac{5}{2}$ and the Lande factor $g = \frac{6}{7}$. The spectroscopic representation of term is---
   A. $^2F_{\frac{5}{2}}$
   B. $^2G_{\frac{5}{2}}$
   C. $^2D_{\frac{5}{2}}$
   D. $^2P_{\frac{5}{2}}$

2. The number of photons emitted per second by 100W sodium lamp $\lambda = 589.3 \, nm$
   A. 29.65×10^{17}
   B. 29.65×10^{18}
   C. 29.65×10^{19}
   D. 29.65×10^{26}

3. When the electron rotates in the nth shell, the energy of a hydrogen atom is given by $E_n = -\frac{1}{n^2} (13.6 \, eV)$. If the energy of a hydrogen atom is estimated as -3.4 eV, the angular momentum of the rotating electron (according to Bohr's theory) will be—
   A. $2.11 \times 10^{-27} J.s$
   B. $2.11 \times 10^{-34} J.s$
   C. $2.11 \times 10^{-30} J.s$
   D. None of the above

4. The shape of a nucleus for positive electric quadrupole moment is-
   A. Spherical
   B. Ellipsoidal
   C. Oblate spheroid
   D. Prolate spheroid

Turn Over

5. On the basis of extreme single particle shell model, the ground state spin(J) and parity of $^{27}_{13}Al$ nucleus will be-

A. $J = \dfrac{5}{2}, odd\ parity$

B. $J = \dfrac{5}{2}, even\ parity$

C. $J = \dfrac{1}{2}, odd\ parity$

D. $J = \dfrac{1}{2}, even\ parity$

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2020

PHYSICS (Honours)

Paper Code : IX - B

[New Syllabus]

Full Marks : 70   Time : Three Hours Thirty Minutes

The figures in the margin indicate full marks.

Answer any *five* questions   14×5=70

1. Write down the time-dependent Schrödinger wave equation for a particle. Hence obtain steady-state Schrödinger wave equation, mentioning the necessary condition.   3+11

2. A particle is confined in a one dimensional box with infinitely hard walls. Find the energy eigenvalues and normalized wave functions.   9+5

3. Define photoelectric effect. Mention the characteristic features of photo electric effect. Write down Einstein's photoelectric equation and explain the above-mentioned characteristic features.   3+(6+5)

4. Show that the eigenfunctions of a Hermitian operator belonging to different eigenvalues are orthogonal. Find the de Broglie wavelength associated with a 15 kV electron.   9+5

5. What is Compton effect? Derive the expression for the Compton shift.   3+11

6. State and explain Moseley's law on X-rays. State and prove Ehrenfest's theorem. 5+9

7. Discuss the construction, working and theory of Betatron.   14

8. What is Raman effect? Discuss the characteristics of Raman lines and explain Raman effect on the basis of quantum theory.   3+(6+5)

9. Explain nuclear fission on the basis of the liquid drop model.
   A nucleus with A=235 splits into two fragments with mass numbers in the ratio 3:2. Taking r_0 =1.4 F, what is the separation between the fragments at the moment of splitting?   8+6

Turn Over

10. Discuss the theory of successive disintegration of radioactive substance.
What are leptons and hadrons? Give the quark structure of a neutron. 9+(4+1)

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