Entrance Examination on
10August 2022 ,
11.00 AM - 1.00 PM

Department of Nuclear Physics
University of Madras

Syllabus and Model Pattern for M.Sc. Physics Entrance Examination

Syllabus: Standard UG level Physics primarily consisting of Mathematical Physics, Mechanics, Heat and Thermodynamics, Acoustics, Solid State Physics, Electricity and Magnetism, Optics, Electronics, Modern Physics, Atomic and Nuclear Physics

Model Pattern

Part A (25 x 1 = 25 marks)

Each **wrong** answer carries **MINUS ⅓** mark

1. The equation of motion for a small particle of mass m at position x is $m\ddot{x}+\gamma\dot{x}-mg=0$. Assuming initial speed to be v_0, the terminal speed of the particle will be

   (A) mg/γ (B) $\sqrt{v_0^2+2gx}$ (C) v_0+gt (D) mg/γ^2t

2. The contribution of coulomb energy in the semi-empirical mass formula of a nucleus with mass number A and atomic number Z is of the form (a=const)

   (A) $aZA^{2/3}$ (B) $aZ\{(Z-1)\}/A^{1/3}$ (C) $aZ\{Z+1\}/A$ (D) $aZ^2/A^{2/3}$

3. A block of mass m is connected to another block of mass M by a spring (massless) of spring constant k. The blocks are kept on a smooth horizontal plane. Initially the blocks are at rest and the spring is unstretched. Then, a constant force F starts acting on the block of mass M to pull it. Find the force on the block of mass m?

   (A) $\frac{MF}{(m+M)}$ (B) $\frac{mF}{(m+M)}$ (C) $\frac{(M+m)F}{m}$ (D) $\frac{mF}{M}$

4. The half life time of an atom of a radioactive sample is

   (A) $e^{-\lambda/2}$ (B) $\frac{\ln 2}{\lambda}$ (C) $\frac{\ln \lambda}{2}$ (D) $2\ln\lambda$

Part B (25 x 3 = 75 marks)

Each **wrong** answer carries **MINUS ONE** mark

1. $\int_0^1 x\sqrt{1-x}\,dx$ is equal to

   (A) -1 (B) $\frac{4}{15}$ (C) ⅞ (D) $\frac{16}{15}$

2. For a diamond structure the packing fraction is

   (A) $\frac{\pi\sqrt{3}}{8}$ (B) $\frac{\pi\sqrt{3}}{4}$ (C) $\frac{\pi\sqrt{3}}{2}$ (D) $\frac{\pi\sqrt{3}}{16}$

3. Let $P_n(X)$ be the Legendre polynomial, then $P_n(-x)$ is equal to

   (A) $(-1)^{n+1}P_n'(x)$ (B) $(-1)^n P_n'(x)$ (C) $(-1)^n P_n(x)$ (D) $P_n''(x)$

4. An electron of mass 'm' kg and charge 'q' coulombs moves from rest through a potential difference of 'v' volts. Calculate its final energy.

   (A) mqv J (B) q/v J (C) qv J (D) qv/m J

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