

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2004-05 & thereafter)

SUBJECT CODE : PH/MC/AN64

B.Sc. DEGREE EXAMINATION APRIL 2008
BRANCH III - PHYSICS
SIXTH SEMESTER

REG. No. _____

COURSE : MAJOR – CORE
PAPER : ATOMIC AND NUCLEAR PHYSICS
TIME : 30 MINS. MAX. MARKS : 30

SECTION – A

TO BE ANSWERED IN THE QUESTION PAPER ITSELF

ANSWER ALL QUESTIONS: (30 x 1 = 30)

I CHOOSE THE CORRECT ANSWER:

- The Bragg law is
a) $2 \sin \theta = d\lambda$ b) $2d \sin \theta = n\lambda$ c) $d \sin \theta = n\lambda$ d) $\sin \theta = d\lambda$
- Positive rays consists of
a) Protons b) Positrons
c) Positively charged ions d) all the above
- The maximum kinetic energy acquired by a photoelectron is equal to
a) $h\nu$ b) $h\nu_0$ c) $h(\nu + \nu_0)$ d) $h(\nu - \nu_0)$
- The energy required to remove an electron from a given orbit to an infinite distance from the nucleus is called as _____ potential.
a) excitation b) ionization
c) second excitation d) second ionization
- The Zeeman shift is directly proportional to
a) λ^2 b) λ c) $1/\lambda$ d) $1/\lambda^2$
- The L shell gets completed when it contains _____ electrons.
a) 2 b) 8 c) 18 d) 6
- The Bhor electron magneton is equal to
a) $e\hbar/2m$ b) $2m/e\hbar$ c) $e\hbar^2/2m$ d) $2m/e\hbar^2$

22. The velocity of the electron moving in an elliptical orbit varies at different parts of the orbit.
23. Sommerfeld's theory could not explain the complex spectra of alkali metals like sodium.
24. The nuclei containing a magic number of nucleons of the same kind form closed shell structure.
25. Hypercharge is not conserved in strong interaction.

IV ANSWER BRIEFLY:

26. What is photoelectric effect?
27. What is stark effect?
28. Distinguish between normal Zeeman effect and anomalous Zeeman effect.
29. What is radiative capture? Give an example.
30. State the Soddy Fajan's displacement law.

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TIME : 2 ½ HOURS MAX. MARKS : 70

SECTION – B

ANSWER ALL QUESTIONS: (5 x 5 = 25)

1. Calculate the work function of a metal (in eV) which has a threshold wavelength of 6800\AA (Given $h=6.625 \times 10^{-34}$ Js).
2. The Spacing between principal planes of NaCl crystal is 2.82\AA . Calculate the wavelength of X-rays for first order Bragg reflection occurring at the angle of 10° .
3. Explain anomalous Zeeman effect and derive the expression for Lande g factor.
4. Find the threshold energy for the reaction ${}_7N^{14}(n,\alpha){}_5B^{11}$. Given mass of Nitrogen = 14.003074 amu neutron = 1.008665 amu, alpha = 4.002603 amu and Boron = 11.00935 amu.
5. Find the binding energy, binding energy per nucleon of ${}_{15}P^{31}$ given mass of proton = 1.007825 amu, mass of neutron = 1.008665 amu mass of phosphorus = 30.973763 amu.
6. A cyclotron with dees of radius 90cm is operated with magnetic field of 0.6 Tesla. Calculate the energy to which a proton is accelerated. Given mass of proton = 1.67×10^{-27} kg and charge = 1.6×10^{-19} coulomb.
7. 1 Kg of radium is reduced by 2.1 g in 5 years by α decay. Calculate the half life period of radium.

SECTION – C

ANSWER ANY THREE QUESTIONS: (3 x 15 = 45)

8. Give the theory of Compton effect and explain its experimental verification.
9. Describe the construction of Aston's mass spectrograph with necessary theory and explain how it can be used for the detection of isotopes.

10. Describe the vector atom model and explain the various quantum numbers associated with it.
11. Describe the construction and working of a nuclear reactor. When is the reactor said to be critical?
12. Give the theory of successive disintegration of radioactive substances. Explain secular and transient equilibrium.

