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				
COUF PAPE TIME	R : ATO	OR – CORE MIC AND NUCLEA INS.		MAX. MARKS : 30		
SECTION – A						
TO BE ANSWERED IN THE QUESTION PAPER ITSELF						
	ANSWER ALL QU	JESTIONS:		$(30 \times 1 = 30)$		
I	CHOOSE THE CO	RRECT ANSWER:				
1.	The Bragg law is a) $2 \sin \theta = d\lambda$	b) $2d \sin \theta = n\lambda$	c) $d \sin \theta = n\lambda$	$d) \sin \theta = d\lambda$		
2.	Positive rays consist a) Protons c) Positively charge		b) Positrons d) all the above	ve		
3.	The maximum kine a) hv	tic energy acquired by b) hv_0	•	n is equal to d) $h(v-v_0)$		
4.	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					
5.	The Zeeman shift is directly proportional to					
	a) λ^2	b) λ	c) $\frac{1}{\lambda}$	d) $1/\lambda^2$		
6.	The L shell gets com a) 2	npleted when it contai b) 8	ns	electrons. d) 6		
7.	The Bhor electron ma) $e \hbar / 2m$	nagneton is equal to b) 2m / eħ	c) $e\hbar^2/2m$	d) $2m / e\hbar^2$		

8.	Lorentz unit is a unit of	FII/MC/AN04				
0.	a) momentum c) energy	b) direction d) magnetic mo	ment			
0						
9.	is not conserved in nuclear reactions					
	a) chargec) electric quadrupole moments	b) mass-energy d) parity				
	c) electric quadrupoie moments	d) parity				
10.	The $_4Be^9 + _2He^4 \rightarrow _6C^{12} + _0n^1$ is a	react	reaction			
	a) (p, α) b) (d, α)					
11.	S	\ 10	1) 00			
	a) 120 b) 80	c) 18	d) 20			
12.		ectly proportional to $A^{1/3}$ d)	$A^{3/4}$			
	,	,				
13.	1 · · · · · · · · · · · · · · · · · · ·					
	a) meson b) lepton	c) hyperon	d) baryon			
14.	The weakest of the four types of fundamental interactions is interaction.					
	a) Gravitational b) Electromagne	tic c) Weak	d) Coulomb			
15.	In pair production,	_ is created.				
	a) a proton	b) a proton – ne	utron pair			
	c) an electron d)	an electron – positro				
II	FILL IN THE BLANKS:					
16.	The velocities of positive rays range from to					
17.	An atom is said to be in the state when its energy is least.					
18.	The Stern and Gerlach experiment is based on the behaviour of atomic magnet in a magnetic field.					
19.	The semi-empirical mass formula for binding energy of a nucleus is					
20.	The Cyclotron frequency is					
III	STATE WHETHER TRUE OR FALSE:					
21.	X-rays are produced when fast moving electrons are suddenly stopped by a solid target.					

- 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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COURSE : MAJOR – CORE

PAPER : ATOMIC AND NUCLEAR PHYSICS

TIME : **2** ½ **HOURS** MAX. MARKS : 70

SECTION - B

ANSWER ALL QUESTIONS:

 $(5 \times 5 = 25)$

- 1. Calculate the work function of a metal (in eV) which has a threshold wavelength of 6800\AA (Given h= $6.625 \times 10^{-34} \text{Js}$).
- 2. The Spacing between principal planes of NaCl crystal is 2.82 Å. 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 nuclean 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:

 $(3 \times 15 = 45)$

- 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.

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