KATHMANDU UNIVERSITY
End Semester Examination
March/April, 2017

Marks Scored:

Level : B.Sc.
Year : II

Course : PHYS 203
Semester : I

Exam Roll No. :

Time : 30 mins.

F. M. : 20

Registration No. :

Date : APR 10 2017

SECTION "A"
[20 Q. × 1 = 20 marks]

Choose and tick (√) the most appropriate answer.

1. The pair of nuclides $_{20}Ca^{40}$ and $_{19}K^{39}$ are
   [a] Isotopes [b] Isotones [c] Isobars [d] Isomers

2. In Balmer series of hydrogen atom, H-beta line is formed when electrons jump from
   [a] 3^{rd} orbit to 2^{nd} orbit [b] 5^{th} orbit to 2^{nd} orbit
   [c] 4^{th} orbit to 2^{nd} orbit [d] 4^{th} orbit to 3^{rd} orbit

3. Mirror nuclei are those nuclei for which
   [a] there are same number of protons
   [b] there are same number of neutrons
   [c] number of protons equals number of neutrons
   [d] the number of neutrons in one equals the number of protons in the other

4. The required energy to detach one electron completely from H atom is equal to
   [a] 13.6 eV [b] 10.2 eV [c] -1.5 eV [d] -3.4 eV

5. The wavelength of X-rays is of the order of
   [a] 1 cm [b] 1 m [c] 1 micron [d] 1 A^o

6. A Curie is a standard unit of radioactivity.Its value is
   [a] 10^9 disintegrations /sec [b] 10^{10} disintegrations/sec
   [c] 3.7×10^{10} disintegrations/sec [d] 3700 disintegrations/sec

7. The work function of a metal is 2.51 eV. Its threshold frequency is
   [a] 6.5×10^{13} Hz [b] 9.4×10^{12} Hz
   [c] 6.08×10^{14} Hz [d] 5.8×10^{11} Hz

8. The energy of an excited state of H-atom is −0.85 eV. What is the quantum number of the orbit if the ground state for H-atom is −13.6 eV?
   [a] 2 [b] 1 [c] 3 [d] 4

9. A liquid hydrogen bubble chamber, operates at a temperature of
   [a] 273 K [b] 127 K [c] 27 K [d] 57 K

10. Geiger Nuttal law gives the range of
    [a] Alpha-particles [b] Beta particles
    [c] Gamma rays [d] X-rays

11. Which one of the following has the greatest ionizing power?
[a] beta particle [b] X-rays [c] alpha particle [d] gamma rays

12. De-Broglie hypothesized that the linear momentum and wavelength of a free massive particle are related by
[a] Planck's constant [b] Boltzmann's constant
[c] The Rydberg constant [d] Avogadro's number

13. In the Bohr model of the hydrogen atom, the angular momentum of the electron at radius r_n is equal to (n is the principal quantum number)
[a] $n\hbar$ [b] $nr_n\hbar$ [c] $n\hbar / r_n$ [d] $n^2 r_n \hbar$

14. The decay constant of the end product of the radio-active series is
[a] Zero [b] Infinity
[c] Uncertain [d] May be zero or infinity

15. The process in which the energy of the particle is converted to light, is the basis of
[a] Bubble chamber [b] G. M. counter
[c] Ionization chamber [d] Scintillation counter

16. Radioactive nuclei whose mass numbers is represented by A=4n+3 belongs to
[a] Uranium Series [b] Actinium Series
[c] Thorium Series [d] Neptunium Series

17. The time during which pulses are recorded but are of smaller size in G.M. counter is called
[a] Recovery time [b] Dead time
[c] Resolving time [d] None

18. Which pair of nuclei is most stable?
[a] even-odd [b] even-even
[c] odd-even [d] odd-odd

19. The radius of a nucleus with mass number 16 is 16 fm. Then the radius of a nucleus with mass number 128 is equal to
[a] 4 fm [b] 8 fm [c] 16 fm [d] 32 fm

20. The tunnel effect involves the leakage of
[a] Alpha-particles [b] electrons
[c] protons and neutrons [d] Gamma-rays

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SECTION "B"
[5Q. × 4 = 20 marks]

1. Describe the construction and working principle of cyclotron

OR

Describe the construction and working principle of betatron.

2. Give an account of experiment to determine the range and energy of alpha-particles accurately.

3. What is neutrino theory of beta-decay? How does it explain the continuous spectrum of beta-decay?

4. Write short notes on:
a. Photoelectric effect b. Pair production

5. State and explain Pauli's exclusion principle.

OR

State and explain Moseley's law and write its applications

SECTION "C"
[5Q.× 7 = 35 marks]

6. Define angle of scattering and impact parameter. Establish the relation between them.

OR

Describe the vector atom model of an atom and explain the different quantum numbers associated with it. Give the two important applications of this model.

7. What is meant by Compton Effect? Obtain an expression for Compton shift and discuss all special cases with labeled diagram.

8. a. What is the distance of closest approach for a 5.5 MeV alpha particle in a head-on collision with a gold nucleus?($Z = 79, \varepsilon_o = 8.85 \times 10^{-12} F/m, e = 1.6 \times 10^{-19} C$)

b. A cyclotron of extreme radius 1 m has a magnetic field of 2 T. Determine the maximum energy of the emergent deuterons. Through what potential difference would they have to be accelerated to attain the same energy? (Mass of deuteron $=3.34 \times 10^{-27}\ kg$).

9. What do you understand by Zeeman Effect? Discuss Normal Zeeman effect. How will you determine the value of e/m?

OR

Explain the Sommerfield non relativistic atom model. Show that the expression for the total energy of a single electron is the same as that obtained by Bohr's model.

10. a. NaCl has its principal planes spaced at 2.82 A^0.The first order Braggs reflection is observed at 10^0. Calculate (a) the wavelength of X-rays and (b) the angle for the second order Bragg reflection.

b. The half-life of ${}_{92}U^{238}$ is 4.51×10^9years. What percentage of ${}_{92}U^{238}$ that existed 10^{10} years ago still survives?