KATHMANDU UNIVERSITY
End Semester Examination [C]
June, 2018

Marks scored:

Level : B.Sc.
Year : II

Course : PHYS 203
Semester: I

Exam. Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date JUN 19 2018

SECTION "A"
[20 Q. × 1 = 20 marks]

Choose and tick (√) the most appropriate answer.

1. A certain metal has a threshold wavelength of 600 nm. The stopping potential when the metal is irradiated with light of wavelength 400 nm is
[a] 2.6 V [b] 1.03 V [c] 1.8 V [d] 0.8 V

2. 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

3. In hydrogen spectrum,the lyman series lies in
[a] ultraviolet region [b] visible region [c] infrared region [d] far infrared region

4. The energy in an excited state of H-atom is –3.4 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

5. If the radius of a nucleus with mass number 8 is 8 fm. Then the radius of a nucleus with mass number 64 is equal to
[a] 4 fm [b] 8 fm [c] 16 fm [d] 32 fm

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

7. The disintegration constant λ of a radioactive element is 0.00231 per day. Then its half-life is
[a] 100 days [b] 150 days [c] 200 days [d] 300 days

8. The spacing between principal planes of NaCl crystal is 2.83 A^o.If the first order Bragg reflection occurs at an angle 10^o,then the wavelength of X-rays is
[a] 2.5 A^o [b] 0.65 A^o [c]0.98 A^o [d] 1.58 A^o

9. The word voltage doubler is used in
[a] cyclotron [b] linear accelerator
[c] synchrotron [d] cockroft and Walton accelerator

10. 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] Saturation time [d] Resolving time

11. The frequency of 7.5 KeV photon is
[a] 1.5×10^7 Hz [b] 1.8×10^{18} Hz [c] 2×10^7 Hz [d] 1.5×10^{16} Hz

12. The decay constant of the end product of the radioactive series is
[a] zero [b] infinity [c] unity [d] uncertain

13. The tunnel effect involves the leakage of the
[a] alpha particles [b] positrons [c] electrons [d] γ-rays

14. The closest distance of approach of an α-particle of energy 5 MeV shot at a gold nucleus is equal to
[a] 4.54×10^{-14} m [b] 4.54×10^{-10} m [c] 4.54×10^{-17} m [d] 4.54×10^{-11} m

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. A curie is a standard unit of radioactivity .Its value is.....

17. The ionization potential of the hydrogen atom is .....

18. In the Bohr model of the hydrogen atom, the linear momentum of the electron at radius r_n is given .....

19. The change in wavelength of X-ray photon when it is scattered through an angle of $90^o$is.....

20. The process in which high energy photon disappears and is converted into electron-positron pair is called.....

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Level : B.Sc.
Year : II
Time : 2 hrs. 30 mins.

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Semester: I
F. M. : 55

SECTION "B"
[5Q. × 4 = 20 marks]

Attempt *ALL* questions.

1. Write short notes on:
   (i) Compton effect
   (ii) Photoelectric effect.

2. State and explain the Pauli's exclusion principle as applied to electrons in atoms.

3. Describe the construction and working principle of Ionisation chamber.

4. Describe the principle, construction and working of Bainbridge's mass spectrograph. How the nuclear mass is determined using the spectrograph?

   OR

   Explain how x-rays are produced and write its properties. How can we determine wavelength of x-ray by Bragg's law.

5. What is the principle of radioactive dating? How is the age of the earth determined from radioactive decay?

   OR

   State and explain Larmor's theorem.

SECTION "C"
[5Q. × 7 = 35 marks]

Attempt *ALL* questions.

6. Define impact parameter, angle of scattering and distance of nearest approach as applied to a α-ray scattering. Deduce the relation between them.

   OR

   What is β-decay? Discuss the energy spectrum curve from β-decay of a radioactive nuclide. What is the end point energy? Is β-spectrum discrete or continuous?

7. Derive an expression for Lande's splitting factor and explain the anomalous Zeeman effect of sodium doublet lines D_1 and D_2 with its help.

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

   OR

   What are the postulates of Bohr's theory of H-atom? Derive an expression for the energy of n^{th} orbit of an electron in same atom.

9. *(i)* A cyclotron of extreme radius 1 m has a magnetic field of2 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 $=3.34 \times 10^{-27}\ kg$).

(ii) 1 gram of radium is reduced by 2.1 mg in 5 years by α-decay. Calculate the half-life period of radium.

10. *(i)* Calculate the wavelength separation between the two component lines which are observed in the normal Zeeman effect. The magnetic field used is 0.4 Wb/m^2; $e/m = 1.76\times10^{11}\ C/kg$ *and* $\lambda = 6000\ A^o$

(ii) Calculate the wave number, wavelength and frequency of the H_α line of Hydrogen, assuming that the nucleus has infinite mass. Find the wavelength of the Balmer series limit. (Rydberg constant=$1.097\times10^7\ m^{-1}$)